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Measurement and Sorting of MSMEs Business Performance Rating Using Analytical Hierarchy Process

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ABSTRACT

This research was conducted in an enterprise that provides venture capital assistance to its 876 Micro, Small, and Medium Enterprises (MSME) partners to measure and sort the performance of their business. The enterprise wished for a business performance calculation system that is more reliable and utilized more than one criterion. In addition, the enterprise also desired to give rewards to MSMEs with the most excel accomplishment, so they need to know which MSMEs are the most developed among others. This study uses focus group discussions and existing data to obtain the appropriate performance measurement criteria. The determination of the weight of the importance of each criterion was carried out using the Analytical Hierarchy Process (AHP) method using pairwise comparison techniques and its consistency is measured using the transitive property and consistency ratio. The proposed method is emphasized on ease of use and delivery to stakeholders but still capable of acquiring the performance calculation. The calculation includes the increase or decrease rate of the business performance for each MSME, and after sorting the rating, the most accomplished MSME also can be found. The application of this method also can help the stakeholder to reach consensus swiftly.

Keywords: MSME; Venture Capital; Business Performance; Analytical Hierarchy Process; Sorting

1. INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) in Indonesia are the backbone of the national economy. However, the turnover of capital in the MSME sector is still relatively small. A common problem for MSMEs in Indonesia is limited venture capital which makes it difficult for their business to develop [1] [2]. The growth rate of capital loans for MSMEs in Indonesia from the banking industry is only around 13.6% [3]. Therefore, one of the state-owned enterprises in Indonesia has a business development program for its MSME partners. This development program includes the provision of capital loans and business development assistance in the form of training and seminars related to business development in their respective sectors.

There are 876 MSME partners in this enterprise. These MSME partners are grouped into 4 classes that are divided in terms of the maximum amount of capital loans and the repayment period. The 4 classes, respectively, are Class 1, Class 2, Class 3, and Class 4, with the lowest loan limit being in Class 1 and the highest loan limit being in Class 4. The

enterprise evaluates their MSME partners periodically to monitor the partners business progress during their program. The MSMEs with satisfying business performance will have the opportunity to be promoted to higher class so that they are entitled to get a higher amount of business capital loans with a longer repayment period. However, the enterprise still had no regulation to decide the MSMEs that are entitled to be promoted. So far, the promotion decision is taken by the auditors based on their respective judgment regarding the adequacy of the sales number obtained by their partners. However, this kind of assessment is still considered inaccurate by stakeholders since the judgment is too subjective and they think that measuring business development should not be done by the size of the sales increase only, especially considering that the size of the business of their MSME partners is not uniform.

In addition, the enterprise also wishes to present an award for their MSME partner who is considered the most accomplished and has the most significant business development among other MSMEs partners. But they still have no measurement to determine which MSMEs are entitled to receive this award. In the future, stakeholders also hope that, by knowing which MSMEs are the most accomplished, these leading MSMEs can become role models and act as the benchmarks that can encourage other MSMEs partners to develop as well. Knowing which the best MSMEs are is also beneficial for the enterprise to learn more about how to develop more effective and appropriate coaching programs for other partner MSMEs.

By considering the wishes of the stakeholders in the enterprise, as well as considering the existing problems, this research creates a business performance measurement system for MSMEs partner using various assessment criteria, and then the results of these performance measurements will be sorted so it can be obtained which MSME has the highest total value of business performance measurement. Thus, a more objective and empirical business performance measurement system will be obtained so that decision making among MSME partners who are entitled to apply for a class promotion can be carried out more reliably. In addition, by sorting the results of business performance measurements, the MSMEs with the best accomplishment can also be discovered.

2. METHOD

The steps of the calculation method proposed in this study, we describe on the flowchart in Figure 1.

