PREDICTING SUSTAINABLE SUPPLY CHAIN OF FRUITS FARMING AGRICULTURE BUSINESS

Billiam Christofer Wijaya[1*], Rudy Aryanto[2]
Bina Nusantara University
Billiam.wijaya@binus.ac.id
Rudyaryanto@binus.ac.id

ABSTRACT

The production of superior, important, and prospective horticultural commodities in Bandung City during the 2015-2020 period shows a fluctuating pattern. This occurs not only in vegetable commodities but also in the fruit commodity group. The aim of this research is to analyze to the potential of superior agribusiness fruit commodities and to analyze the feasibility of developing superior agribusiness fruit commodities in Bandung City. The data used are primary and secondary data. The analytical tools used are the Location Quotient (production value) and the feasibility analysis of farming (Revenue Cost Ratio). The research results show that the leading agriculture commodities in most sub-districts in Bandung City are dragon fruit, watermelon, mango, papaya, banana, and melon. This research focuses on the fruit and vegetable processing process on a small scale. They discuss various processing techniques and products that can be produced from fruits and vegetables. However, our research differs because it focuses more on the business and marketing aspects of the fruit business.

Keywords: business, horticultural, fruits, commodities

1. INTRODUCTION

The agricultural sector is one of the sectors that supports the economy in Indonesia. This sector remains a mainstay as a driver of national development until now. Therefore, national economic development in the 21st century will still be broadly based on agriculture. However, in line with the stages of economic development, agricultural-based business activities are also increasing, namely agribusiness activities will become one of the leading activities in national economic development in various broad aspects. The further development of agriculture is aimed at the growth and development of agribusiness ventures from the family scale, medium scale, and large scale (Darmawan et al., 2021). One of the agricultural developments that can contribute to the economy is the development of horticultural commodities (Hernanto, 2007). The horticultural crop sub sector remains an important contributor to national economis development. Horticultural plants in Indonesia can be grouped into four, namely: vegetables, fruits, ornamental plants, and bio-pharmaceutical plants. Thus, fruits are one of the horticultural products that gave great potential to be developed in Indonesia. Fruit commodities have a diversity of types and have higher economic value compared to food crops. Because fruits not only have high economic value but are also location-specific, responsive to advanced technology, special products with great added value, and a continuously growing market, fruit crops are very suitable to be developed into agribusiness ventures.

Steady One of the fruit commodities that has good prospects in the future is dragon fruit. Dragon fruit is one of the commodities that has a good strategy for development in Indonesia. The development of dragon fruit agribusiness has bright prospects for export opportunities and its market is still wide open and has very good potential for the domestic market (Cahyono, 2009). Moreover, the development of dragon fruit plants is very good to be cultivated in tropical areas like Indonesia. Saragih (2002) emphasizes the importance of development with an agribusiness approach for several reasons: increasing competitiveness through comparative advantage, being the main regional economic sector that contributes to GDP formation and employment opportunities, and being a significant new source of growth. The agricultural sector, which is the main driver in the field of agribusiness in Bandung City, is the most important sector that can be improved to increase people's income. Soekartawi (1999) states that agribusiness is a set of business activities that includes one or all of the production, processing, and marketing chains related to agriculture in a broad sense. The fundamental and very interesting problem to be researched in this study is: What are the leading fruit and plantation commodities in Bandung City. What is the existing condition of the leading fruit and plantation commodity business in Bandung City. How is the allocation of production factors of fruit and plantation farming commodities in Bandung City.

2. LITERATURE REVIEW

The type of research used in this study is descriptive quantitative research. The variables in this study are the production volumes of fruits that are the leading sector in Bandung City. The data used in this research is secondary data with a time series from 2015 to 2020. Secondary data is data obtained from the Bandung City Government, the

Central Statistics Agency (BPS) of West Java Province, and BPS Bandung City. The data used in this study are fruit production data from all sub-districts in Bandung City. The data collection methods in this research were conducted through literature study and documentation. The literature study was carried out by collecting information through in-depth literature related to the study object. The documentation technique was conducted by tracing and documenting data and information related to the study object. Data Mining is a term that is currently widely used to describe the process of mining or finding knowledge from a number of data that are owned. Data mining uses mathematics, artificial intelligence techniques, and statistics to identify and extract useful information and subsequent patterns or knowledge derived from large data sets. The pattern in question can be a business rule, correlation, trend, affinity, or prediction model.

