

Optimization of Kebaya Product Grouping Using K-Means Algorithm for Marketing Strategy of Rental Services at Gifaattire Store

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Abstract

This study aims to implement the K-Means algorithm to improve the kebaya clustering model to support the rental marketing strategy at Gifaattire Store. The K-Means algorithm was used to analyze eight months of historical kebaya rental data, focusing on the attributes of kebaya type and color. Using the Knowledge Discovery in Database (KDD) approach, the research conducted data selection, preprocessing, transformation, data mining, and evaluation of clustering results. Davies-Bouldin Index (DBI) was utilized to assess the quality of clustering, resulting in an optimal value of 6 clusters with a DBI of 0.580. The results showed that each cluster has unique characteristics that reflect customer demand patterns. Cluster 0, the largest cluster, indicates kebayas with high demand but limited color variations. In contrast, Cluster 1 indicates kebayas with a wide variety of colors but specific demand. This information enables Gifaattire Store to design more targeted data-driven marketing strategies and improve stock management efficiency. The research contributes to the development of literature on the application of K-Means in the fashion rental sector and offers practical insights into understanding customer preferences.

Keywords: K-Means algorithm, clustering, marketing strategy, stock management, data mining

1. Introduction

In recent years, the fashion industry has witnessed tremendous growth, especially in the kebaya rental segment. Kebaya rentals are increasingly favored by consumers looking for practical and budget-friendly options for special occasions. This shift in consumer behavior is driven by various factors, including increased awareness of sustainability and cost-effectiveness. The integration of data mining technology in the fashion sector can improve operational efficiency and enhance customer satisfaction. The need to understand complex kebaya rental trends has driven the development of advanced data analysis techniques, such as the K-means Clustering algorithm. By recognizing kebaya rental trends based on their popularity, business owners can carry out more efficient inventory management and respond effectively to changing market demands. This research seeks to explore how the utilization of K-means clustering can enhance the development of efficient stocking strategies and improve customer satisfaction. With major advancements in information technology, this study has been very helpful in adapting data mining to suit the specific needs of businesses in the fashion industry[1].

A major challenge faced in the kebaya rental industry is inefficiency in inventory management, which often leads to overstocks or inventory shortages[2]. Traditional methods of inventory management are unable to deal with the complexity of fluctuating market demand. Lack of understanding of rental trends and customer preferences can result in shortages or overstocks, which can ultimately jeopardize customer satisfaction and business profitability. This research identified that there was no systematic approach implemented at Gifaattire Store to analyze rental data and optimize kebaya stock based on its popularity. This issue is relevant given that kebaya rental trends are constantly changing and influenced by various factors, including seasons, specific events, and fashion trends. This gap indicates the need for more in-depth research to develop clustering models that can assist in more effective stock management and responsiveness to market demand [3]. This study aims to utilize the K-means clustering algorithm to uncover kebaya rental trends based on popularity, with a warm focus on optimizing stock management at Gifaattire Store. By utilizing clustering analysis, this study hopes to provide clearer insights into market demand and rental behavior, making inventory-related decision-making easy[4]. This research is significant for its ability to fill the knowledge gap in the application of data mining techniques in the kebaya rental industry. In addition, the results of this research can offer practical benefits to business owners in devising more efficient stocking strategies, while also improving customer satisfaction by providing products that are better aligned with demand.

This research will use the K-mean clustering method to investigate kebaya rental data at Gifaattire Store. The data to be used includes historical rental records that include information about the renter's name, rental date, kebaya type, color, rental duration, price and address. Analyzing this data will help identify patterns and trends, which will then be used to improve stock management. This technique is anticipated to categorize kebayas based on their popularity, thus allowing for more precise stock adjustments according to market needs.

The approach will include pre-processing the data, applying the K-means algorithm, and evaluating the results to ensure the analysis is appropriate[5].

If the objectives of this research are successfully met, the results will significantly enrich the understanding and practical application of data mining techniques in the kebaya rental industry. The findings from this research can be used to devise more effective stock management strategies, thereby reducing costs and increasing customer satisfaction[6]. In addition, the findings from this study may be applicable in other areas of the fashion industry, offering deeper insights to technological advancements in inventory management[7]. This contribution will empower business practitioners to make informed and data-driven decisions, and lay the foundation for further research in data analysis and stock optimization.

2. Research Methodology

The research methodology used in this research is Knowledge Discovery Database (KDD). The flow of research design carried out in this study can be seen in Figure 1.