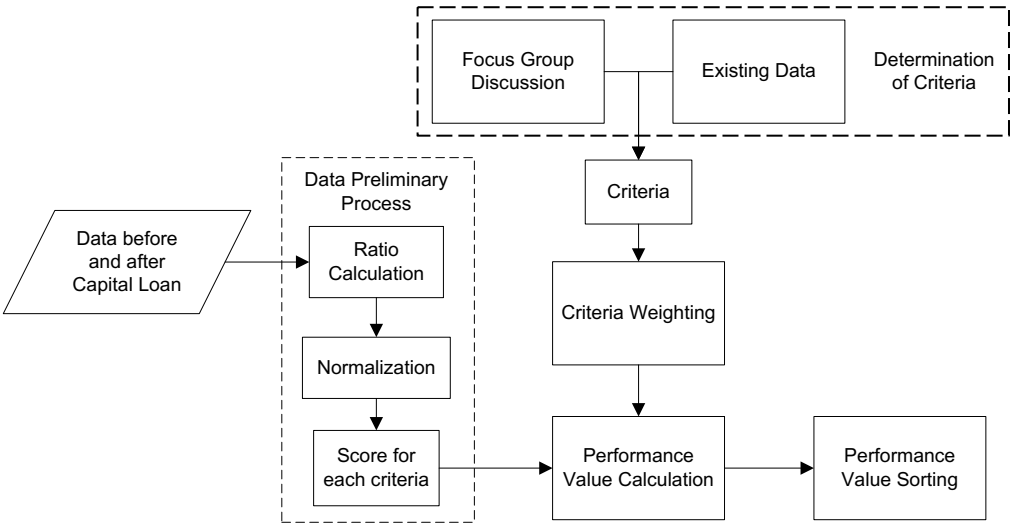

Figure 1. Method Flow

2.1. Determination of Performance Measurement Criteria

The stakeholders of the enterprise, regarding the MSME partners, wish that the performance measurement of their partners be measured by more than one criterion. So far, the business performance measurement only utilized the rate of the sales turnover obtained by the MSMEs. If the sales obtained is considered high enough by the auditor, then the said MSME is considered to have satisfying business performance. This kind of assessment is very subjective and tends to be biased. Therefore, stakeholders desire a more reliable and unbiased measurement. In addition, measurements should not only use one criterion, since MSMEs with larger capital strength will generally also generate a larger sales turnover [4]. Therefore, measuring the business performance of partner MSMEs should use criteria that can involve non-uniform capital strength and the business size of MSMEs partner in this enterprise so that a more inclusive and appropriate measurement and assessment system of the partners business performance is obtained.

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The study began by conducting focus group discussions with stakeholders to capture their perceptions and desires regarding the measurement of the business performance of their partners. This focus group discussion involved 3 parties representing 3 divisions, each of which handles the audits and measurement, finances, and partners relationship which handles training and business development.

In addition to conducting focus group discussions, this research also utilized the existing data in the company. This data includes the list of MSMEs partners containing information about the business of each partner as well as financial data and their proprietary assets. These existing data will be taken into consideration in determining the measurement criteria since it is considerably logically better that this research would only utilize the existing data so that research can be carried out faster.

2.2. Determination of Criteria Weight

After the criteria used in business performance measurement have been mutually agreed by the stakeholders, the next step is to determine the weight for each criterion. The weight reflects the level of importance and influence on the performance measurement of each partner. The greater the weight of criterion indicates that it has a high level of importance and influence on decision making, and vice versa.

Determination of the weight of these criteria would be ineffective and take a long time if it is done with a focus group discussion, even more so if consensus is hard to get [5]. Moreover, there is a potential for bias if the determination of the weight of the criteria is not carried out with a reliable method that can calculate the weight of the criteria appropriately. Therefore, this study uses The Analytic Hierarchy Process (AHP) method in the process of calculating and determining the appropriate weight for each criterion.

The problem faced in this research is a decision-making problem that has various criteria, or generally called Multi-Criteria Decision Making (MCDM). In MCDM, the decision makers need to determine the level of importance of a criterion compared to one another. Therefore, with a multi-criteria decision problem like this, this research uses the AHP method. This AHP method is a method that has long been introduced by Thomas L. Saaty in the 1970s. This method was chosen due to its ability to capture judgments, feelings, and preferences from decision makers who are human beings whose decisions are influenced by emotions, and therefore it is possible that their judgment will be biased and difficult to be validated even by themselves [6]. The selection of the AHP method is also based on the simplicity of this method that helps researchers to get results efficiently and easily communicate them to stakeholders [7].

The AHP method has been widely used by decision makers and researchers. The AHP method uses the definition of criteria and the calculation of the weight of each criterion as the core of this method to consider each alternative. The AHP method also excels in terms of its ability to combine conflicting judgments by giving each factor a weighting, compared to other methods such as Choosing by Advantage (CBA) [8]. The AHP method can not only be used to select alternatives but can also be used for resource allocation and forecasting. However, mostly it is utilized for measuring criteria and selecting and ranking various alternatives [9].

In this study, the AHP method will be used to calculate the weight of each criterion, considering the opinions of all stakeholders consisting of various divisions related to decision making regarding MSME partners in the enterprise. So, concisely, the AHP method in this study was used to calculate weights and not to choose alternatives. The weight of the criteria will be used as a benchmark in calculating the business performance of each partner MSME.

The steps to determine the weight of each criterion are as follows (Figure 2):

1. Make a pairwise comparison questionnaire aimed to capture the opinions of each party of stakeholders. The use of pairwise comparison technique is very prone to inconsistency since this technique relies on decisions made by humans [10]. The potential for inconsistency will be greater if the criteria used are greater [11]. However, the use of pairwise comparison is quite important and is a fundamental calculation process for measuring properties that cannot be clearly measured mathematically [12] [13]. Various methods are used to reduce the potential for inconsistency such as the use of Consistency Index, Consistency Ratio, Euclidean distance, or alternative permutations and repeated ANOVA measurements [14]. Those methods can measure the level of consistency and reduce the potential for inconsistency although in some cases the inconsistencies still occurred. Therefore, this study attempted to use only sufficient criteria to reduce inconsistency that might happen.
2. Test the consistency of each respondent's answers. This study combines the use of Transitive Property, Consistency Index (CI), and Consistency Ratio (CR) to test the consistency of each respondent's answers. The use of transitive properties can be easily done if the criteria used and the respondents who determine are not too many [15].

3. Calculating the priority vector, which is the weight or level of importance of each criterion. Priority vector is measured for each respondent first, then the central tendency is searched for all answers from the three respondents.
4. Create Consistency Vector, with the help of Principal Eigenvector [16], to ensure that each respondent's answer is consistent adjusting to Saaty's recommendation where the answer can be accepted if the CR calculation result is still below 10%.