EDM (Educational Data Mining) is a field of science that studies how educational data can be useful for improving the performance of educational institutions. EDM has the aim of finding and predicting hidden patterns that can support decisions from the management of an educational institution. EDM in the theoretical aspect is a combination of various fields of computing science, namely statistics, computer science, machine learning, and data mining. EDM focuses on the possibility for educational institutions to be able to analyze data using various tools and techniques to create useful insights for the activities of the educational institution. The data in question can be found in various systems, such as in administration systems, learning management systems, and others. This data also has several formats, namely structured, semi-structured, unstructured, and also binary. Modern systems that are currently developing can provide the possibility to connect to various different data sources using APIs (Application Programming Interfaces). Modern system provide many possibilities to connect to different data sources using application programming interfaces (APIs) or provide simple processes to export data in suitable formats (e.g. CSV). This data can be analyzed in various ways. CRISP-DM is an abbreviation for Cross-Industry Standard Process for Data Mining, which is one of the most frequently used models or frameworks in data mining. CRISP–DM consists of 6 steps starting from understanding the business and also the need for data mining, then ending with the deployment of solutions that can solve certain problems or business needs. The stages in CRISP–DM are stages that can be repeated because data mining relies on experimentation and experience. The following are the stages of CRISP – DM. The first phase is business understanding. This phase is the foundation of data mining because it is necessary to know first what the purpose of the study is. There are several steps that need to be taken in the business understanding phase, namely: Determining business goals, namely thoroughly understanding what the business/organization wants to solve, as well as determining the success criteria to be achieved. Assess the situation, namely determining data availability, resources, project requirements, and conducting cost-benefit analysis. Determining data mining goals, namely determining the goals or success criteria for the data mining being carried out, where these goals must be in line with the goals the business wants to achieve. Produce a project plan, namely selecting the technology and tools to be used, as well as determining a detailed plan for each phase of the project.

3. METHOD

The method used by the author in this research is to use a data mining classification model, namely the K-Means algorithm. The use of this method is proposed because it uses data that already has a target class. Through this method, research results will produce a fairly high level of accuracy with an easier process. The use of the K-Means method in this research will go through six stages, namely the business understanding, data understanding, data preparation, modeling, evaluation and deployment stages.

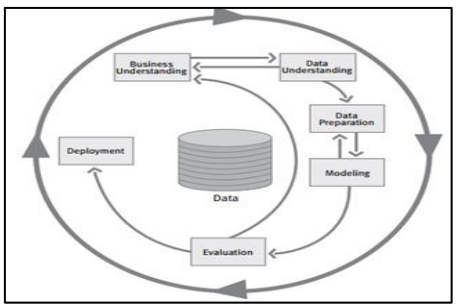

Fig 1. CRISP-DM Process

(Cross Industry Standard Process for Data Mining)

For Determining Business Goals, the party wants to increase sales of fruit so that it has good business prospects in the future. This phase aims to design a data mining model that can show patterns of fruit business prospects in the future. Assess the situation. A collection of fruit type data is available in the form of data sourced from kaggle.com. Determining data mining goals. The aim of conducting this research or data mining is to gain knowledge about the

pattern of criteria that influence the prospects or future predictions of the fruit business. Carry out project planning. The research project was carried out within one week using several tools or supporting technology such as laptops, internet access, and RapidMiner software. For data understanding, there is collect data. In this data collection section, the author uses the Fruit Sales dataset in each country obtained from kaggle.com to become the object of analysis to determine the pattern of consumer buying interest in fruit.

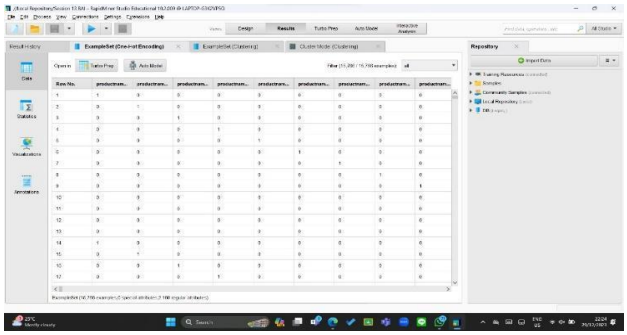

Fig 2. Dataset

After this, the next step is Data preparation. Select or data selection. The data chosen to be used is data on fruit sales and consumer buying interest over time. Clean Data. Based on the previously selected data, there are several unknown values or missing values. Therefore, this data needs to be cleaned first by eliminating it or replacing it with other data. The dataset is processed with the Filter Example operator found in the Rapidminer application to remove missing values in these two categories.