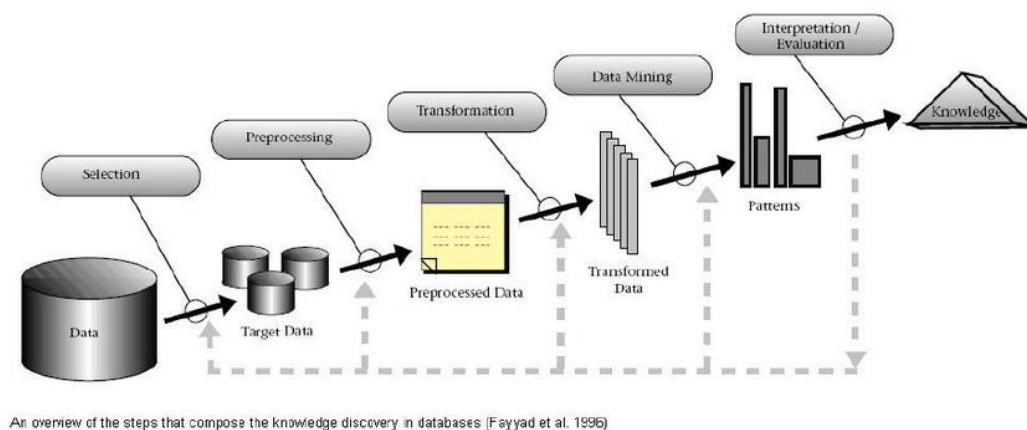


Fig. 1: Stages of Knowledge Discovery Database (KDD)

The research methodology used is Knowledge Discovery Database (KDD). Historical data of kebaya rental for 8 months were analyzed using the K-Means algorithm, focusing on the main attributes of kebaya type and color. The data processing process includes selection, pre-processing, transformation, data mining using RapidMiner, and evaluation of clustering results with the Davies-Bouldin Index.

2.1 Selection

At this stage, relevant data is selected from the kebaya rental database. The data is rental data that includes the type of kebaya, and the color of the kebaya.

2.2 Pre-processing

At this stage, an evaluation of the data quality is carried out. Data that has no value will be discarded or not used in the dataset.

2.3 Transformation

At the data transformation stage, the data will be transformed into a form that can be used by tools so that it can be used in the data mining process.

2.4 Data Mining

The k-means clustering algorithm is applied to the transformed data to group kebayas based on their popularity. This process produces groups of kebayas based on rental characteristics.

2.5 Interpretation/Evaluation

At this stage, the data mining results will be evaluated and interpreted so that they can be used as information. The data mining results will be evaluated using the Davies-Bouldin Index. Then conclusions will be drawn based on the results of the analysis and evaluation.

3. Results and Discussion

3.1. Selection

The dataset used in this study is historical data on kebaya rentals at the Gifaattire store with a period starting from January 2024 to August 2024, with 501 data collected.



Fig. 2: Operator Read Excel

In Figure 2 above is the Excel read operator which aims to import the dataset to be used.

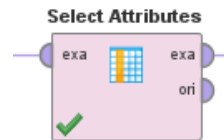


Fig. 3: Operator Select Attributes

This attribute identification and selection process is assisted by the "Select Attributes" feature presented in Figure 3. Through this feature, researchers can determine specific parameters that will be used to sort attributes, such as the type of attribute to be included, the subset of attributes to be selected.



Fig. 4: Operator Set Role

Figure 4 above is the Set Role Operator which functions to determine the role or function of attributes in the dataset..