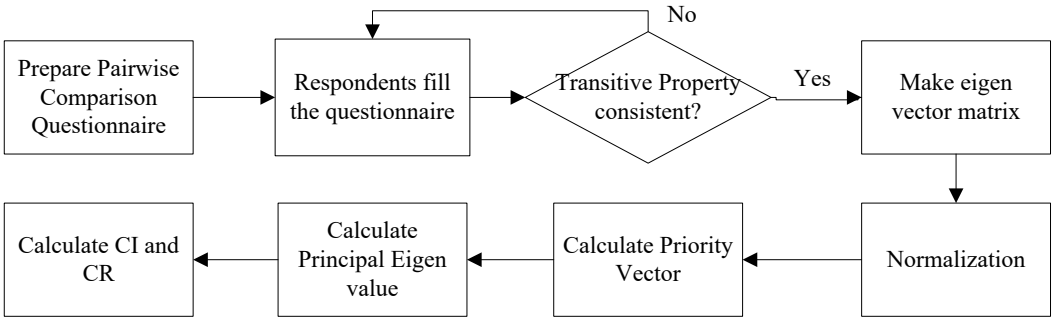

Figure 2. Criteria Weighting Steps

For example, if *n* criteria are used, then we symbolized $C_1, \ldots, C_n$, with each weighting $W_1, \ldots, W_n$, the results of the answers to the pairwise comparison questionnaire will be made into a pairwise ratio matrix where the row is the ratio of each criterion compared to other criteria.

$$\begin{matrix} & C_1 & \cdots & C_n \\ C_1 \\ \vdots \\ C_n \end{matrix} \begin{bmatrix} \frac{W_1}{W_1} & \cdots & \frac{W_1}{W_n} \\ \vdots & \ddots & \vdots \\ \frac{W_n}{W_1} & \cdots & \frac{W_n}{W_n} \end{bmatrix} \quad (1)$$

Therefore, the eigenvalue of the matrix above can be written as $CW = nW$.

Thus, to recover the scale of W into the ratio matrix C, it is necessary to solve the equation $CW = nW$ above. This is called a homogeneous system of linear equations.

The results in the first matrix can be written as the element of the pairwise comparison matrix.

$$\begin{pmatrix} C_{ii} & \cdots & C_{in} \\ \vdots & \ddots & \vdots \\ C_{ni} & \cdots & C_{nn} \end{pmatrix} \quad (2)$$

The sum of each value in each column is:

$$C_{ij} = \sum_{i=1}^{j} \quad C_{ij} \quad (3)$$

Normalization is obtained by dividing each element in the matrix by the sum of each column, to obtain a pairwise normalized matrix.

$$X_{ij} = \frac{c_{ij}}{\sum_{i=1}^{n} \ c_{ij}} = \begin{bmatrix} X_{ii} & \cdots & X_{ij} \\ \vdots & \ddots & \vdots \\ X_{ji} & \cdots & X_{jj} \end{bmatrix} \quad (4)$$

The weight of each criterion is the result of dividing the number of each column in the pairwise normalized matrix with the number of criteria used in the study. Thus, a priority vector matrix will be formed, which not only provides information about the weight of each criterion but also to create a consistency matrix.

2.3. Sorting and Determination of the most superior MSME

After the weight of each criterion has been determined through the AHP method, the next process is calculating the value of each criterion for each partner. However, the value of each criterion obtained by the MSMEs cannot be calculated solely by multiplying the value of each criterion by the weight of the corresponding criteria, since the criteria used here have different units and characteristics. Therefore, the data for each criterion in each partner must go through a preliminary process which is the data normalization process.

In general, data normalization is the process of obtaining comparable numerical data using the same scale or unit [17]. There are many normalization techniques in the literature, including linear comparisons, both max, max-min, and sum, as well as vector and logarithmic normalization. These techniques have their respective advantages although the results still have variances. Although the variance may not be very large, it can have significant consequences when designing a decision-making system.

This study uses the Linear normalization (Max) method, where the data for each criterion will be normalized by comparison with the largest value for each related criterion [18]. This method was chosen since the existing data in the enterprise has a very high variance. With this method, if further investigation found that the data with high variance may contain errors or invalid, then the data can be omitted from the calculation while significantly would not affect the calculation system that has been built.

The formulation for the normalization process with the Linear (Max) method is divided into 2 ways:

1. If the criteria used are the benefit criteria, which the criterion with the higher value is more favorable, then the normalization formula is:

$$n_{ij} = \frac{r_{ij}}{r_{max}} \quad (5)$$

2. If the criteria used are the cost criteria, which the criterion with the smaller value is more favorable, then the formulation is:

$$n_{ij} = 1 - \frac{r_{ij}}{r_{max}} \quad (6)$$

Where r_{ij} is performance rating for alternative A_i on criteria C_j, and r_{max} is the largest value for each criterion *i*.

After the data for each criterion for each partner has been normalized, the total value for each partner can be calculated. The total value is obtained by multiplying the value of each criterion by the weight of the corresponding criterion, then the value of each value is added up in total. The total value of the calculation is considered and accepted as the value of the business performance of each partner MSME.

