Ann PUBLISHER
Journal of ImproSci
e-ISSN: 0000-xxxx
p-ISSN: 0000-xxxx
ann4publisher@gmail.com

Supplier Selection Using the Analytical Hierarchy Process (AHP) Approach in Ma' Ipeh MSME

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Abstract. In the Analytical Hierarchy Process (AHP) method, a hierarchical structure chart is formed to be able to solve a complex and unstructured problem. Which aims to define a problem from the general to the specific. The problem hierarchy is structured to assist in a decision-making process by taking into account all decision elements involved in the system. Ma'Ipeh Micro, Small and Medium Enterprises (MSME) are one of the community industries that are engaged in onion processing, in order to be able to produce a product that is in accordance with the wishes of consumers. Until now, Ma'Ipeh MSME continue to maintain performance both in terms of products and suppliers. To keep things in good condition and continue to grow, it is necessary to select suppliers that are in accordance with the needs and criteria of MSME. The purpose of this study was to find criteria for selecting suppliers, determining the priority of onion suppliers, and determining follow-up on all other onion suppliers according to their performance. The method used in this research is the AHP. The AHP method is used for effective decision making on complex issues. The criteria used in selecting suppliers include price, quality, service and quantity determination. The results of calculations using AHP, obtained the onion supplier with the best value, namely supplier Saniyah with a weight of 0.951. The next priority supplier is Karim with a weight of 0.337, then Amelia with a weight of 0.279.

Keywords: AHP, Supplier, Criteria, UMKM

INTRODUCTION

In the current era of globalization, competition and rapid technological advances have brought considerable influence to the industry. Moreover, free trade has been opened in the ASEAN region. In international trade, who is strong in competition will make players in the trade, while weak countries only become markets for other countries and especially MSME business people. Realizing that in this very tight competitive situation, a reliable strategy is absolutely needed so that the product has more advantages. Many business people are improving the quality of their products. So, more and more competitors are competing to offer the results of the products they make. Therefore, success in the industry competition will be determined by the success of developing products in accordance with consumer desires and expectations.

MSMEs have an important role in economic development. Due to the relatively high employment rate and small investment capital requirements, MSMEs can flexibly adjust

and respond to changing market conditions (Sopanah in Rahman 2010). Therefore, the existence of MSMEs has an important role in national economic development. These developments encourage industry players to be ready to compete by improving performance so that the production process can improve.

Ma'Ipeh MSMEs are one of the MSMEs engaged in onion processing. Ma'Ipeh MSMEs want to make improvements to one of the business processes that have been running in the company, namely in the raw material purchasing section. Where this is related to the supplier selection process for the procurement of raw materials or support in the production process. Coordination with suppliers needs to be improved by fixing cooperation agreements so that it will reduce order costs and increase the number of goods to be ordered.

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Ma'Ipeh MSME onion production data in 2020 experienced an increase and decrease in production with total production in 2020 in February for onion production of 1440 pcs. While in March there was a decrease in onion production by 1260, because there was still a problem found in the production process activity. This is based on the results of interviews and observations conducted by researchers to one of the company's leaders that in their production activities there is still often a scarcity of onions every year and unstable prices and poor quality of onions, this greatly affects the company's production process.

Ma'Ipeh MSMEs want to improve the quality of their products by using quality raw materials. Therefore, Ma'Ipeh MSMEs need to make a strict supplier selection. Ma'Ipeh MSMEs also need to make clear cooperation agreements with suppliers. The cooperation agreement must include the following: the type and quality of raw materials to be supplied, the price of raw materials, the number of raw materials to be supplied each month, the delivery time of raw materials, and the mode of payment for raw materials.

By conducting strict supplier selection and conducting clear cooperation agreements with suppliers, Ma'Ipeh MSMEs can guarantee the quality of raw materials that will be

used to produce onions. This will have a positive impact on the quality of Ma'Ipeh MSME products and consumer satisfaction.

Supplier selection is a multi-criteria problem which includes quantitative and qualitative factors. The AHP (Analytical Hierarchy Process) method is one method that can be used for supplier selection. This method includes qualitative and quantitative measures. AHP is a decision-making method developed for the prioritization of multiple alternatives when multiple criteria must be considered.