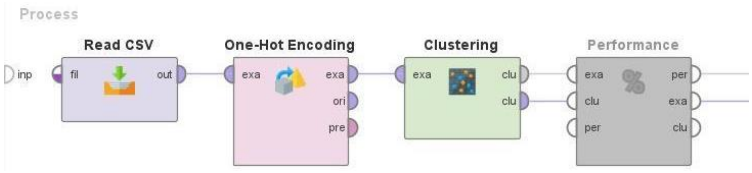

Fig 3. Operator Filter Example in Rapidminer

Through this data Operator Filter Example in Rapidminer. At this stage, is designated as a label, and acts as a marker in seeing the available attribute criteria.

	Attribute	Cluster_0	Cluster_1	Cluster_2	Cluster_3	Cluster_4	Cluster_5	Cluster_6	Cluste
2	productname = Strawberries	0.109547399234400666	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	productname = Romaine Lettuce	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
4	productname = Red Leaf Lettuce	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
5	productname = Potatoes	0.095811754109430481	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	productname = Oranges	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
7	productname = Iceberg Lettuce	0.114163476694430819	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	productname = Green Leaf	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0

Fig 4. Cleaned Dataset

Through this data cleaning process, the research finally obtained the entire dataset. Build data. At this stage, a new attribute is created, namely Job Status, which is designated as a label, and acts as a marker in seeing the available attribute criteria.

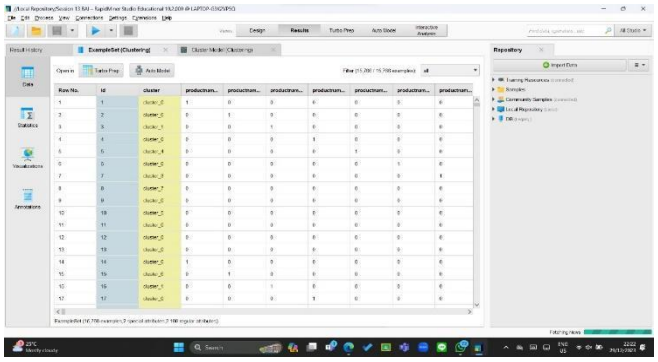

Fig 5. Role Attribute Format in Dataset

Next step is Modeling. Select a Modeling Technique. The data mining modeling technique in this research uses K-Means found in the RapidMiner application or software. Generating text designs. At this stage, the test planning is carried out (dividing the data into training, testing and validation sets). Building models. At this stage, the data mining algorithm is run using the RapidMiner application or software. Assesing models. The K-Means method is able to solve the problems and objectives of this research because it has reliable capabilities in processing data of both categorical, discrete, continuous types, and also in dealing with missing values and noise in the data.

Next step is Evaluation. The evaluation in this data mining study focuses more on the models or patterns produced by K-Means. The resulting model is then analyzed to determine its effectiveness and accuracy before the model is used to determine whether the model achieves the objectives previously set at the business understanding stage. At this stage, evaluation is carried out using the Cross Validation method (a method for validating the accuracy of models built based on certain datasets) using the operator in Rapidminer, namely Performance Classification. The data used to to build the model process is training data and testing data. Then the data used in validation is a dataset. Process review and determination of next steps. At this stage, , a decision is made whether the resulting model has met the objectives and can be continued, or whether it must be repeated, and a new project needs to be started.

Last step is Deployment. Planning implementation. After an evaluation is carried out to assess in detail the results of a model, the knowledge gained will then be presented in an easy-to-understand report. The prediction results from this data mining study are in the form of an analysis of the future prospects of the fruit business. Plan monitoring and maintenance. At this stage, a comprehensive monitoring and maintenance plan will be created to avoid problems during the operational phase. Final report conclusion. Documenting the final project regarding data mining will analyze fruit business prospects. This final report is also a summary of the project and the experiences that have been carried out, after which we present the predicted results of this project. Conduct project reviews. Through the research that has been carried out, the results of research predictions can be used by Bina Nusantara University Bandung as consideration for making decisions in making learning process policies that are more effective and efficient to create business prospects or fruit businesses in the future. Apart from that, at this stage a retrospective is also carried out on the data mining projects that have been carried out. Namely what things went well, what could have been better, and how to improve in the future.