To find which MSME is the most accomplished among other partners, a sorting process is carried out on the total value of the performance of each partner. The sorting process is done from the partner with the largest total value to the smallest total value. The partners that have the largest total value are MSME partners who are considered and accepted as the best MSMEs among others.

3. RESULT AND DISCUSSION

Focus group discussions and the searching for existing data resulted in several measurements that could potentially be the criteria to measure the business performance of each partner. These criteria are:

1. Principal loan value
2. Sales turnover before and after the capital loan
3. Estimated value of business assets before and after the capital loan, as well as
4. Number of employees before and after the capital loan.

The research team then conducted further searches on the criteria mentioned above to find which criteria were appropriate and could be used to calculate the business performance of each partner.

For the Principal Loan Value criteria, we found that the loan value for each partner was different. Even for the same class, not all MSMEs take out the maximum principal loan. This causes the criteria for the Principal Loan Value alone cannot be used as a criterion for calculating business performance since the capital owned by a business plays a role in the development of the business. Businesses with larger capital tend to be able to scale up larger businesses in a relatively shorter time than businesses with small capital [19]. Therefore, the use of the Principal Loan Value criteria as a criterion in calculating business performance for partners with non-uniform loan values is considered inappropriate.

Sales Turnover before and after capital may be used as criteria in calculating business performance at partner MSMEs. However, since the sales turnover prior to the loan is also influenced by the amount of MSME capital before the loan from the enterprise, an adjustment for this criterion is necessary so that the calculations are more accommodating to the

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diversity in the size of the MSMEs before the capital loan. Therefore, this study uses a comparison ratio between the sales turnover before the capital loan and sales turnover after the capital loan. By using the sales turnover ratio, the bias from the inequity of the capital size is expected to be minimized.

The estimated assets value may also be used as a criterion in performance measurement for MSMEs partner. However, the comparison ratio between the value of before and after the loan is also be used here to reduce bias since there are differences in the business size of each partner.

This enterprise has a mission in developing MSMEs, which includes reducing the unemployment rate. Therefore, the enterprise desires a criterion which represents the increase of the number of employees in measuring the business performance. This criterion also uses the ratio in its calculation to be the same as other criteria.

With the various considerations above, stakeholders decided and mutually agreed that the criteria used to measure the business performance, along with the code attached respectively, were as follows:

1. Sales turnover ratio between before and after the capital loan (C1),
2. The ratio of the estimated value of assets between before and after the capital loan (C2), as well as
3. The ratio of the number of workers between before and after the capital loan (C3).

These criteria were then measured for each weight using the AHP method. The use of AHP to capture human perceptions and judgments can reduce subjectivity [20]. Respondents for the pairwise comparison questionnaire are 3 persons, each representing 3 stakeholders in the enterprise, which are the divisions that each handle audits, finance which includes lending and supervision of repayments, as well as divisions related to development and training for the partners.

The collection of the pairwise comparison questionnaire responses are also accompanied by discussion with the research team, especially if the results are inconsistent. The inconsistent results, for example, are as follows: if the respondent considers C1 more important than C2, then C2 is considered more important than C3, then logically the respondent should also think C1 is more important than C3. It should be noted that by using pairwise comparison, the criteria that are considered more important will have a greater value, so that logically, the order will be C1 > C2 > C3. This logic is called a transitive property [15] and results like this are expected from a pairwise comparison questionnaire [10]. If the opposite happens, for example, the respondent answers that C3 is more important than C1, then it will be C3 > C1 > C2 > C3, and this makes the results of the pairwise comparison questionnaire inconsistent. Inconsistency is very likely to occur, especially if the questionnaire uses more criteria since the answer is closely related to human judgment. Therefore, in addition to allowing respondents to fill in the pairwise comparison questionnaire according to their own opinions, mentoring and discussion may be needed so that the results are consistent even before the consistency index is measured.

The first respondent (R1) who filled out the pairwise comparison questionnaire was from the division that handled the audit and yearly evaluation. The auditors are the people who have direct contact with the partners and are tasked with measuring the business performance of each partner. In filling out the pairwise comparison questionnaire, not all auditors filled it out, but only one person that was considered capable of representing the auditors. The perspective of R1 is presented in Table 1.

Table 1. First Respondent (R1) Perspective

Criteria	Priority Score																	Criteria
	More Important Than								Equal	Less Important Than								
C1	**9**	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C2
C2	9	8	7	6	5	4	3	2	1	2	3	4	5	6	**7**	8	9	C3
C3	9	8	7	6	5	4	3	2	1	2	**3**	4	5	6	7	8	9	C1

From the results of the pairwise comparison questionnaire, the first respondent considers that the C1 are more important than the C2. Then the C3 is more important than the C2. Finally, C1 is considered more important than C3. So, if the criteria are sorted by the level of importance, then the order becomes C1 > C3 > C2. By looking at the transitive property, these results are consistent.

Then from the comparison matrix, a priority vector is made which is a normalization of the eigenvector matrix. The normalization of the eigenvectors is obtained from the eigenvalues of each vector divided by the number of columns. Then, the Priority vector is obtained from the average of each row of criteria. The results of the Priority vector calculation are presented in Table 2.

