Analytical Hierarchy Process (AHP) Supplier Selection Analysis on MSME Banana Chocolate Ajo Sikumbang in Pekanbaru City

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Abstract: *This study aims to select the best supplier by using AHP (Analitycal Hierarchy Process). The research method used is descriptive quantitative with criteria consisting of quantity, quality, cost, and delivery. The object of this research is UMKM in the food sector, known as Pisang Chocolate Ajo Sikumbang, which is located in the Panam area of Pekanbaru City. The data analysis for this research was conducted by comparing three suppliers of bananas, namely suppliers in Panam Market, Kualu Market, and Arengka Market. From the results of data analysis, it was found that the criteria for the quantity of bananas from suppliers became the most important factor for the Ajo Sikumbang Chocolate Banana business, with a value of 0.373, or 37%. Meanwhile, for alternative considerations, the performance of the three suppliers was obtained and the highest score was achieved by suppliers in the Panam Market with a value of 7,534.*

Keywords: *Supplier Selection, Analytical Hierachy Process (AHP), Micro Small and Medium Enterprises (MSMEs)*

INTRODUCTION

The COVID-19 pandemic that occurred at the end of 2019 in the world and Indonesia had a negative effect on all lines of life, especially in the economic field. Many business actors have suffered losses and even gone bankrupt One of the pillars in the economic sector in Indonesia, which is found in all provinces in Indonesia, is small, micro, and medium enterprises (MSMEs). The MSME business during the COVID-19 period also experienced a slump.

According to data from the Coordinating Ministry for the Economy in 2021, there are 64.12 million MSMEs spread across all provinces in Indonesia, where the percentage of MSME players grows by around 99.92% of the total business sector. During the COVID-19 pandemic, around 82.9% of MSMEs experienced a decline in business growth, while 5.9% were still able to survive and experience business growth.

There are many types of businesses carried out by MSME actors, one of which is MSMEs engaged in the food sector. MSMEs in the food sector can survive during the COVID-19 pandemic because this business is one of the basic needs of the community. However, to be able to recover and develop after COVID-19, an effective and efficient.

The chocolate banana business is one of the MSME businesses that does not require special skills but requires foresight to see market opportunities. To get this opportunity, the chocolate banana business must implement a market strategy. As for the market strategy that can be implemented, namely the selection of business locations and the selection of raw materials of good quality and quantity, For the selection of raw materials, suppliers are needed who can continuously supply these raw materials.

The chocolate banana business uses the main raw material for agricultural products, namely wax bananas. In the selection of the main raw material for bananas, accuracy is needed so that it can affect the quality of taste and production costs to be incurred. In addition, the availability of this main raw material also depends on the harvest period of agricultural products, where these agricultural products are not always available all the time.

The chocolate banana business in the city of Pekanbaru has been widely carried out by MSME business actors. Almost on every main street, we can find this food seller. One of the well-known chocolate banana businesses in the city of Pekanbaru is Ajo Sikumbang Chocolate Banana, which is located in the Panam area. This chocolate banana offers many flavor variants with prices ranging from Rp. 12,000.00 to Rp. 18,000.00.

To be able to run this chocolate banana business in the midst of competition between similar traders who offer the same product, it is necessary to select the right supplier in order to meet the raw material needs in a sustainable manner. Besides that, choosing the right supplier can reduce the risk of loss in the business being undertaken. Choosing the best suppliers in terms of availability of goods and prices for supplying raw materials is an effective business strategy that can increase profits, allowing the selling price offered to consumers to be more suppressed than other business actors.

Decision-making in this chocolate banana business is a series of steps taken to get the best supplier in the most efficient way. In making supplier selection decisions in the Ajo Sikumbang Chocolate Banana business using the Analytical Hierachy Process (AHP) method AHP is a method that can be applied to making decisions from a series of alternative choices. By using the AHP method, the Ajo Sikumbang Chocolate Banana

business owner can select and evaluate suppliers so that they can determine the right criteria and supplier alternatives.

LITERATURE REVIEW

Supplier Selection

The selection of suppliers in the MSME business is very important. This is because suppliers play an important role in the availability of raw materials. Raw materials are needed so that SMEs can carry out their production activities smoothly. According to Shahroudi and Rouydel (2012), supplier selection is one of the most important activities of a company or business because the purchase of raw materials and components can represent 40 to 80 percent of the total product cost and will have an impact on the performance of the company or business.

Stevenson (2002) states that there are several factors that can be considered by MSME owners when choosing suppliers of raw materials, including: (1) price; (2) quality; (3) service; (4) location; (5) supplier inventory policy; (6) flexibility. Meanwhile, Ge Wang (2004) in Khusairi and Munir (2015) suggests that four factors must be considered in supplier selection, namely: (1) quality; (2) costs; (3) delivery accuracy; (4) flexibility.