3.2. Pre-Processing

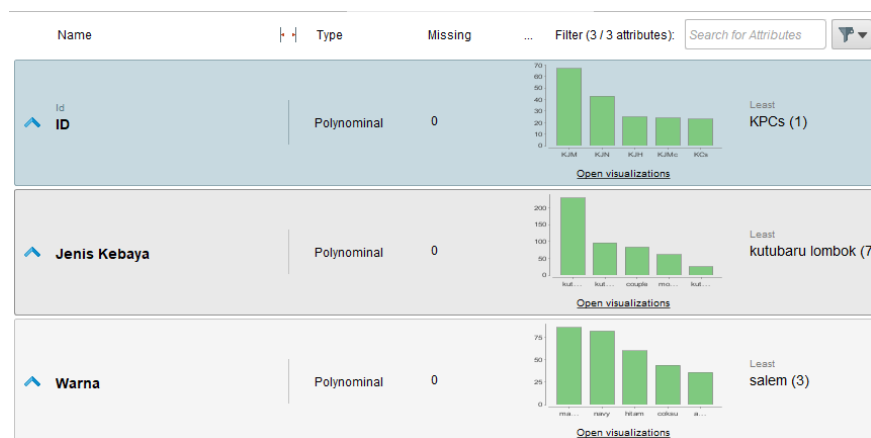


Fig. 5: Static Missing Value

Figure 5 above shows the static missing value display, where the missing value is represented as the number 0 at the pre-processing or data cleaning stage. This method is one of the common approaches in handling missing values so that the data can be further processed using machine learning algorithms such as K-Means Clustering.

3.3. Transformation

The transformation stage aims to change the selected data to be more suitable for the analysis process, especially for algorithms such as clustering. At this stage, the data can go through the following processes:

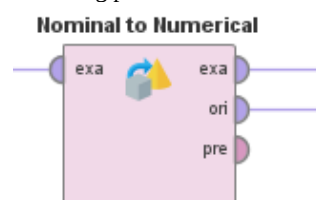


Fig. 6: Operator Nominal to Numerical

Table 1: Parameter Operator Nominal to Numerical

Parameter	Isi
Attributes filter type	Subset: Jenis Kebaya, Warna
Coding type	Unique Integers

In Figure 6, it can be seen that the Nominal to Numerical operator is used to change data from the Polynomial type to Nominal as explained in Table 1 Nominal to Numerical Operator Parameters. The parameters in the table show the selected Attributes filter type, which means the transformation will be applied to the selected attribute. Then the Attribute filter parameter determines the subject of the transformation, in this case the Kebaya Type, Color attributes and the Coding type parameter is filled with Unique Integers which indicates that the unique values in the attribute will be changed to different integers. So overall, the Nominal to Numerical operator is used to change the values in

the "Kebaya Type" and "Color" columns which were originally of the Polynomial type into unique integers, so that the data is ready to be processed by clustering algorithms such as K-Means which require numeric input.

3.4. Data Mining

Data mining is the process of extracting data from very important information. Data mining is also the process of exploring patterns from data. Patterns are obtained from various types of databases, such as relational databases, data warehouses, transactional data, and object-oriented data. The use of data mining can help entrepreneurs make decisions quickly and accurately[8]. The main purpose of data mining is to uncover unknown relationships in data and provide insights that can support decision making. The method applied in this study is K-means clustering. The K-Means Clustering operator is used to group kebaya products.



Fig. 7: Operator K-Means Clustering

Figure 7 shows the K-Means Clustering operator used to process the dataset, helping to identify groups of data with similar characteristics. In the K-Means parameter section, the range of K values is set from 3 to 8, with a max run of 10 times. This parameter allows the K-Means algorithm to perform repeated clustering with varying initialization values.

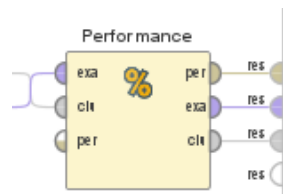


Fig. 8: Operator Cluster Distance Performance

Figure 8 is the Cluster Distance Performance Operator used to evaluate the quality of clustering by measuring the distance between clusters and within clusters. This operator calculates the average distance of data to centroids within a cluster (intra-cluster) and between centroids of different clusters (inter-cluster). The results of this evaluation help assess how well the data is clustered, so that it can ensure that each cluster has unique characteristics that distinguish it from other clusters.

3.5. Interpretation/Evaluation

Row No.	ID	cluster	Jenis Kebaya	Warna
1	KH	cluster_5	0	0
2	KN	cluster_5	0	1
3	KCs	cluster_5	0	2
4	ML	cluster_4	1	3
5	KJM	cluster_4	2	4
6	KJM	cluster_4	2	4
7	CM	cluster_4	3	4
8	KPRP	cluster_4	4	5
9	KPN	cluster_0	4	1
10	CN	cluster_0	3	1
11	KJN	cluster_0	2	1
12	KJN	cluster_0	2	1
13	KJM	cluster_4	2	4
14	KJCs	cluster_0	2	2
15	KJAT	cluster_2	2	6

ExampleSet (501 examples, 2 special attributes, 2 regular attributes)

Fig. 9: Hasil Cluster pada data view proses K-Means

Figure 9 above shows the final result of the data mining process carried out using the K-Means algorithm, which produces 6 clusters from a total of 501 records in the dataset. Each cluster in the kebaya clustering model represents a group of data that has similar characteristics,

making it easier to understand the hidden patterns in Gifaattire Store customer data. These results provide more specific insights into the distribution of kebaya among different clusters, as well as being the basis for developing a more effective and targeted rental marketing strategy based on the analysis that has been carried out.

