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SEGMENTATION OF MSMEs BASED ON FINANCIAL MANAGEMENT PATTERNS

(Case Study of MSMEs in the Industrial Sector in Rantepao District)

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Abstract

This study uses a quantitative research approach with the aim of analyzing the segmentation of MSMEs based on financial management patterns in the Rantepao District. Using a clustering method with the K-Means algorithm, this study groups MSMEs based on the characteristics of financial recording, planning, reporting, and control that are implemented. The results show that there are two main clusters: the first cluster (68%) consists of MSMEs that still use manual financial recording, have unclear financial planning, and lack structured financial control. Meanwhile, the second cluster (32%) consists of MSMEs that have adopted more systematic financial recording with tools such as Microsoft Excel or accounting applications, and have regular financial reports and better cash reserves. Based on these results, interventions are needed in the form of financial literacy training, access to digital recording technology, and mentoring for MSMEs to improve financial stability and long-term sustainability.

INTRODUCTION

Based on initial observations at the Department of Industry, Cooperatives andMSMEs through interviews, there are several problems that often occur in MSMEs in North Toraja including MSMEs in Rantepao District in the industrial sector, such as the lack of knowledge and understanding of MSMEs actors about available financing alternatives and good financial management patterns. MSME actors often have difficulty in getting access to capital to develop their businesses, because they do not have adequate knowledge about financial institutions that can provide capital assistance. This causes MSMEs actors to have difficulty in planning and managing their business finances

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properly, resulting in weak business problems and potentially making MSMEs businesses unsustainable. The selection of MSMEs in the industrial sector as the focus of this research is because this sector faces special challenges in financial management, such as greater capital requirements, more complex cash flow management, and high operating costs. Although other sectors also face similar problems, the industrial sector has more specific characteristics related to production and costs that require more careful financial management. Therefore, this study aims to provide an in-depth understanding of financial management patterns in the industrial sector of MSMEs in Rantepao District. The number of MSMEs in Rantepao District is also quite significant, so it is necessary to segment MSMEs based on financial management patterns to improve the performance and sustainability of MSME businesses in the region. Based on the background description above, the author is interested in discussing problems related to financial management patterns with the title " Segmentation Of MSMEs Based On Financial Management Patterns (Case Study Of MSMEs in the Industrial Sector In Rantepao District)".

LITERATURE REVIEW

Definition of MSMEs

Micro, Small, and Medium Enterprises (MSMEs) are activities managed individually or by institutions and play an important role in the growth of the country's economy in a region. MSMEs are business entities carried out by a group or individual who are not related to a particular company. MSMEs aim to grow and develop their businesses in building the country's economy. In this way, MSMEs become one of the pillars of economic growth, and play a role in overcoming the existing unemployment problem (Linarti et al., 2024). MSMEs have various business fields including trade, services, production, industry and several other fields (Hafsari & Nurcahyo, 2021).

Financial management

Good financial management is related to the ability to manage income for expenses, desires and needs, and the ability to predict uncertainty in the future. To support the financial management process, it is necessary to record both income and budget expenditures before actually spending on needs.

The indicators of financial management (Wardah et al., 2022) are:

1. Planning

Planning is the activity of setting organizational goals and choosing the best way to achieve those goals.

2. Recording

Recording is the activity of recording financial transactions that have occurred, written chronologically and systematically. Recording itself is used as a marker that a

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transaction has occurred during a specified period in an organization.

3. Reporting

Reporting is the next step after posting to the general ledger and subsidiary ledger.

4. Controlling

Controlling is the process of measuring and evaluating the actual performance of each part of the organization, if necessary improvements will be made. Controlling is carried out to ensure that the company or organization is able to achieve its stated goals.

Data Mining

Data Mining is a process that employs one or more computer learning techniques to analyze and extract knowledge automatically or a series of processes to extract added value from a collection of data in the form of knowledge that has been known manually (Arifullah et al., 2022). Data Mining is a process in which data processing, the process of finding patterns or information based on the methods or techniques to be used (Azzam et al., 2024).

Clustering

Clustering is a technique that searches for and groups of data that have similar characteristics. The main focus of clustering is to group data or objects into clusters so that each cluster contains similar data. In this process, clustering attempts to unite similar objects into one cluster while maintaining as much distance between clusters as possible.

K-Means Algorithm

The algorithm is the key in data mining, where the algorithm contains structured steps that are used to apply data mining techniques to the dataset (RF Putra et al., 2023). One of the algorithms in data clustering is the K-Means Algorithm. The K-means algorithm is one of the partitional algorithms, because K-Means is based on determining the initial number of groups by defining the initial centroid value. K-means clustering is a non-hierarchical data clustering method that groups data in the form of one or more clusters/groups.