Criteria that are influential and commonly used in supplier selection include price, quality, delivery accuracy, quantity accuracy, and service criteria. Sometimes, these criteria contradict each other. For example, one supplier prefers to offer lower prices with below-average quality, while another supplier offers good quality goods with uncertain delivery. However, it is difficult to find a supplier who can meet all the criteria or who is good at all, but at least can find the optimal supplier for the company

What is the priority order of criteria and sub criteria in supplier selection and which supplier should be chosen by Ma'Ipeh MSMEs using the AHP method.

LITERATURE

According to Law number 20 of 2008, Micro, Small and Medium Enterprises (MSMEs) are businesses or businesses carried out by individuals, groups, small business entities, and households. Indonesia as a developing country makes MSMEs the main foundation of the community's economic sector, this is done to encourage the ability of independence in developing in the community, especially in the economic sector. Law Governing MSMEs More clearly, the definition of MSMEs is regulated in Law of the Republic of Indonesia No. 20 of 2008 concerning MSMEs.

Shallots (Allium cepa L. Aggregatum group) is a type of plant that spices various cuisines in Southeast Asia and the world. The most widely used part is the bulb, although some culinary traditions also use the leaves and flower stalks as flavoring spices. This plant is thought to come from the regions of Central Asia and Southeast Asia. Red onions contain vitamin C, potassium, fiber, and folic acid. In addition, red onions also contain calcium and iron. Shallots also contain natural growth regulators in the form of auxin and gibberellin hormones. Another use of shallots is as a traditional medicine, red onions are known as medicine because they contain antiseptic effects and alliin compounds. Alliin

compounds by the alliinase enzyme are then converted into pyruvic acid, ammonia, and alliisin as bactericidal antimicrobials (Pratiwi, 2020).

Based on the description of the type of shallot, the types / variants of shallots that are often used for fried onion products include Sumenep onions and Brebes onions. Both types of onions have prominent advantages when compared to other types of shallots when fried. Sumenep shallots have been known as the right raw material to be used as fried onions. This is because the water content in Sumenep onion bulbs is relatively less so that it dries and matures faster if processed with the right technique. So that in the cooking process, Sumenep onions do not need to be cooked until overcooked or too long.

According to the Ministry of Trade (2012) Fried onions with Sumenep shallot raw materials have a brighter yellowish color with a crunchy texture. The aroma of fried onions produced is also more fragrant and not too sharp. In addition, fried onions cooked with the right technique also taste light and sweet and not too sharp like fried onions produced from Brebes shallots. If fried, will give crispy results and fragrant aroma that is also very distinctive. In meeting their production needs, Ma'Ipeh MSMEs use Brebes shallots as the preferred raw material used in their processed products. Considerations for choosing Brebes shallots include the taste produced better and more affordable prices because Brebes shallots come from local farmers.

According to Punjawan, Supply Chain Management (SCM) was first proposed by Oliver and Weber in 1982. SCM or supply chain management is a management activity that aims to obtain raw materials, transform raw materials into intermediate or finished goods and distribute these goods until they reach consumers. In a supply chain there are three streams, namely material, information and costs (Yuliani, 2009).

The key to effective supply chain management is balancing production flows with ever-changing consumer demands. Below are some of the advantages of supply chain management including reducing inventory in various ways, ensuring the smooth supply of goods and ensuring product quality. Supply chain is a system where organizations distribute their production goods and services to their customers. This chain is also a network of various interconnected organizations with the same goal, which is to best organize the procurement or distribution of these goods. Supply chain can also be said to be a logistics network with the main players being suppliers, manufacturers, distribution, retail outlets, and customers (Yuliani, 2009).

According to Saaty, decision making in a very dynamic and rapidly developing world is a challenge in itself and it is not easy to determine, especially related to problems or things that affect many people or society, the continuation of a policy or program or the sustainability of an institution / organization, even the survival of the nation and state. Decision making basically involves a set of alternative choices that are most appropriate from the available alternatives to be executed or taken the best (Marsono, 2020).

Basically, humans are decision makers. Everything that is done every day, consciously or unconsciously is the result of several decisions. Moreover, the leaders of an organization or institution are sometimes even often faced with problems that require a decision. For that it takes a certain amount of information or data. The information collected helps a person understand an event or problem, develop good judgment, then for decisions about the problem.