Table 2: Perbandingan DBI

Nilai (K)	Max Run	Max Optimization Steps	Davies Bouldin Index
3	10	100	0,295
4	10	100	0,306
5	10	100	0,290
6	10	100	0,289
7	10	100	0,325
8	10	100	0,343
9	10	100	0,354
10	10	100	0,321

In Table 2 above, based on the analysis of clustering quality evaluation using the Davies Bouldin Index (DBI), from several experiments that have been carried out with different k values ranging from k = 3 to k = 10, the results obtained are that the value of k = 6 gives the most optimal results. This can be seen from the DBI value produced at k = 6, which is 0.289, which is the smallest value compared to other k values. A small DBI value indicates that grouping data into 6 clusters produces good cluster quality with high cohesion characteristics (similarity of data in clusters) and good separation (differences between clusters). Thus, it can be concluded that the use of 6 clusters (k = 6) is the best choice for grouping data in this case because it produces the most compact clusters and is well separated from other clusters.

Cluster Model

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Cluster 0: 127 items
Cluster 1: 47 items
Cluster 2: 76 items
Cluster 3: 86 items
Cluster 4: 101 items
Cluster 5: 64 items
Total number of items: 501

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Fig. 10: Cluster Model

Based on the clustering results shown in Figure 10, there are 6 clusters with varying numbers of items, reflecting the diversity of characteristics in the grouping of kebaya data. Cluster 0 is the largest group with 127 items, indicating significant similarities in a large number of kebaya in the cluster. Meanwhile, Cluster 1 has the fewest number of items, namely 47 items, indicating a group of kebaya with more specific or unique characteristics. Other clusters show variations such as Cluster 2 consisting of 76 items, Cluster 3 consisting of 86 items, Cluster 4 consisting of 101 items, and Cluster 5 consisting of 64 items. The difference in the number of items in each cluster indicates that there are different groupings based on the similarities or differences in attributes in each kebaya, such as the type of kebaya and color. With a total of 501 items grouped into 6 clusters, these results provide a clear picture of the structure and variation in the kebaya data owned by Gifaattire Store. This information can be used to develop a more targeted marketing strategy, where each cluster can be targeted differently based on its distinctive characteristics.

Cluster	Jenis Kebaya	Warna
Cluster 0	2.591	0.819
Cluster 1	1	18.745
Cluster 2	2.316	7.421
Cluster 3	1.372	12.256
Cluster 4	2.307	4.010
Cluster 5	0.031	1.266

Fig. 11: Centroid Table

The information presented in the Centroid Table above provides a comprehensive understanding of the characteristics of each cluster formed from the grouping of Gifaattire Store kebaya data. This table shows the details of the number of items (Kebaya Types) and color distribution for each cluster. Cluster 0 is the largest cluster, with 2,591 kebaya items dominated by color 0.819. This indicates a high demand for a particular type of kebaya, but with limited color variations in this cluster. In contrast to Cluster 1 which only has 1 kebaya

item, but in 18,745 colors. This indicates a more specific customer preference for a particular style and color combination in this cluster. Cluster 2 has 2,316 kebaya items with 7,421 colors, indicating a fairly large demand for this type of kebaya with a distinctive color. Cluster 3 consists of 1,372 kebaya items in 12,256 colors, representing a customer segment that has a specific preference for this type of kebaya and color scheme. Cluster 4 includes 2,307 kebaya items in 4,010 colors, indicating significant demand for the kebaya styles and colors in this cluster. Finally, Cluster 5 is the smallest cluster, with only 0.031 kebaya items in 1,266 colors. This indicates more specific or limited preferences among customers in this cluster. A deeper understanding of the demand patterns in each of these clusters will allow Gifaattire Store to develop more effective and responsive marketing strategies. These strategies can include adjusting stock availability, product offerings, and developing kebaya lines that are tailored to the specific preferences of each market segment.