4. RESULTS AND DISCUSSION

The results showed that the dataset used is a fruit sales dataset using several attributes.

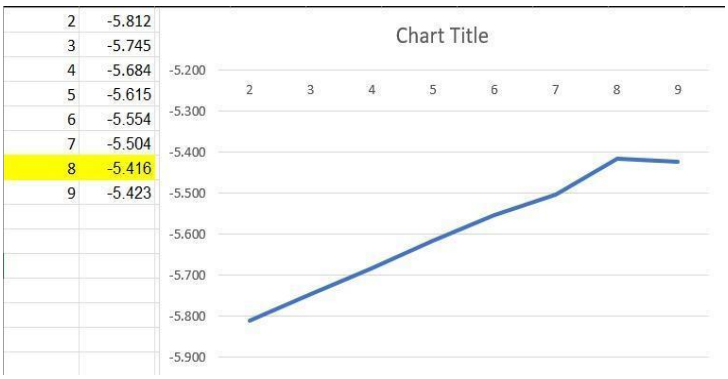

Fig 6. Data Graph

After knowing the average classification of each attribute that will be used, the dataset is then tested to see how the pattern of these attributes affects fruit business prospects or what kind of prospects will be generated with the average calssification. The series of processes are carried out through the Rapidminer application and use the K-Means algorithm method using the following operators: Read CSV. Reads a dataset that has been changed using CSV format to be run in the RapidMiner application. One-Hot Encoding. Converts a categorical variable into a number of new columns representing each category with binary values. For example, if you have a variable "color" with the categories "red," "blue," and "green," One Hot Encoding will create three new columns: "red," "blue," and "green." Each row of data will have the value 1 in the column corresponding to the corresponding category, and the value 0 in the other columns. Clustering. Dividing data into groups that have similar characteristics or patterns among them. Identify patterns or relationships. Performance (classification). See the accuracy of predictions with the model used with the classification method.

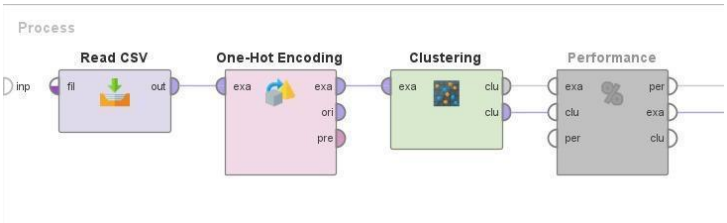

Fig 7. RapidMiner Process Series

In designing successful strategies to increase sales and marketing techniques, carefully collected data is a crucial element. In-depth research into the fruit market will provide a deeper understanding of consumer preferences, market trends, and other factors that influence purchasing decisions. By using this data effectively, companies can identify existing opportunities and challenges, which can lead to more appropriate solutions that have a positive impact.

Apart from that, an in-depth explanation of the research results is also very important. Careful analysis and deep understanding of research findings can provide valuable insights. By detailing the implications of research results, companies can formulate more targeted and effective action plans. This explanation can also help in communicating research findings to internal teams and external stakeholders, ensuring that all parties involved have a deep understanding of the strategy to be implemented.

Finally, integrating data and explaining research results into sales and marketing strategies is an important step. This can include developing marketing campaigns tailored to consumer preferences, optimizing supply chains to increase fruit availability, and adjusting prices based on market analysis. By making good use of information that has been collected and understood, companies can achieve better results in achieving their marketing and sales goals.

5. CONCLUSION

The conclusion that can be given from each explanation is the importance of conducting careful research. By researching carefully, a person can gain a deeper understanding of the topic or problem at hand. This can help in gathering relevant and accurate information, and provide a solid basis for decision making.

Apart from that, using the available tools is also an important step in solving a task or problem. Today's technology and software can be invaluable allies for increasing work efficiency and accuracy. By utilizing these tools, one can speed up work processes and overcome various challenges more effectively.

Finally, it is recommended to remain critical and selective in choosing research tools or methods. Not all tools or information may be relevant or reliable. Therefore, it is important to carry out a thorough evaluation of the resources used, so that the results obtained can be more reliable and make a meaningful contribution to solving the problems faced.

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