At the time of decision making, there are typically three conditions or situations faced by decision makers, which can be classified based on the level of certainty of the outcome (payoff / outcome) that will occur. The three types of conditions are: (1) decision making under uncertainty, refers to situations where there is more than one possible outcome of a decision, and the probability of each possibility is unknown; (2) decision making under risk, refers to situations where there is more than one possible outcome of a decision, and the probability of each outcome being known or foreseeable by the decision maker; (3) decisions under conditions of certainty; refers to a situation where there is only one possible outcome of a decision, and this outcome is known precisely by the decision maker.

The complexity in decision making lies not only in the uncertainty or imperfection of information, but also caused by dealing with very complex problems, many factors or elements related to them.

According to Saaty (in Marsono 2020) Analytical Hierarchy Process (AHP) is a decision support method developed by a professor Thomas L. Saaty, professor of mathematics at the University of Pittsburgh. AHP is a method of breaking down a complex unstructured situation into several components in a hierarchical order, by subjectively assigning a subjective value to the relative importance of each variable, and determining which variable has the highest priority to influence the outcome of that situation.

The decision-making process is basically about choosing the best alternative. Such as structuring problems, determining alternatives, determining possible values for aleatory

elements, determining values, preference requirements for time, and specification of risk. However wide the alternatives that can be determined and the detailed assessment of probability values, the limitations that remain pervade are the basis for comparison in the form of a single criterion. According to Saaty The basis for using AHP is *decomposition,* comparative judgements, and priority synthesis *(*Lestari, 2019; Marsono 2020).

AHP is a decision-making method used to solve complex and multicriterial problems. AHP is based on the theory that each problem can be solved into several smaller, more manageable components. These components can then be analyzed hierarchically to determine their priorities.

AHP is a powerful decision-making method and can be used to solve a variety of problems. AHP is a structured and systematic method, so it can help decision makers to make better decisions (Handayani, 2017).

METHOD

The method used is the *Analysis Hierarchy Process* (AHP), which is a hierarchical structure chart formed to be able to solve a complex and unstructured problem. Which aims to define a problem from general to specific. AHP consists of several steps, namely: (1) define the problem, the first step is to define the problem to be solved. The problem must be clearly defined and specific, so that it can be solved into smaller components; (2) Create a hierarchy, the second step is to create a hierarchy of problems. A hierarchy is a diagram that shows the relationships between the components of a problem.

The topmost component in the hierarchy is the primary goal, while the bottommost component is the available alternative; (3) Create a pairwise comparison matrix, the third step is to create a paired comparison matrix for each component in the hierarchy. A paired comparison matrix is a table used to compare the relative importance of two components; (4) Calculate weights, the fourth step is to calculate the weights for each component in the hierarchy. The weights are calculated using a pairwise comparison matrix; (5) Make a decision, the last step is to make a decision. The decision is made by choosing the alternative with the highest weight.

DISCUSSION

To select a supplier, four criteria have been set, among others: price, quality, service, and accuracy. Each criterion is arranged sub-criteria to be assessed. The assessment of the criteria and sub-criteria was carried out on three alternative suppliers to be selected.

Table 1. Priorities global (global priority)