Furthermore, Austin (1992) and Brown (1994) in Marimin and Maghfiroh (2010) state that supply chain management for agricultural products is different from supply chain management for manufactured products. This is caused by several things:

1. Agricultural products are easily damaged and rotten, so they require proper handling.

2. The process of planting, growing, and harvesting depends on the climate and season.

3. Yields vary in size and shape.

Therefore, the selection of the right supplier is very necessary in this case, so companies or MSME actors need special criteria in determining the selection of raw material suppliers. Gary W. Dickson (1966) in Pujawan and Mahendrawati (2010) states that there are twenty-one criteria that can be used by companies or SMEs to conduct supplier selection and evaluation, as listed in table 1 below:

Table 1. Supplier Selection and Evaluation Criteria

No.	Criteria	No.	Criteria
1.	Quality	12.	Management and Organization
2.	Delivery	13.	Operating Controls

No.	Criteria	No.	Criteria
3.	Performance History	14.	Attitudes
4.	Warranties and Claim Policies	15.	Impression
5.	Price	16.	Packaging Ability
6.	Technical Capability	17.	Labor Relations Records
7.	Financial Position	18.	Geographical Location
8.	Prosedural Compliance	19.	Amount of past business
9.	Communication System	20.	Training Aids
10.	Reputation and Position in Industry	21.	Reciprocal Arrangements
11.	Desire for Business		

Source: Gary W Dickson (1966)

Analytical Hierachy Process **(AHP)**

The Analytic Hierarchy Process (AHP) is a decision support model developed by Thomas L. Saaty using additive weighting (Wang, in, Li, and Chen, 2009). It is said to be additive because the arithmetic operation to get the total weight is an addition. According to Saragih (2013) this method is used to describe complex multi-factor or multi-criteria problems into a hierarchy. The hierarchy in question is defined as a representation of a complex problem in a multilevel structure where the first level is the goal followed by the level of factors, criteria, sub-criteria, and so on down to the last level of alternatives.

According to Saaty (2008), in the AHP method, there are several principles that must be understood to solve problems with explicit logical analysis, including:

1. Hierarchy

   Analysis of these factors in AHP is done by making a hierarchical structure. Problems are defined first, followed by decomposition, which is the process of breaking down a complex problem into supporting elements, arranging them hierarchically, and combining them.

2. Evaluation of Criteria and Alternative Criteria

   By pairwise comparison, According to Saaty (1988) and Saaty (2008), for various problems, a scale of 1 to 9 is the best scale for expressing opinions.

3. Prioritization of Implementation

   To determine the priority of each criterion and alternative, it is necessary to do pairwise comparisons. The relative comparison values of all alternative criteria can be adjusted according to predetermined judgments to produce weights and priorities. Weights and priorities are calculated by manipulating matrices or by solving mathematical equations.

4. Logical Consistency

Consistency has two meanings. The first is that similar objects can be grouped according to uniformity and relevance. And the second concerns the degree of relationship between objects based on certain criteria. The focus in this stage is on the system components that are selected and used in the form of the existing hierarchical system.

Micro, Small and Medium Enterprises (MSMEs)

According to Law Number 20 of 2008 concerning Micro, Small and Medium Enterprises (MSMEs), the criteria for MSMEs are as follows:

1. Specifically, productive businesses owned by individuals or privately owned business entities that meet the following criteria: (1) a net worth of at least Rp. 50,000,000 (fifty million rupiahs), excluding land and buildings for business premises; or (2) annual sales of at least Rp. 300,000,000 (three hundred million rupiahs).

2. Small Business, which is a stand-alone productive economic business carried out by individuals or business entities that are not subsidiaries or not branches of companies that are owned, controlled or become a part either directly or indirectly of medium-sized businesses or large businesses that meet the criteria, namely: (1) have a net worth of more than Rp. 50,000,000.00 (fifty million rupiah) up to a maximum of Rp. 500,000,000.00 (five hundred million rupiah) excluding land and building for business; (2) or have annual sales of more than Rp.300,000,000.00 (three hundred million rupiah) up to a maximum of Rp.2,500,000,000.00 (two billion five hundred million rupiah).

3. Medium Enterprises, namely productive economic businesses that stand alone, which are carried out by individuals or business entities that are not subsidiaries or branches of companies that are owned, controlled, or become part either directly or indirectly with small businesses or large businesses that fulfill criteria, namely: (1) having a net worth of more than IDR 500,000,000.00 (five hundred million rupiah) up to a maximum of IDR 10,000,000,000.00 (ten billion rupiah) excluding land and building for business; (2) or have annual sales of more than IDR 2,500,000,000.00 (two billion five hundred million rupiah) up to a maximum of IDR 50,000,000,000.00 (fifty billion rupiah).