Orange Data Mining

Orange Data Mining is a visualization-based software, making it an ideal tool for performing this sentiment analysis. With its ability to handle text-based data, Orange provides various machine learning and data analysis methods that can help in efficient sentiment classification (Pokhrel, 2024).

RESEARCH METHODS

Type of Research

The type of research that will be used in this study is quantitative research with the K-means clustering method to identify financial management patterns of MSMEs in Rantepao District.

Data Type

The type of data that will be used in this study is secondary data obtained directly from the object being studied. In the context of this study, secondary data is in the form of financial records from the observed MSMEs.

Data Source

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The data used in this study is data obtained directly from the MSMEs studied.

Population and Samples

The population in this study is all MSMEs in Rantepao District in the industrial sector, totaling 122 businesses in 2023. To facilitate this research, the author took samples using random sampling.

Operational definition and measurement of variables

The operational definitions of variables and indicators in this study are::

Table 1. Operational Definitions and Indicators

No	Variable	Operational Definitions	Indicators
1	Financial Management of MSMEs	Financial management is the foundation of finance, financial management can provide an overview of the company's financial health both now and in the past, so that it can be used to make decisions for company managers (Ningsih et al., 2023)	1. Planning 2. Recording 3. Reporting 4. Controlling 5. Financial Recording Habits 6. Capital Structure 7. Cash Flow

Source: Processed Data (2025)

Data Collection Techniques

Data collection techniques in this study are by:

1. Documentation

Documentation in this study is in the form of information in the form of books, writings and pictures that can be used as accurate evidence.

2. Questionnaire

The questionnaire or survey in this study is a series of written questions submitted to respondents or MSME actors in the industrial sector in Rantepao District.

Data Analysis Techniques

Data analysis techniques for research use the Knowledge Discovery In Database (KDD) process and use the K-means algorithm in its grouping. The use of the KDD process functions so that the stages carried out run systematically. The following are the stages in Knowledge Discovery in Databases (KDD), namely:

1) Data Selection

The selection of data from a set of operational data needs to be done before the information mining stage in Knowledge Discovery in Database (KDD) begins. The

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selected data that will be used for the Data Mining process is stored in a file, separate from the operational database.

2) Pre-processing/Cleaning

Before the Data Mining process can be carried out, a cleaning process needs to be carried out on the data that is the focus of KDD. The cleaning process includes, among others, removing duplicate data, checking consistent data, and correcting errors in the data, such as typographical errors. An enrichment process is also carried out, namely the process of "enriching" existing data with other data or information that is relevant and needed for KDD, such as external data or information.

3) Transformation

Coding is the process of transforming selected data, so that the data is suitable for the data mining process. The coding process in KDD is a creative process and is highly dependent on the type or pattern of information to be searched for in the database.

4) Data Mining

Data mining is the process of searching for interesting patterns or information in selected data using certain techniques or methods. The right technique, method, or algorithm is highly dependent on the overall purpose and process of KDD.

5) Interpretation Evaluation

The information patterns generated from the Data Mining process need to be displayed in a form that is easily understood by interested parties. This stage is part of the KDD Process which includes checking whether the patterns or information found contradict previously existing facts or hypotheses.

RESULTS AND DISCUSSION

Testing process

1. Data Selection

The first stage of the data mining process is determining the database to be used according to the problems related to the clustering process. The data we use is MSME data based on financial management patterns obtained by distributing questionnaires. Data selection aims to select data, because not all data is used, only data that is suitable for analysis is taken from the database. The first step includes the data input process, which is accompanied by ensuring the completeness of the data. Furthermore, the data is arranged in such a way as to facilitate further processing using Microsoft Excel with the aim of making the data more structured, clean, and ready for analysis.

Table 2 Results of Selection and Preprocessing

Owner Code	Business Name	length of business	Number of employees	Type of Business
U1	coffee powder fortune	37 years	2	coffee processing