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Table 2. Priority Vector from First Respondent

Eigenvector				Normalization			Priority Vector
Criteria	**C1**	**C2**	**C3**	**C1**	**C2**	**C3**	
C1	1	9	3	0.692	0.529	0.724	0.648619129
C2	0.111	1	0.143	0.077	0.059	0.034	0.056743122
C3	0.333	7	1	0.231	0.412	0.241	0.294637749
Sum	1.444	17	4.143	1	1	1	1

The sum of priority vectors for all criteria is 1 since normalization has been carried out. Priority vectors represent the relative weight among criteria. The results in Table 2 shows that the first respondent thinks that the C1 are the most important criterion with the weight of 64.6%, followed by the C3 with the weight of 28.9% and the last is the C2 with a weight of 6.4%. The result of the calculation also shows that the first respondent prioritizes C1 by 2.2 times more importance than C3, which is obtained from the weight of C1 divided by the weight of C3. The first respondent also prioritized criteria C1 for 10.1 times higher than C2.

As a final step to confirm that the results of the first respondent have been consistent, a calculation for the Consistency Ratio (CR) is also carried out. The result of the CR calculation is 9.6%. Thus, the answer from the first respondent may be deemed as consistent since it is smaller than Saaty's recommendation, which is 10%.

Then, the research continued by asking the opinion of the second respondent (R2), the financial part. This process also uses the same pairwise comparison questionnaire and is also accompanied and discussed with the research team. The results of filling out the pairwise comparison questionnaire for the second respondent is presented in Table 3.

Table 3. Second Respondent (R2) Perspective

Criteria	Priority Score																Criteria
	More Important Than								Equal	Less Important Than							
C1	**9**	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	C2
C2	9	8	7	6	5	4	3	2	1	2	3	4	**5**	6	7	8	9	C3
C3	9	8	7	6	5	4	3	2	1	2	3	**4**	5	6	7	8	9	C1

Based on the answers of the second respondent on the pairwise comparison questionnaire, the results obtained are not much different from the answers from the first respondent. The second respondent also thinks that C1 has a greater priority than C2. Criterion C1 is also more important than C3. While the C3 are still more important than the C2. Thus, it is possible to make an order of importance which turns out to be the same as the opinion of the first respondent, which is C1 > C3 > C2. These results are consistent by transitive property.

The answer from the second respondent is then processed for the priority vector to determine the magnitude of the priority, in the same way as in the first respondent. The results of the priority vector calculation for the second respondent are presented in Table 4.

Table 4. Priority Vector from Second Respondent (R2)

Eigenvector				Normalization			Priority Vector
Criteria	**C1**	**C2**	**C3**	**C1**	**C2**	**C3**	
C1	1	9	4	0.735	0.6	0.769	0.701308216
C2	0.111	1	0.2	0.082	0.067	0.038	0.062253619
C3	0.25	5	1	0.184	0.333	0.192	0.236438165
sum	1.361	15	5.2	1	1	1	1

The results of the priority vector calculation for the second respondent shows that although they have the same priority order as the first respondent, the priority weights for each criterion are different. The second respondent believes that the C1 are the most important criterion with the weight of 70.1%, while the second priority is the C3 with a weight of 23.6%, and the last priority is the C2 with a weight of only 6.2%. This means that the second respondent thinks that the C1 has an importance level of 2.97 times higher than the C3, and 11.3 times more important than the C2.

Considering that later the weight of each criterion will be used as a multiplier on the value of each criterion for each partner, it is possible that there will be differences in the results of calculating the total value if the weight of the criteria from the second respondent is ignored. Therefore, although the order of priority criteria between the first respondent and the second respondent is the same, the weight of each criterion from the two respondents will still be considered when calculating the total value of business performance for each partner.

The result of the CR calculation for the answers from the second respondent is 10.2%. This result is slightly higher than Saaty's recommendation, which is 10%. However, the answer from the second respondent can still be used in the study since the answer is consistent in terms of their transitive property. In addition, the CR of the second respondent is still not too far from Saaty's recommendation of 10%.

Finally, the research continued by capturing the opinion of the third respondent (R3), the representatives from the division that handles training and business development of MSMEs partners. By using the same pairwise comparison questionnaire, the results are presented in Table 5.

Table 5. Third Respondent (R3) Perspective

Criteria	Priority Score																Criteria
	More Important Than								Equal	Less Important Than							
C1	9	8	7	6	5	4	**3**	2	1	2	3	4	5	6	7	8	9	C2
C2	9	8	7	6	**5**	4	3	2	1	2	3	4	5	6	7	8	9	C3
C3	9	8	7	6	5	4	3	2	1	2	3	4	5	6	**7**	8	9	C1

The third respondent has a slightly different point of view compared to the first and second respondents. The third respondent considered that, similar to the other two respondents, the most prioritized criterion is criterion C1. It is quite understandable that a business should always try to increase profits through increasing sales turnover. However, the third respondent has the opinion that C2 has a higher priority than C3. This is different from the first respondent and the second respondent who think that the C3 is more important than the C2. The third respondent argues that the ratio of the estimated value of assets between before and after the loan is an important criterion since they think that in the long term, larger assets will be better able to help MSME businesses to develop more. In addition, the third respondent believes that the increase in the number of workers does not have much effect on the business development. Thus, the order of importance of the three criteria, starting from the most important, according to the third respondent is C1 > C2 > C3. This result has been consistent for its transitive property.