Meanwhile, based on the perspective of MSME development, it can be classified as follows:

1. Livelihood activities are small and medium enterprises that are used as job opportunities to earn a living, which is more commonly known as the informal sector.

An example is a street vendor. In this case, the Ajo Sikumbang Chocolate Banana business is included in the type of UMKM with the classification of Livelihood Activities.

2. A microenterprise is a small and medium business that has the nature of a craftsman but does not yet have the nature of entrepreneurship.

3. Small Dynamic Enterprise is a small and medium business that has an entrepreneurial spirit and is able to accept sub-contract and export work.

4. A fast moving enterprise is a small or medium business that already has an entrepreneurial spirit and will transform into a big business (UB).

METHOD

The research method used in this study is a quantitative descriptive method, according to Sugiyono (2017) descriptive method is a method used to describe or analyze a research result but is not used to make broader conclusions. In this study, the variables used were supplier selection criteria using the Quantity, Quality, Cost, and Delivery (QQCD) criteria.

The data collection in this research is in the form of primary and secondary data. Primary data is where the data source is obtained directly from the original source or the first party. Secondary data is a source of data obtained by researchers indirectly through intermediary media (Sugiyono, 2017). Primary data collection was conducted through interviews with Ajo Sikumbang Chocolate Banana seller located on Jl. HR. Soebrantas KM 15, Panam, Pekanbaru City, and also through a questionnaire. Meanwhile, the collection by literature study is to look for sources from books, journals, articles on the internet, and other library sources that are relevant to this research.

This study uses the Analytical Hierarchy Process (AHP) method, which is a decision-making method developed for prioritizing several alternatives when several criteria must be considered and allowing decision makers to organize complex problems into a form of an integrated hierarchy or series of levels.

The AHP method is able to solve multi-objective and multi-criteria problems based on a comparison of the preferences of each element in the hierarchy, so that it can be said that this model is a comprehensive decision making model.

The first step that must be taken in determining the priority arrangement of the elements is to make a pairwise comparison, which is to compare all elements in pairs for each hierarchical subsystem (saaty, 2008).

Table 2. Comparison Scale Determining the Weight of Supplier Criteria

Level of Important	Definition	Note
1	Equally Important	Both elements have the same effect
3	a little more important	Ratings favor one element less than its partner.
5	More important	Both elements have the same effect
7	Very important	One element is very influential and its dominance can be seen clearly
9	Absolute more important	There is evidence that one element is more important than its partner at the highest confidence level
2,4, 6,8	the Middle value between the above judgments	This value is given if there is doubt between two adjacent assessments
-	reverse	Aij =1/a (If activity i receives one point more than activity j, then j has the opposite value as i

Source: Saaty (2008)

The next stage in this research is to choose a supplier. This stage is an important stage in building a performance measurement consisting of several parts, which are the steps of supplier selection using the Analytical Hierarchy Process (AHP). The suppliers selected were in three markets located in Pekanbaru City, namely banana suppliers at the Tuesday Panam Market, Arengka Morning Market, and Kualalu Market.

After determining the supplier, the next step is the classification of suppliers. Supplier classification aims to determine the assessment criteria for each supplier group. The level of importance is seen based on the value of the goods obtained by multiplying the price with the amount of use of the goods.

In this study, the next step is to determine the weight of the supplier criteria. The determination of the criteria that most influence the performance of each group of suppliers can be seen from the weight of each. The weight of each criterion is determined by the results of the pairwise comparison of each criterion. Next, fill in the pairwise comparison matrix.

Consistency Calculation The assessment is carried out after the pairwise comparison stage. The AHP assessment is carried out based on experience and understanding that is quantitative and subjective in nature, so as to allow for

assessments that deviate from logical consistency. In a practically consistent matrix = n, while in an inconsistent matrix, the CI (Consistency Index) must be calculated.