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U2	copy	10 years	3	coffee processing
U3	Sangulele coffee	15 years	3	coffee processing
U4	handycrafts	8 years	3	handicrafts
U5	weaving business	5 years	2	weaving
U6	Toraja coffee salu sopai	15 years	4	coffee processing
U7	Indonesian chips	2.5 years	4	cake processing
U8	coffee grinder	15 years	4	coffee processing
U9	Aluminum display case	16 years	3	metal furniture
U10	pasakke ground coffee	2 years	1	coffee processing
U11	cake business	5 years	2	cake making
U12	cake business	4 years	3	cake making
U13	Toraja crafts	15 years	1	wood carving
U14	weaver craftsman	3 years	2	weaving
U15	beads	14 years	3	beads
U16	weaving business	10 years	1	weaving
U17	coffee ema	10 years	2	coffee processing
U18	coffee business	5 years	3	coffee processing
U19	Reski coffee	10 years	1	coffee processing
U20	vanesya cake	8 years	1	cake making
U21	cake business	6 years	3	cake making
U22	bakery business	3 years	3	cake making
U23	cake business	4 years	2	cake making
U24	carpentry	5 years	3	wooden furniture
U25	yuli beads	13 years	2	beads
U26	furniture and aluminum	10 years	5	metal furniture
U27	Yoga Tori	10 years	5	cake making
U28	Toraja crafts	6 years	2	handicrafts
U29	pasele crackers	10 years	2	cake processing
U30	Toraja accessories	16 years	2	beads
U31	cake business	3 years	3	cake making
U32	vito aluminum	15 years	3	metal furniture
U33	weaving business	5 years	2	weaving
U34	carving business	13 years	2	wood carving
U35	weaving business	5 years	3	weaving
U36	handicraft (bracelet)	10 years	2	handicrafts
U37	weaving business	8 years	4	weaving

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U38	coffee business	15 years	2	coffee processing
U39	cake business	7 years	3	cake processing
U40	weaving business	13 years	3	weaving
U41	cake business	5 years	2	cake processing
U42	souvenir	5 years	2	handicrafts
U43	souvenir crafts	13 years	2	handicrafts
U44	weaving business	10 years	3	weaving
U45	furniture business	13 years	3	metal furniture
U46	weaver craftsman	8 years	2	weaving
U47	yahzel bakery	6 years	6	cake processing
U48	kanaa toraja coffee	15 years	8	handicrafts
U49	souvenir craft industry	8 years	2	weaving
U50	coffee	3 years	1	coffee processing

Source: Processed Data (2025)

Furthermore, the data that has gone through the selection and preprocessing process will undergo a transformation stage before being used to build an algorithm with the K-means method.

2. Pre-processing / Cleaning

Data in the preprocessing stage is the stage of cleaning data from data containing outliers, inconsistencies, duplicates, or incomplete data. Duplicate or incomplete data will be deleted. The data preprocessing stage in this study uses the data preprocessing widget by performing Normalize zeeatures on the orange tools then selecting Normalize to interval.

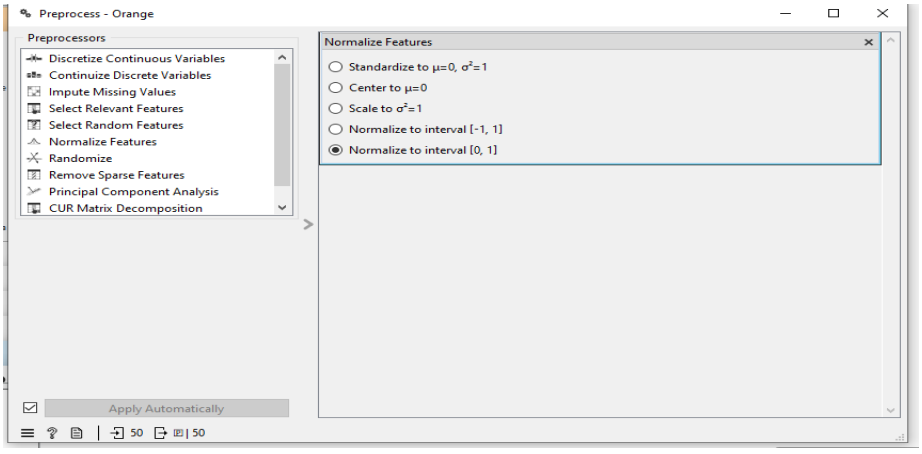

Figure 1 Preprocessed Data

3. Transformation

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At this stage, data transformation on attributes is not performed because the available data can be processed directly and continued to the next process, as in the following image:

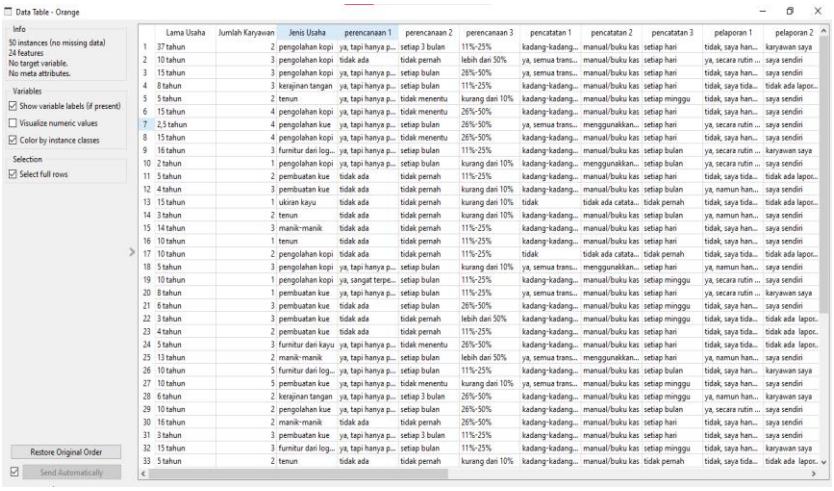

Figure 2data transformation

4. Data Mining

After the data is collected, the next step is to conduct a K-Means Clustering analysis using the Orange Data Mining application to group the data based on the financial management indicators of MSMEs in the industrial sector in Rantepao sub-district to determine the cluster. The steps taken are as follows:

a. Select the File Widget on the Data tab in Orange

Figure 3 Widget File View on Orange

b. Click on the File Widget to select the data file to be processed

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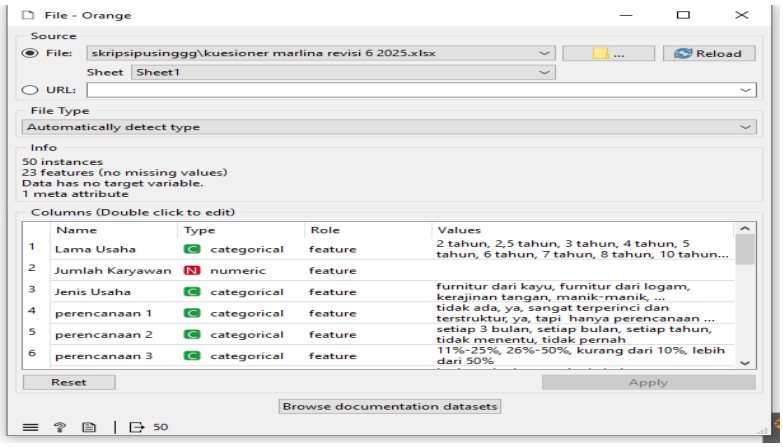

Figure 4 Data Entry on Orange

c. For the clustering process, connect the file widget, preprocess widget and k-means widget.

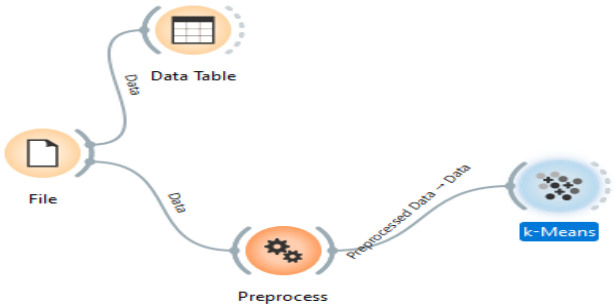

Figure 5 Widget file, Widget preprocess with Widget K-Means

d. Then determine the number of clusters that have been created automatically by the application. After the k-means feature is set, the ideal number of clusters is 2 clusters with the highest silhouette score of 0.090.

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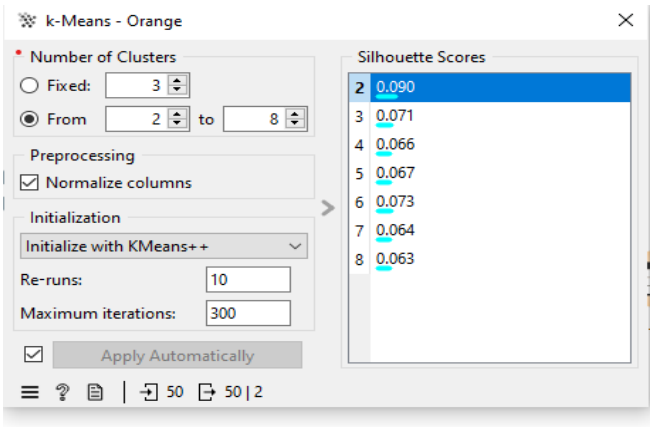

Figure 6 Cluster Determination Process

e. Then the application is carried out on the data that has been obtained using the orange application, as shown in the following image:

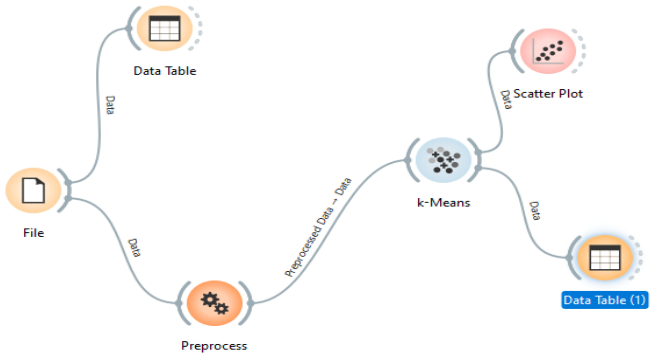

Figure 7 Implementation Structure of K-Means Algorithm on Orange

f. Click the Scatter Plot Widget, then click Find Informative Projections to see the best visualization results.