Level 0	Level 1	Level 2	Weight	Level 3	Weight	Weight
Purpose	**Criterio**	**Sub criteria**		**Alternative**	**Local**	
Choosing the Best Supplier	Price 0.213	Appropriateness of price with the quality of the goods produced 0.187	0.040	Amelia	0.406	0.016
				Karim	0.135	0.005
				Saniyah	0.459	0.018
		Ability to give discounts on bookings of a certain amount 0.411	0.088	Amelia	0.357	0.031
				Karim	0.193	0.017
				Saniyah	0.450	0.039
		Ease and Payment Term 0.087	0.020	Amelia	0.279	0.005
				Karim	0.474	0.009
				Saniyah	0.247	0.005
		The ability to negotiate 0.315	0.070	Amelia	0.626	0.042
				Karim	0.152	0.010
				Saniyah	0.222	0.015
	Quality 0.397	**Conformity of goods with established specifications** 0.189	0.075	Amelia	0.294	0.022
				Karim	0.456	0.034
				Saniyah	0.249	0.019
		Provision of Defect less Goods 0.418	0.166	Amelia	0.163	0.027
				Karim	0.494	0.082
				Saniyah	0.343	0.057
		Ability to deliver consistent quality 0.079	0.031	Amelia	0.106	0.003
				Karim	0.606	0.019
				Saniyah	0.288	0.009
		Suitability of onion dryness level 0.314	0.124	Amelia	0.149	0.019
				Karim	0.543	0.068
				Saniyah	0.309	0.038
	Service 0.0	Ease of contact 0.239	0.021	Amelia	0.454	0.010
				Karim	0.230	0.005
				Saniyah	0.316	0.007
		Ability to provide information clearly and easily to understand 0.235	0.021	Amelia	0.256	0.005
				Karim	0.165	0.003
				Saniyah	0.580	0.580
		Speed in terms of responding to customer requests 0.194	0.017	Amelia	0.332	0.006
				Karim	0.107	0.002
				Saniyah	0.560	0.010
		Quick Response in Resolving Customer Complaints 0.332	0.030	Amelia	0.172	0.005
				Karim	0.443	0.013
				Saniyah	0.385	0.011
	Stipulation of the number of bookings and receipts **0.301**			Amelia	0.292	0.088
				Karim	0.232	0.070
				Saniyah	**0.476**	**0.143**

From the results of the calculation of priority weights in table 1, the value of the criteria weights in the selection of suppliers for Ma'Ipeh MSMEs is obtained as follows: (1) price criteria with a value weight of 0.213; (2) quality criteria with a value weight of 0.397; (3) Service criteria with a value weight of 0.090; (4) the criteria for the determination of the number with a value weight of 0.301. The weight value indicates that the higher the priority weight value, the value indicates the earliest priority order level. With the selection of quality criteria as the first priority in supplier selection, it shows that Ma'Ipeh MSMEs prioritize the quality of their products in order to be able to compete and develop so that the production process continues to run with good quality. This is because quality raw materials according to order will affect the smooth production. Conversely, the quality of raw materials that are not suitable will interfere with production quality.

In the price criteria, the sub-criterion that is considered the most important is the ability of the supplier to provide discounts (discounts) on orders in a certain amount with a weight value of 0.411, the sub-criterion on the quality criterion that is considered the most important is the provision of defect less goods with a weight value of 0.418, the sub-criterion on the service criteria that is considered the most important is responsiveness in resolving customer complaints with a weight value of 0.332.

In the price criterion with the sub criterion of price appropriateness with quality, Saniyah suppliers were considered the best by respondents with a weighting value of 0.459. Furthermore, Amelia supplier with a weight value of 0.406 and Karim supplier with a weight value of 0.135. Furthermore, in the price criterion with the sub criterion of the ability to provide discounts on orders in certain quantities, Saniyah suppliers were considered the best by respondents with a weighting value of 0.450. Furthermore, Amelia supplier with a weight value of 0.357 and Karim supplier with a weight value of 0.193. Then on the price criterion with the payment period sub criterion, Karim's supplier was considered the best by the respondents with a weighted value of 0.474. Furthermore, Amelia's supplier with a weight value of 0.279 and Saniyah's supplier with a weight value of 0.247. As well as on the price criterion with the sub criterion of the ability to negotiate, Amelia's supplier was considered the best by the respondents with a weighting value of 0.626. Furthermore, Saniyah suppliers with a weight value of 0.222 and Karim suppliers with a weight value of 0.152.

In the quality criteria with sub criteria for conformity of goods with predetermined specifications, Karim suppliers were considered the best by respondents with a weight value of 0.456. Furthermore, Amelia's supplier with a weight value of 0.294 and Saniyah's supplier with a weight value of 0.249. Furthermore, in the quality criteria with the sub criteria of providing goods without defects, Karim's supplier was considered the best by respondents with a weighting value of 0.494. Furthermore, supplier Saniyah with a weight value of 0.343 and supplier Amelia with a weight value of 0.163. Then on the quality criteria with the sub criterion of the ability to provide consistent quality, Karim's supplier was considered the best by the respondents with a weighting value of 0.606. Furthermore, supplier Saniyah with a weight value of 0.288 and supplier Amelia with a weight value of 0.106. As well as in the service criteria with the sub criteria of responsiveness in resolving customer complaints, Karim's supplier was considered the best by respondents with a weighting value of 0.543. Furthermore, supplier Saniyah with a weight value of 0.309 and supplier Amelia with a weight value of 0.106.