Calculation of Performance Value is the final stage in the AHP method. The calculation of the performance value starts from the lowest level of the hierarchy and moves to the top hierarchy. This performance value is obtained from the results of multiplying the measurement results (called the index value obtained from the comparison between the data and the best data). A formula is used to calculate performance value.

$$\sum_{t=1}^{n} Qt.Yt$$

Note:

Qi =   The weight of each element (Q1,Q2.........Qn)

Yi =   The measurement value for elements/criteria in a hierarchical sub-system
$(Y_1, Y_2 ...... Y_n)$

RESULTS & DISCUSSION

Banana Chocolate Ajo Sikumbang is a small business engaged in the sale of snacks located in the Panam area of Pekanbaru City. This chocolate banana business requires the main raw material in the form of wax bananas, where the raw materials are supplied from suppliers around the Panam area. The suppliers that supply the wax bananas are in three different locations, namely the banana suppliers in Panam Market, Arengka Market, and Kualu Market. Ordering bananas is done by the owner of the Banana Chocolate business, Ajo Sikumbang.

The data collected is the result of a questionnaire in the form of priority choices from predetermined criteria. The data used is as follows:

1. **Determining the Dominant Factor**

Selection criteria and supplier selection using a multi-criteria model of quantity, quality, cost, and delivery. Calculation of alternative supplier criteria as follows:

Tabel 3. Supplier Selection Criteria Matrix

| Criteria	Quantity	Quality	Cost	Delivery
Quantity	1	5	3	3
Quality	1	1	1	1
Cost	1	5	1	0,22
Delivery	5	1	3	1
Total	8	12	8	5,22

Source: Data Processing (2022)

The table above describes the results of processing the weighting data from the questionnaire given to the chocolate banana business owner by three suppliers of wax banana raw materials. After processing, the results of the supplier selection matrix will be re-weighted by calculating each column of the matrix criteria by recalculating each column of the paired matrix so that a new matrix is formed from the results of data processing where the results obtained will produce the expected priority. The results for the weighting are as follows:

Table 4. Supplier Criteria Alternative Matrix

Criteria	Quantity	Quality	Cost	Delivery
Quantity	0,125	0,417	0,375	0,575
Quality	0,125	0,083	0,125	0,192
Cost	0,125	0,417	0,125	0,042
Delivery	0,625	0,083	0,083	0,192
Total	1	1	1	1

Source: Data Processing (2022)

After the criteria matrix is carried out, the number of weights and priorities can be obtained. From the results of data processing, it was found that the most dominant influence for the ajo chocolate banana business was the quantity of waxy bananas at 0.373, or 37%. The graph of the results of data processing is as follows:
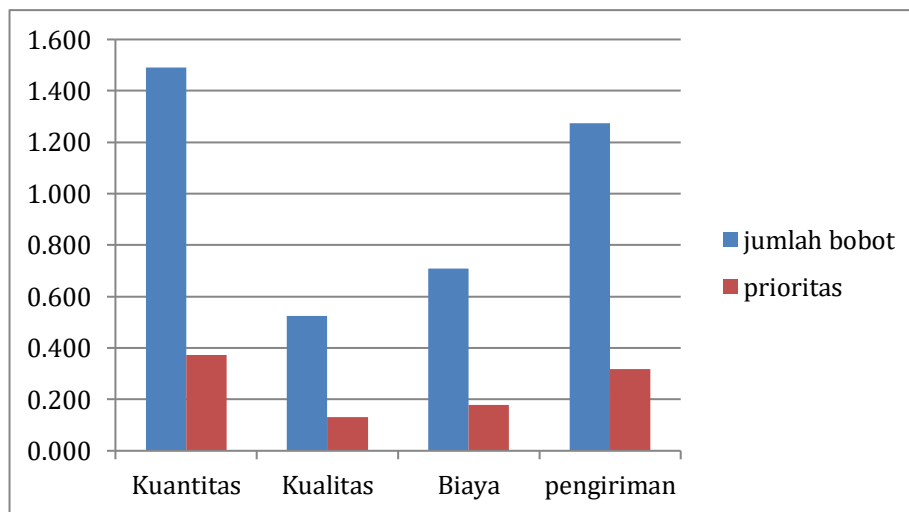
Figure 1. Weighting and Priority Rating Chart for Criteria

Source: Data Processing (2022)

2. Determination of Supplier Performance Indicators for Each Criteria

The determination of supplier performance indicators aims to get maximum results by using data from the chocolate banana business, where the data obtained is daily data from business owners. This data is then calculated into monthly data. The calculation is done by comparing each item received with the items ordered per month,

and then the results are presented. The results of the supplier performance assessment can be seen in the following calculations:

Table 5. Supplier Performance Appraisal of Quantity Evaluation

No	Supplier	Pisang Lilin		Kinerja
		Diorder (buah)	Diterima(buah)	
1	Pasar Kualu	19200	9600	50%
2	Pasar Arengka	19200	12480	65%
3	Pasar Panam	19200	14976	78%

Source: Data Processing (2022)