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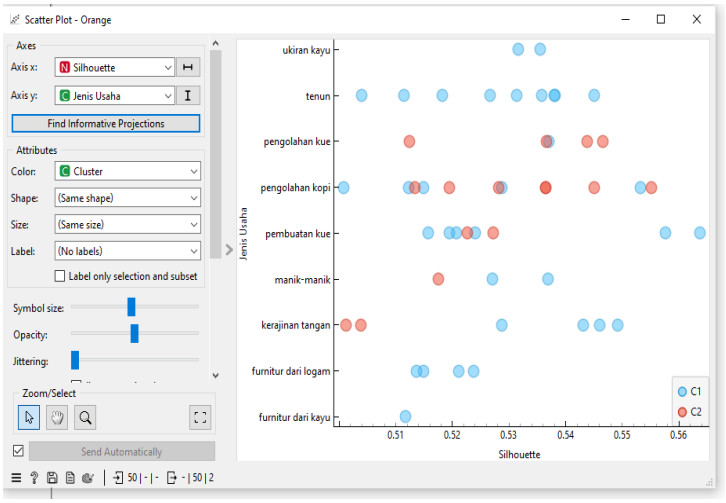

Figure 8 Scatter Plot Widget

The image above is the result of applying the scatter plot widget used to visualize the results of cluster c = 2 from MSMEs data based on the type of business using the k-means algorithm on the orange tools. This scatter plot widget explains the cluster results based on the type of business consisting of 2 clusters, in each cluster there are several types of businesses between cluster 1 and cluster 2. In cluster 1 there are several types of businesses including wood carving, weaving, coffee processing, cake processing, wood making, beads, handicrafts, metal furniture, and wooden furniture while cluster 2 consists of coffee processing, cake processing, wood making, beads and handicrafts.

5. Interpretation Evaluation

The researcher conducted an evaluation using the Silhouette Score method to determine whether the number of clusters that had been determined was the most optimal. The higher the value of the Silhouette Score, the better the cluster results. The author determined the number of clusters between 2 and 8 clusters and the result was that the cluster with the number 2 had a score of 0.090 which was the highest score compared to the other number of clusters. From the cluster evaluation, it can be concluded that clustering with K of 2 is the most optimal. The results of the Silhouette Score evaluation can be seen in the image below:

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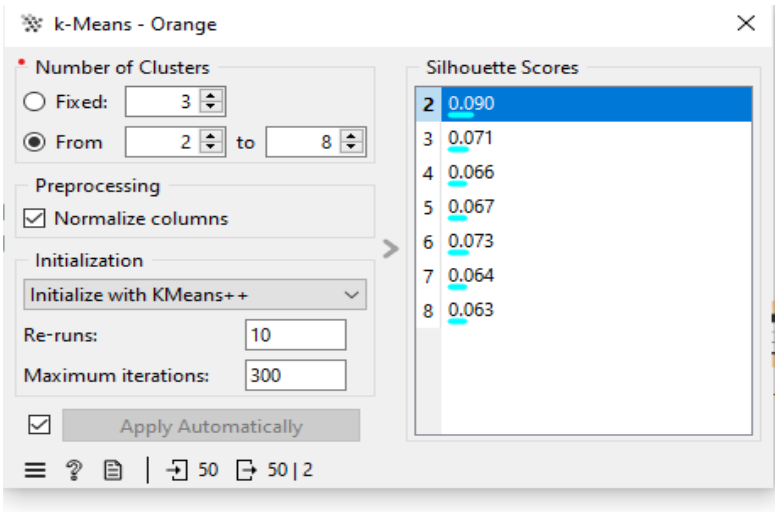

Figure 9 Silhouette Score

Research results

Based on the results of the cluster analysis, two main groups were found based on business financial management as shown in the following image:

Nama Usaha	Cluster	Silhouette	Lama Usaha	Jumlah Karyawan	Jenis Usaha	perencanaan 1	perencanaan 2	perencanaan 3	pencatatan 1	pencatatan 2	pencatatan 3
pertukangan	C1	0.511646	5 tahun	0.286	furnitur dari k...	ya, tapi hanya ...	tidak menentu	26%-50%	kadang-kada...	manual/buk...	setiap hari
vito aluminium	C1	0.514905	15 tahun	0.286	furnitur dari l...	ya, tapi hanya ...	setiap bulan	11%-25%	kadang-kada...	manual/buk...	setiap ming...
usaha meubel	C1	0.523687	13 tahun	0.286	furnitur dari l...	ya, tapi hanya ...	tidak menentu	11%-25%	kadang-kada...	manual/buk...	setiap hari
etalase alumini...	C1	0.513679	16 tahun	0.286	furnitur dari l...	ya, tapi hanya ...	setiap bulan	11%-25%	kadang-kada...	manual/buk...	setiap bulan
meubel dan alu...	C1	0.521069	10 tahun	0.571	furnitur dari l...	ya, tapi hanya ...	setiap bulan	11%-25%	kadang-kada...	manual/buk...	setiap bulan
souvenir	C1	0.549216	5 tahun	0.143	kerajinan tan...	tidak ada	tidak pernah	11%-25%	kadang-kada...	manual/buk...	setiap hari
kerajinan souve...	C1	0.546014	13 tahun	0.143	kerajinan tan...	tidak ada	tidak pernah	lebih dari 50%	kadang-kada...	manual/buk...	setiap hari
industri kerajin...	C1	0.543118	8 tahun	0.143	kerajinan tan...	tidak ada	tidak pernah	kurang dari 10%	kadang-kada...	manual/buk...	setiap hari
kerajinan tangan	C1	0.52878	8 tahun	0.286	kerajinan tan...	ya, tapi hanya ...	setiap bulan	11%-25%	kadang-kada...	manual/buk...	setiap hari
aksesoris toraja	C1	0.526998	16 tahun	0.143	manik-manik	tidak ada	tidak pernah	26%-50%	kadang-kada...	manual/buk...	setiap hari
manik-manik	C1	0.536841	14 tahun	0.286	manik-manik	tidak ada	tidak pernah	11%-25%	kadang-kada...	manual/buk...	setiap hari
usaha kue	C1	0.563668	5 tahun	0.143	pembuatan k...	tidak ada	tidak pernah	11%-25%	kadang-kada...	manual/buk...	setiap hari
usaha kue	C1	0.557625	4 tahun	0.143	pembuatan k...	tidak ada	tidak pernah	11%-25%	kadang-kada...	manual/buk...	setiap hari
usaha kue	C1	0.52401	4 tahun	0.286	pembuatan k...	tidak ada	tidak pernah	kurang dari 10%	kadang-kada...	manual/buk...	setiap bulan
usaha kue	C1	0.520757	3 tahun	0.286	pembuatan k...	ya, tapi hanya ...	setiap 3 bulan	11%-25%	kadang-kada...	manual/buk...	setiap hari
usaha kue	C1	0.515734	6 tahun	0.286	pembuatan k...	tidak ada	setiap bulan	26%-50%	kadang-kada...	manual/buk...	setiap ming...
usaha roti	C1	0.519383	3 tahun	0.286	pembuatan k...	tidak ada	tidak pernah	lebih dari 50%	kadang-kada...	manual/buk...	setiap ming...
kopi reski	C1	0.500739	10 tahun	0.0	pengolahan k...	ya, sangat ter...	setiap bulan	11%-25%	kadang-kada...	manual/buk...	setiap ming...
kopi	C1	0.553145	3 tahun	0.0	pengolahan k...	tidak ada	tidak pernah	11%-25%	kadang-kada...	manual/buk...	setiap hari
kopi bubuk rezeki	C1	0.512322	37 tahun	0.143	pengolahan k...	ya, tapi hanya ...	setiap 3 bulan	11%-25%	kadang-kada...	manual/buk...	setiap hari
kopi ema	C1	0.528673	10 tahun	0.143	pengolahan k...	tidak ada	tidak pernah	11%-25%	tidak	tidak ada cat...	tidak pernah
kanaa toraja co...	C1	0.514948	15 tahun	1.0	pengolahan k...	tidak ada	tidak menentu	lebih dari 50%	kadang-kada...	manual/buk...	setiap bulan
usaha kue	C1	0.536986	5 tahun	0.143	pengolahan k...	tidak ada	tidak pernah	11%-25%	kadang-kada...	manual/buk...	setiap hari
usaha tenun	C1	0.545004	10 tahun	0.0	tenun	tidak ada	tidak pernah	11%-25%	kadang-kada...	manual/buk...	setiap hari
usaha tenun	C1	0.518266	5 tahun	0.143	tenun	ya, tapi hanya ...	tidak menentu	kurang dari 10%	kadang-kada...	manual/buk...	setiap ming...
pengrajin tenun	C1	0.526612	3 tahun	0.143	tenun	tidak ada	tidak pernah	kurang dari 10%	kadang-kada...	manual/buk...	setiap bulan
pengrajin tenun	C1	0.503954	8 tahun	0.143	tenun	ya, tapi hanya ...	setiap bulan	11%-25%	kadang-kada...	manual/buk...	setiap bulan