The next step is to calculate the priority vector to determine the weight of the importance of each criterion. In the same way as the other two respondents, the results of the priority vector calculation for the answers of the third respondent are shown in Table 6.

Table 6. Priority Vector from Third Respondent (R3)

	Eigenvector			Normalization			Priority Vector
Criteria	C1	C2	C3	C1	C2	C3	
C1	1	3	7	0.677	0.714	0.538	0.643388869
C2	0.333	1	5	0.226	0.238	0.385	0.282839025
C3	0.143	0.2	1	0.097	0.048	0.077	0.073772106
Sum	1.476	4.2	13	1	1	1	1

The results of the priority vector calculation from the third respondent shows that the C1 criterion, which is the most priority criterion, has an importance weight of 64.3%. Meanwhile, criterion C2 which is the second priority has an importance weight of 28.3%, and the criterion with the last priority is criterion C3 with an importance weight of only

7.4%. Thus, it can be stated that the third respondent is more concerned with criteria C1 by 2.26 times more important than C2 and 8.7 times more important than C3.

Even though the transitive property has been consistent, the CR calculation is still carried out to ensure the consistency of the answers from the third respondent. The results of the CR calculation of the third respondent's answer show the number 8.3% so that this answer is considered consistent since it meets Saaty's recommendation for a CR value of less than 10%.

Since each respondent has equal voice in this matter, the central tendency is chosen as the appropriate weight for measuring business performance. In measuring this central tendency, the study used the arithmetic mean using the formula:

$$A = \frac{1}{n}\sum_{i=1}^{n} a_i \quad (7)$$

Thus, the importance weights for each criterion for calculating business performance for each partner MSME are obtained, which is the average of the weights for each criterion from each of the three respondents above (Table 7).

Table 7. Weight of the Criteria

Criteria	R1	R2	R3	Weight
C1	64.86%	70.13%	64.34%	66.44%
C2	5.67%	6.23%	28.28%	13.39%
C3	29.46%	23.64%	7.38%	20.16%

Table 7 presents that the weight for C1, the ratio of sales turnover between before and after the capital loan, is 66.4%. Criterion C1 is the most prioritized criterion since it has the greatest importance weight. Followed in the second is the C3 criterion, the ratio of the increase in the number of employees between before and after being given a capital loan. The weight for the C3 is 20%. Meanwhile, the criterion with the lowest importance is C2 with a weight of 13.6%. Criterion C2 is the ratio of the estimated assets value of each partner between before and after the capital loan.

The value of the weight of each criterion as shown in table 7 can be easily agreed upon and reach consensus since it has gone through a process that is able to capture the voices and opinions of each stakeholder on this issue. In addition, this process is an empirical calculation so that, although there may be an approximity error in it, these results can be accepted collectively. The process using the AHP method is preferable to determining the weight of the criteria using only focus group discussions since the views and opinions of each party are different, so reaching a mutual agreement will take a long time and there is a high possibility of bias in judgment.

The next step is to calculate the value of each criterion for each partner. Before calculating the value of each criterion, the normalization process must be carried out first so that each criterion has an equivalent unit and characteristics. This study uses the Linear Scale Transformation normalization method with a maximum value (Max), while it turns out that all the criteria used in this study are benefit criteria, so to calculate the value of the normalization results, only multiply the value by the highest value for each criterion.

We take an example to display in this study, which is the result of calculations in class 2, since this class has the most members among other classes, which are 595 MSMEs. Table 8 is an example of data from class 2 and the value of the criteria before being normalized.

Table 8. Example Data from Class 2

No.	MSME	Ratio of sales turnover per year (C1)	Ratio of estimated assets value (C2)	Ratio of number of employees (C3)
1	MSME 1	60.71%	53.85%	16.67%
2	MSME 2	18.03%	0.00%	300.00%
3	MSME 3	16.26%	33.33%	33.33%
…				
594	MSME 594	33.33%	33.33%	0.00%
595	MSME 595	50.00%	366.67%	0.00%

The calculation to find the maximum value for each criterion shows the results that C1 has a maximum value of 3500%, while the C2 has maximum value of 1466.7%, and finally on the C3 the maximum value is 900%. The normalization results are shown in Table 9.

Table 9. Data Normalization

		Normalized		
No.	MSME	Ratio of sales turnover per year (C1)	Ratio of estimated assets value (C2)	Ratio of number of employees (C3)
1	MSME 1	1.73%	3.67%	1.85%
2	MSME 2	0.52%	0.00%	33.33%
3	MSME 3	0.46%	2.27%	3.70%
…				
594	MSME 594	0.95%	2.27%	0.00%
595	MSME 595	1.43%	25.00%	0.00%

The next step is to multiply the value of the normalization results in table 3 above with the weight of each criterion. Then, to get the total value, which is the business performance value of each partner MSME, is to sum up all the values for each criterion. The result of calculation of total score for class 2 as an example of the calculation is presented in Table 10.