In the service criteria with ease of contact sub criteria, Amelia's supplier was considered the best by respondents with a weighting value of 0.454. Furthermore, Saniyah supplier with a weight value of 0.316 and Karim supplier with a weight value of 0.30. Furthermore, in the service criteria with the sub criterion of the ability to provide information clearly and easily understood, Saniyah suppliers were considered the best by respondents with a weighted value of 0.494. Furthermore, Amelia supplier with a weight value of 0.256 and Karim supplier with a weight value of 0.165. Then in the service criteria with speed sub criteria in terms of responding to customer requests, Saniyah suppliers were considered the best by respondents with a weighting value of 0.560. Furthermore, Amelia supplier with a weight value of 0.332 and Karim supplier with a weight value of 0.107. As well as in the service criteria with the sub criteria of responsiveness in resolving customer complaints, Karim's supplier was considered the best by respondents with a weighting value of 0.443. Furthermore, supplier Saniyah with a weight value of 0.385 and supplier Amelia with a weight value of 0.172.

In the number determination criterion, Saniyah suppliers were considered the best by respondents with a weighting value of 0.476. Furthermore, Amelia supplier with a weight value of 0.292 and Karim supplier with a weight value of 0.232.

The assessment that has been given by respondents must be carried out consistently. To find out it can be by measuring logical consistency. Which aims to find out whether the assessment by respondents in comparing between elements has been done consistently. If the assessment is done inconsistently, the researcher needs to re-evaluate or ask respondents to re-answer related questions. Inconsistencies can arise due to misconceptions or inaccuracies in doing hierarchies, lack of information, errors in writing numbers, and others. The answer / assessment of informants / expert respondents (data) about comparison between elements is considered consistent if the CR value does not exceed 10% (CR ≤ 0.1). If the CR value > 10%, it means that the assessment that has been made may be random and needs to be revised. From the results of measuring the consistency of responses given by respondents as in table 4.75, it can be concluded that all respondents' assessments are consistent because the CR value < 0.1. So that filling in the values on the paired matrix does not need to be redone. This means that the smaller the CR value is less than 0.1, the data is considered consistent and valid, and vice versa, if the CR value is greater than 0.1, the data is considered inconsistent and invalid.

After calculations are made to obtain the overall alternative weight from each existing criteria and alternatives as in table 1, the overall Saniyah Supplier is the first priority to be selected with a value weight of 0.951. Furthermore, Supplier Karim with a value weight of 0.337 and finally Supplier Amelia with a value weight of 0.279. This shows that Saniyah Supplier is the best supplier that Ma'Ipeh MSMEs will choose as a long-term supplier because it has the highest value compared to the other two suppliers.

Table 2. Priority Weight

ALTERNATIF	BOBOT	PRIORITAS
A**melia**	0.279	3
K**arim**	0.337	2
S**aniyah**	0.951	1

From the table above, it can be seen that the weight of the first, second, and so on priorities of each alternative is known. The first priority is Saniyah supplier with a weight of 0.951, the second priority is Karim supplier with a weight of 0.337 and the third priority is Amelia supplier with a weight of 0.279.

CONCLUSION

The priority order of criteria that are very influential in the selection process of selecting suppliers for Ma'Ipeh MSMEs is quality, quantity determination, price. While the order of priority of sub criteria on price criteria is the ability to provide discounts (discounts) on orders in certain quantities, the ability to negotiate, the appropriateness of prices with the quality of the goods produced, the term of payment. In the quality criteria, the priority order of sub criteria is the provision of goods without defects, the suitability of the level of dryness of onions, the conformity of goods with predetermined specifications, the ability to provide consistent quality. In the service criteria, the priority order of the sub criteria is quick responsiveness in resolving customer complaints, ease of contact, ability to provide information clearly and easy to understand, speed in terms of responding to customer requests.

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