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usaha tenun	C1	0.538063	5 tahun	0.143	tenun	tidak ada	tidak pernah	kurang dari 10%	kadang-kada...	manual/buk...	tidak pernah
usah tenun	C1	0.538049	5 tahun	0.286	tenun	tidak ada	tidak pernah	26%-50%	kadang-kada...	manual/buk...	setiap hari
usaha tenun	C1	0.511466	10 tahun	0.286	tenun	ya, tapi hanya ...	setiap bulan	26%-50%	ya, semua tra...	manual/buk...	setiap bulan
usaha tenun	C1	0.531361	13 tahun	0.286	tenun	ya, tapi hanya...	tidak menentu	11%-25%	kadang-kada...	manual/buk...	setiap hari
usaha tenun	C1	0.535769	8 tahun	0.429	tenun	tidak ada	tidak pernah	26%-50%	kadang-kada...	manual/buk...	setiap hari
kerajinan Toraja	C1	0.53163	15 tahun	0.0	ukiran kayu	tidak ada	tidak pernah	kurang dari 10%	tidak	tidak ada cat...	tidak pernah
usaha ukiran	C1	0.535452	13 tahun	0.143	ukiran kayu	tidak ada	tidak pernah	26%-50%	kadang-kada...	manual/buk...	setiap hari
kerajinan tanga...	C2	0.501241	10 tahun	0.143	kerajinan tan...	ya, tapi hanya ...	setiap tahun	11%-25%	ya, semua tra...	manual/buk...	setiap hari
kerajinan Toraja	C2	0.503807	6 tahun	0.143	kerajinan tan...	ya, tapi hanya ...	setiap 3 bulan	26%-50%	kadang-kada...	manual/buk...	setiap ming...
manik-manik yuli	C2	0.517566	13 tahun	0.143	manik-manik	ya, tapi hanya ...	setiap bulan	lebih dari 50%	ya, semua tra...	menggunak...	setiap hari
vanesya cake	C2	0.522649	8 tahun	0.0	pembuatan k...	ya, tapi hanya ...	setiap bulan	11%-25%	ya, semua tra...	manual/buk...	setiap hari
yoga tori	C2	0.527141	10 tahun	0.571	pembuatan k...	ya, tapi hanya ...	tidak menentu	kurang dari 10%	ya, semua tra...	manual/buk...	setiap ming...
kopi bubuk pas...	C2	0.513343	2 tahun	0.0	pengolahan k...	ya, tapi hanya ...	setiap bulan	kurang dari 10%	kadang-kada...	menggunak...	setiap bulan
usaha kopi	C2	0.545014	15 tahun	0.143	pengolahan k...	ya, tapi hanya ...	setiap tahun	kurang dari 10%	ya, semua tra...	menggunak...	setiap hari
kopinta	C2	0.528156	10 tahun	0.286	pengolahan k...	tidak ada	tidak pernah	lebih dari 50%	ya, semua tra...	manual/buk...	setiap hari
kopi sangulele	C2	0.519402	15 tahun	0.286	pengolahan k...	ya, tapi hanya ...	setiap bulan	26%-50%	ya, semua tra...	manual/buk...	setiap hari
usaha kopi	C2	0.555121	5 tahun	0.286	pengolahan k...	ya, tapi hanya ...	setiap bulan	kurang dari 10%	ya, semua tra...	menggunak...	setiap hari
kopi toraja salu ...	C2	0.53649	15 tahun	0.429	pengolahan k...	ya, tapi hanya ...	tidak menentu	26%-50%	kadang-kada...	manual/buk...	setiap hari
penggilingan k...	C2	0.53649	15 tahun	0.429	pengolahan k...	ya, tapi hanya ...	tidak menentu	26%-50%	kadang-kada...	manual/buk...	setiap hari
kerupuk pasele	C2	0.512457	10 tahun	0.143	pengolahan k...	ya, tapi hanya ...	setiap bulan	26%-50%	kadang-kada...	manual/buk...	setiap bulan
usaha kue	C2	0.536591	7 tahun	0.286	pengolahan k...	ya, sangat ter...	setiap tahun	11%-25%	ya, semua tra...	menggunak...	setiap hari
kripik nusantara	C2	0.546584	2,5 tahun	0.429	pengolahan k...	ya, tapi hanya ...	setiap bulan	26%-50%	ya, semua tra...	menggunak...	setiap hari
yahzel bakery	C2	0.543747	6 tahun	0.714	pengolahan k...	ya, tapi hanya ...	setiap 3 bulan	kurang dari 10%	ya, semua tra...	menggunak...	setiap hari