Table 10. Example of Calculation Results in Class 2

No.	MSME	Scores			Total Score
		C1	C2	C3	
1	MSME 1	1.15%	0.50%	0.37%	2.02%
2	MSME 2	0.34%	0.00%	6.67%	7.01%
3	MSME 3	0.31%	0.31%	0.74%	1.36%
…					
594	MSME 594	0.63%	0.31%	0.00%	0.94%
595	MSME 595	0.95%	3.40%	0.00%	4.35%

After obtaining the total value of each partner, we assume the total value as the growth rate or even a decline in the business of each MSME partner. The total value then shortens from the largest value to the smallest value to acquire one MSME that has the greatest value compared to the others. An example of the sorting results for the MSME partners in class 2 is shown in Table 11.

Table 11. Example of Sorting Result in Class 2

No.	MSME	Scores			Total Score
		C1	C2	C3	
1	MSME 108	66.40%	3.71%	0.28%	70.39%
2	MSME 323	15.81%	4.64%	15.56%	36.00%
3	MSME 229	15.95%	7.42%	4.44%	27.81%
4	MSME 388	3.46%	13.60%	6.67%	23.72%
5	MSME 91	2.12%	10.20%	11.11%	23.44%
…					
594	MSME 460	1.01%	-0.35%	-1.48%	-0.82%
595	MSME 495	0.21%	0.93%	-2.22%	-1.08%

From the calculation results, in class 2, MSMEs with the best business performance are MSME 108 with a growth rate of 70.39%. Meanwhile, the partner MSMEs with the worst business performance were MSME 495 with a growth rate of -1.08%, which indicates that instead of growing, they experienced a 1.08% decline in their business.

The same calculation is done for all classes. The results of the calculations of the total value show that, in all classes, MSMEs that are ranked first as MSMEs with the best business performance are MSMEs that have the highest annual sales turnover ratio. This is quite understandable since the weight for the sales turnover ratio reaches more than 50% indicating that this criterion is very dominant and very important according to the stakeholders. However, not all partner MSMEs that have a high increase in sales turnover are always in the top ranking. Interestingly, in the second rank for all classes, they are not held by the second largest increase in sales turnover ratio. It might be due to the performance rating being influenced by other criteria, so that if a partner only has a high sales turnover ratio but the increase in asset value and the number of employees is low, then its business performance may get a not so good rating compared to other MSMEs. MSMEs that have a prevalent increase in all criteria might have more opportunity to be in higher rating compared to those who only have one aspect of increase but slumped in others.

Considering the calculation results, the stakeholders decide that the partners that have a performance rating of, at least, 1% are entitled to get a promotion to move up to the next class. This promotion is only available for class 1 to 3 since class 4 is the highest class.

The summary of the calculation results for all classes shown in Table 12.

Table 12. Summary of Calculation in All Class

	Class 1	Class 2	Class 3	Class 4
Best MSME	MSME 14	MSME 108	MSME 188	MSME 9
Best Performance Rating	78.19%	70.39%	73.99%	79.39%
Worst MSME	MSME 31	MSME 495	MSME 67	MSME 15
Worst Performance Rating	-46.28%	-1.08%	-6.10%	-4.31%
Number of MSME promoted to higher class	46	457	212	-
Number of MSME experience decline in business	2	8	4	1

4. CONCLUSION

Encountering a problem that uses various criteria for decision making might become complicated, especially if the decision maker is a body with various individuals who have their own opinions and points of view. Moreover, if each view is an independent voice but cannot be separated from one another. If this happens, then a consensus must be drawn that is accepted by all parties. This process of reaching consensus can take a long time if it is only carried out by discussion without a method that can capture all the voices and bring them together. The AHP method is a good method that can capture the intangible opinion of all parties into a certain model that can be measured empirically and mathematically [21]. Although many other methods can deal with this kind of problems, such as PROMETHEE [22], TOPSIS [23], and

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VIKOR, the AHP method is still widely used because of its simplicity and transparency [24]. The ease of this AHP method supports researchers to communicate it to the stakeholder who might be not accustomed with mathematical processes such as those methods mentioned above. Thus, the calculation process can be better understood by the stakeholders so that the results obtained are faster to reach consensus. Although, some literature suggests successful use of the combined use of AHP and other methods, such as AHP and TOPSIS [25], AHP and Triangular Fuzzy Number-based AHP (TFN-AHP) [26], AHP dan PROMETHEE [27] [28], and even a combination of using three methods such as AHP integrated PROMETHEE and VIKOR [29].

The process in the AHP method utilizes a pairwise comparison matrix, which is still criticized regarding the level of consistency and the measurement scale used. Nevertheless, the use of pairwise comparison is still an important mathematical tool that can capture opinions of respondents and convert them into a form that can be calculated. This study combines the use of transitive properties and CR calculation to confirm the consistency of answers from the respondents. We found that even answers that were consistent with transitive properties, the CR calculation might turn out to have higher numbers than Saaty's recommendation, which was 10%. Therefore, although the focus in this research is not the consistency of pairwise comparisons, we suspect that the use of scales in designing the questionnaire may have an important role in calculating CR. Of course, this assumption needs to be proven by further research and using more case studies.