A quality assessment is obtained by counting the number of goods received from the quantity assessment. Then the number of goods is calculated and a comparison is made between goods received in good condition and damaged condition. The indicator for the calculation of the shipping appraisal is the time from delivery to receipt of the goods, and to calculate the price assessment, the total price of the ordered goods is used. Furthermore, the results of data processing for quality, delivery, and cost assessments can be seen in the following table:

Table 6. Supplier Performance Appraisal of Quality Evaluation

No	Supplier	Banana			Performance
		Received (pcs)	Good condition	Bad condition	
1	Kualu Market	9600	9300	300	96,8%
2	Arengka Market	12480	12030	450	96,4%
3	Panam Market	14976	14706	270	98,2%

Source: Data Processing (2022)

Table 7. Supplier Performance Appraisal of Delivery Evaluation

No	Supplier	Banana		Performance
		Target	Accepted	
1	Kualu Market	1	2	50 %
2	Arengka Market	1	2	50 %
3	Panam Market	1	2	50 %

Source: Data Processing (2022)

Table 8. Supplier Performance Appraisal of Cost Evaluation

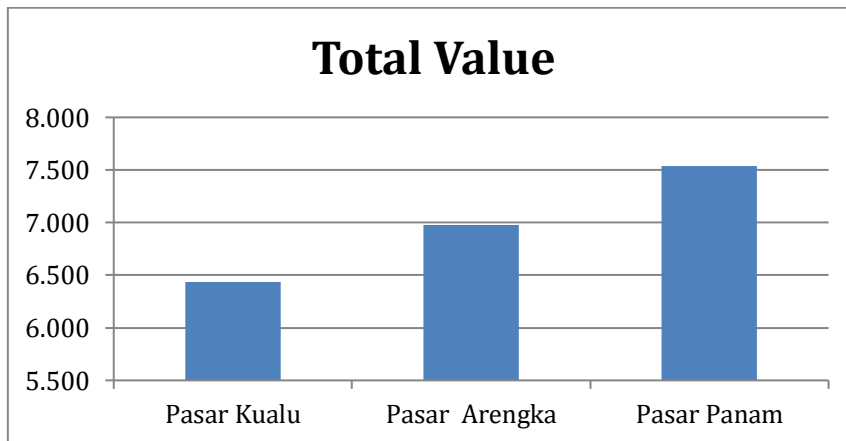| No	Supplier	Banana	Performance
		Total Price	
1	Kualu Market	9.600.000	96,2%
2	Arengka Market	9.408.000	95,8%
3	Panam Market	9.360.000	98,4%

Source: Data Processing (2022)

From the results of data processing, the highest performance value for quantity assessment is 78% for panam market suppliers; the highest quality assessment is 98.2% for panam market suppliers; delivery assessment is 50% for all suppliers; and cost

assessment is 98.4% for suppliers to the panam market. An assessment of all the factors used is carried out to get the best performance so that it can be used as a reference for preparing raw material needs. The result of processing the overall supplier performance are as follows:

Table 9. Supplier Performance Appraisal

No	Supplier	Appraisal	Appraisal Result	Total Value
1	Kualu Market	Quantity Quality Delivery Cost	1,864 1,270 1,705 1,594	6,4
2	Arengka Market	Quantity Quality Delivery Cost	2,423 1,265 1,697 1,593	6,9
3	Panam Market	Quantity Quality Delivery Cost	2,908 1,288 1,743 1,593	7,5

Source: Data Processing (2022)

Figure 2. The Performance Appraisal Chart

Source: Data Processing (2022)

CONCLUSION

Research on supplier selection using the AHP-QQCD (Quality, Quantity, Cost Delivery) method in the Ajo Sikumbang Banana Chocolate business conducted by researchers at this time shows that the quantity criterion (Q) has the highest priority in the selection of suppliers of the main raw material for bananas. This is because the sale of Ajo Sikumbang Chocolate Bananas is carried out every day and the demand for chocolate bananas as snacks and for the community every day can be said to be quite high, so that the availability of raw materials in large quantities is needed. This is intended

for business continuity so that it can run smoothly and also to avoid the occurrence of vacancies in raw material supplies caused by harvest season constraints.

Meanwhile, for findings based on the performance of three supplier sources, it was found that the highest or best value was the supplier in the Pasar Selasa Panam with a value of 7.534. Therefore, based on these findings, it can be concluded that the main supplier of raw materials for bananas for the Ajo Sikumbang Chocolate Banana business is sourced from the Tuesday Panam Market, so it can be recommended that the MSME owners of the Ajo Sikumbang Chocolate Banana business establish cooperation and partnerships with traders who sell wax bananas. So you can get a cheaper price and the availability of stock of raw materials can be more guaranteed.

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