Figure 10 cluster results

Based on the image above, the test results show that the segmentation of industrial sector MSMEs based on financial management patterns is divided into 2 clusters, namely:

1. First Cluster 34 data or (68%)
   a) MSMEs in this cluster still use manual financial records, such as recording in a cash book or even not recording at all.
   b) Their financial planning is unclear, with most not having a structured budget or financial evaluation.
   c) Financial reporting is only done when needed, and most do not have routine reports such as profit and loss statements or balance sheets.
   d) Financial control is also weak, with many businesses not having a mechanism to monitor cash flow or manage expenses properly.
   e) The majority of MSMEs in this cluster still rely on personal capital without sufficient cash reserves to overcome financial uncertainty.
2. Second Cluster 16 data or (32%)
   a) MSMEs in this cluster have implemented more systematic financial records using tools such as Microsoft Excel or accounting applications.
   b) They have better financial planning and conduct regular financial evaluations.
   c) Financial reporting is done regularly every month or every year, allowing business owners to better understand the financial condition of their business.
   d) The financial control system is better than the first cluster, with more careful efforts in monitoring expenses and maintaining stable cash flow.
   e) Businesses in this cluster are better prepared to face economic uncertainty because they have better cash reserves compared to the first cluster.

Discussion

FAKULTAS EKONOMI
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The results of the study indicate that MSMEs in Rantepao District have variations in financial management patterns that are categorized into two main clusters based on K-Means analysis. Cluster 1 includes 34 data or 68% of the total 50 data, consisting of businesses that have been operating for between 5 and 16 years, with dominant business types such as wood/metal furniture, handicrafts, cake making, coffee processing, and weaving. Although most businesses have basic financial planning, many of them still use manual financial recording and do not make financial reports regularly. Unclear financial control, as well as undisciplined recording habits, also worsens cash flow management, where many businesses have difficulty managing and monitoring their cash flow. Most businesses also do not prepare routine cash reserves, rely on personal capital, and only occasionally deal with financial problems that arise without careful planning. Thus, businesses in cluster 1 need improvements in financial management to support their sustainability and growth in the future.

Cluster 2, consisting of 16 data or 32% of the total 50 data, includes businesses that have been operating for between 2 and 15 years, with dominant business types such as coffee processing, cake processing, and handicrafts. Compared to Cluster 1, businesses in Cluster 2 show more structured financial planning, using Microsoft Excel or accounting applications for more disciplined daily recording. Many businesses also make routine financial reports, both monthly and annually, and have better financial control, although still simple. Although most businesses rely on personal capital, some also use bank loans or financial institutions. To achieve more stable growth, financial management must continue to be developed by using sophisticated technology such as the Enterprise Resource Planning (ERP) system that can integrate various aspects of the business. The main challenge for Cluster 2 is the limited market which is only in Rantepao District. Therefore, they need to expand the market to regional, national, and even international levels through e-commerce. The development of quality innovative products will also increase competitiveness. In addition, cooperation with financial institutions for access to capital and the use of fintech technology will support business development. Mentoring programs for digital marketing strategies and market expansion are also important so that MSMEs in Cluster 2 can develop and compete more widely.

CONCLUSIONS AND RECOMMENDATIONS

From the results of the study in the application of data mining grouping of MSMEs based on financial management patterns using the K-Means algorithm, the following conclusions were obtained:

1. From the results of the application of the k-means clustering algorithm to MSME data, it is known that based on their financial management patterns, MSMEs in the industrial sector in Rantepao District are divided into 2 segments, namely cluster 1 and cluster 2.
2. Each MSME segment observed in this study has different characteristics. The differences in these characteristics include:

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a) Businesses in cluster 1 show less structured financial management, with manual recording, lack of discipline in making routine financial reports, and suboptimal cash flow management. This makes businesses in this cluster more vulnerable to financial uncertainty and liquidity difficulties.

b) Businesses in cluster 2 show more structured financial management compared to cluster 1, with the use of financial recording applications and routine financial reporting. Although their financial control is better, businesses in this cluster still depend on personal capital and face the challenge of limited local markets. To achieve more stable and sustainable growth, businesses in this cluster need to continue to develop financial management by using more sophisticated technology, expanding market access through e-commerce, and collaborating with financial institutions to obtain more flexible capital.

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