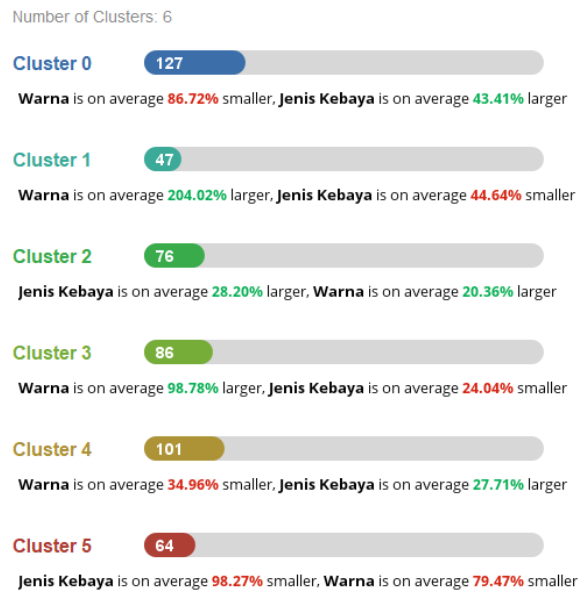


Fig. 12: Overview

Based on Figure 12 Overview, the unique characteristics of each cluster can be identified more clearly. Cluster 0 has 127 items, with an average color of 86.72% smaller and kebaya type 43.73% larger than the whole. This indicates a high demand for a certain type of kebaya but with limited color variations. Cluster 1 consists of 47 items, but the color is 24.62% larger and kebaya type 44.52% smaller than the average. This indicates a specific preference for a certain combination of style and color. Cluster 2 has 76 items, with kebaya type 27.02% larger and color 20.36% larger than the whole. The demand pattern in these clusters is different. Cluster 3 consists of 86 items, where the color is 98.78% larger but the kebaya type is 23.87% smaller than the average. This profile is in contrast to other clusters. Cluster 4 with 101 items has 34.96% fewer colors, but 27.99% more kebaya types compared to the whole. Customer preferences in this cluster are also unique. Cluster 5 is the smallest, with 64 items. Its kebaya types are 98.27% smaller and its colors are 79.47% smaller than the average, indicating specific demand. A comprehensive understanding of the characteristics of each cluster allows Gifaattire Store to design marketing strategies and product development that are more effective and responsive to customer preferences in each segment.

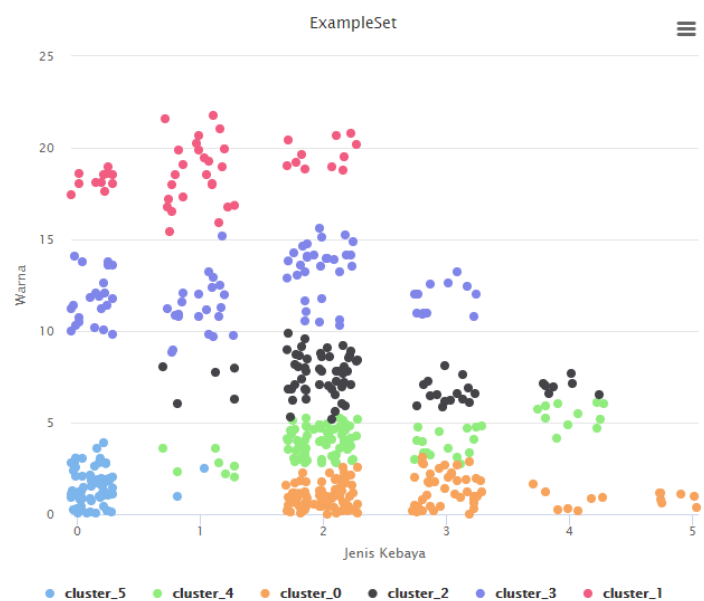


Fig. 13: Scatter Plot

The scatter plot above shows the types of kebaya and colors based on clusters, each cluster has unique characteristics. Cluster 0 has a wide distribution of kebaya types, but limited color variations. This shows that customer preferences in this cluster tend to be on various types of kebaya, but with less varied color choices. Cluster 1 shows a more focused distribution of kebaya types and colors compared to cluster 0. This indicates that customers in this cluster have more specific preferences. Cluster 2 also shows a tendency towards more limited types

of kebaya and colors. The profile of this cluster is different from clusters 0 and 1. Cluster 3 shows a wider distribution of kebaya types but with color variations that tend to be homogeneous. This reflects customer preferences that are different from other clusters. Cluster 4 has more focused types of kebaya, but with more diverse colors. This characteristic is different from the previous cluster. Cluster 5 appears the most homogeneous, with the most limited distribution of kebaya types and colors among all clusters. This reflects very specific customer preferences in this cluster. Understanding the profile of each cluster will greatly assist Gifaattire Store in designing a marketing strategy that is responsive to customer needs in each segment.

4. Conclusion

Based on the results of the research that has been conducted, a comprehensive conclusion can be drawn. The K-Means algorithm has been successfully implemented effectively to improve the kebaya clustering model by grouping kebaya data into 6 different clusters based on the characteristics of kebaya types and color variations. The results of the clustering analysis show that each cluster has unique characteristics that reflect specific customer demand patterns, such as Cluster 0 which is the largest group with various types of kebaya but limited color variations, while Cluster 1 has a wide color variation but focuses on a specific type of kebaya, and other clusters also show typical customer preferences. A deep understanding of the characteristics of each cluster allows Gifaattire Store to design a more effective and efficient marketing strategy by adjusting the marketing approach to be more relevant and attractive to specific target customers, increasing the efficiency of stock management by adjusting the number and variety of kebaya provided based on cluster characteristics, so as to reduce the risk of shortages or excess stock that can harm the business and ultimately increase overall business profitability.

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References

- [1] R. Samsudin, M. Martanto, and U. Hayati, "Optimalisasi Stok Barang Melalui Algoritma K-Means Clustering Analisis Untuk Manajemen Persediaan Dalam Konteks Bisnis Modern," *JATI (Jurnal Mhs. Tek. Inform.*, vol. 8, no. 3, pp. 3572–3580, 2024, doi: 10.36040/jati.v8i3.9742.
- [2] Nelly and Irsan, "Analisis Persediaan Barang Dagang Terhadap Penjualan Celana Casual Pada Pt Multi Garmenjaya Cabang Matahari Department Store Internasional Plaza Palembang," *J. Ilm. Akunt. Rahmadiyah*, vol. 6, no. 1, p. 84, 2023, doi: 10.51877/jiar.v6i1.261.
- [3] N. Susi, S. Sugiana, and B. Musty, "Analisis Data Sistem Informasi Monitoring Marketing; Tools Pengambilan Keputusan Strategis," *Jutisi J. Ilm. Tek. Inform. dan Sist. Inf.*, vol. 12, no. 2, pp. 696–708, 2023.
- [4] Hakim, M. Abdurrahman, A. B. Prasetyo, and D. Eridani, "PENERAPAN DATA MINING DENGAN ALGORITMA K-MEANS CLUSTERING PENYEWAAN ALAT - ALAT EVENT PADA STUDI KASUS CV . DIPO RENTAL CREATIVINDO IMPLEMENTATION OF DATA MINING USING THE K-MEANS CLUSTERING EVENT RENTAL," vol. 1, no. 4, pp. 148–155, 2023, doi: 10.14710/jtk.v1i4.37011.
- [5] M. R. Tetlageni and A. Solichin, "Klasterisasi Penyewaan Kendaraan Menggunakan Metode K-Means Pada PT. Mardika Daya Tribuana," *Bit (Fakultas Teknol. Inf. Univ. Budi Luhur)*, vol. 20, no. 2, p. 141, 2023, doi: 10.36080/bit.v20i2.2496.
- [6] A. Ardiansah, A. Razak, and B. H. Harto, "Adaptasi dan Inovasi dalam Manajemen Inventori Pada E-Commerce Lazada," *Innov. J. Soc. Sci. Res.*, vol. 4, no. 3, pp. 10335–10350, 2024.
- [7] Sambharakreshna, Yudhanta, F. Kusumawati, and A. Wulandari, "Dampak Pengelolaan Keuangan dengan Pendekatan Kebebasan Finansial , Teknologi Keuangan , Dan Modal Sosial Terhadap Pendapatan Usaha The Impact of Financial Management with A Focus on Financial Freedom , Financial Technology , And Social Capital on Busines," vol. 5, no. 02, pp. 175–192, 2024.
- [8] G. Aprilianur and E. L. Hadisaputro, "Penerapan Data Mining Menggunakan Metode K-Means Clustering Untuk Analisa Penjualan Toko Myam Hijab Penajam," *Jupiter*, vol. 14, no. 1, pp. 161–170, 2022.