The criteria selection process is also quite influential for the inconsistency rate in the pairwise comparison matrix. Therefore, in this study, we use criteria that are not too many, so that the transitive property can still be found, and sufficient to represent the wishes of stakeholders. In addition, the selection of criteria is also based on existing data since this study wished to build the method of decision making. Considering that the existing data has a high variance, the Linear (Max) normalization method was chosen. By using a normalization method like this, it will be relatively easy to eliminate data if later investigations found that the data submitted by the partner is untrue or its validity is doubtful.

Although this study utilizes only 3 criteria, it would be better if the enterprise improves their partners audit method so that they could obtain more important data and measure their partners business performance better. These criteria may refer to the existing literature, such as the ability to manage finances, marketing strategies, profitability ratios, and others.

Disclaimer

The authors whose names are written certify that they have no conflict of interest

REFERENCES

[1] I. Y. Niode, "SEKTOR UMKM DI INDONESIA: Profil , Masalah, Dan Strategi Pemberdayaan," *Jurnal Kajian Ekonomi dan Bisnis OIKOS-NOMOS,* vol. 2, no. 1, Januari 2009.

[2] E. Purwanti, "Pengaruh karakteristik wirausaha, modal usaha, strategi pemasaran terhadap perkembangan UMK di Desa Dayaan dan Kalilondo Salatiga," *Among Makarti,* vol. 5, no. 1, 013.

[3] Y. R. Suci, "PERKEMBANGAN UMKM (USAHA MIKRO KECIL DAN MENENGAH) DI INDONESIA," *Jurnal Ilmiah Cano Ekonomos,* vol. 6, no. 1, pp. 51-58, 2017.

[4] J. Y. Abor, Entrepreneurial Finance for MSMEs: A Managerial Approach for Developing Markets, Springer, 20

[5] M. M. Hennink, Focus Group Discussions, Oxford University Press, 2013.

[6] T. L. Saaty and K. Peniwati, Group Decision Making: Drawing Out and Reconciling Differences, RWS Publications, 2013.

[7] A. Khaira and R. K. Dwivedi, "A state of the art review of analytical hierarchy process," *Materials Today: Proceedings,* vol. 5, no. 2, pp. 4029-4035, 2018.

[8] P. Arroyo, I. Tommelein and G. Ballard, "Comparing AHP and CBA as Decision Methods to Resolve the Choosing Problem in Detailed Design," *Journal of Construction Engineering and Management,* vol. 141, no. 1, January 2015.

[9] M. Velasquez and P. T. Hester, "An Analysis of Multi-Criteria Decision Making Methods," *International Journ of Operations Research,* vol. 10, no. 2, pp. 56-66, 2013.

[10] F. Liu, Y. Peng, W. Zhang and W. Pedrycz, "On Consistency in AHP and Fuzzy AHP," *Journal of Systems Scie and Information,* vol. 5, no. 2, p. 128–147, 2017.

[11] S. Siraj, L. Mikhailov and J. A. Keane, "Contribution of individual judgments toward inconsistency in pairwise comparisons," *European Journal of Operational Research,* vol. 242, no. 2, pp. 557-567, 2015.

[12] G. Kou, D. Ergu, C. Lin and Y. Chen, "Pairwise comparison matrix in multiple criteria decision making," *Technological and Economic Development of Economy,* vol. 22, no. 5, p. 738–765, 2016.

[13] A. Z. Grzybowski and T. Starczewski, "Remarks about Inconsistency Analysis in the Pairwise Comparison Technique," in *IEEE 14th International Scientific Conference on Informatics*, 2017.

[14] V. Bureš, J. Cabal, P. Cech, K. Mls and D. Ponce, "The Influence of Criteria Selection Method on Consistency o Pairwise Comparison," *Mathematics,* vol. 8, p. 2200, 2020.

[15] F. Catalá-López, B. Hutton and D. Moher, "The transitive property across randomized controlled trials: if B is better than A, and C is better than B, will C be better than A?," *Revista Española de Cardiología (English Editic* vol. 67, no. 8, pp. 597-602, 2014.

[16] T. L. Saaty, "Decision-making with the AHP: Why is the principal eigenvector necessary," *European Journal of Operational Research,* vol. 145, no. 1, pp. 85-91, 2003.

[17] N. Vafaei, R. A. Ribeiro and L. M. Camarinh, "Normalization Techniques for Multi-Criteria Decision Making: Analytical Hierarchy Process Case Study," in *Doctoral Conference on Computing, Electrical and Industrial Systems (DoCEIS 2016): Technological Innovation for Cyber-Physical Systems*, 2016.

[18] A. Celen, "Comparative Analysis of Normalization Procedures in TOPSIS Method: With an Application to Turk Deposit Banking Market," *INFORMATICA,* vol. 25, no. 2, pp. 185-208, 2014.

[19] P. E. PRASETYO, "The Role of Government Expenditure and Investment for MSME Growth: Empirical Study Indonesia," *The Journal of Asian Finance, Economics and Business,* vol. 7, no. 10, pp. 471-480, 2020.

[20] S. Wulandari, A. C. Utama and M. Arfidh, "Selecting Benchmarking Partners Using Analytical Hierarchy Proce Approach," *INTERNATIONAL JOURNAL OF INNOVATION IN ENTERPRISE SYSTEM,* vol. 4, no. 2, 2020.

[21] R. d. F. Russo and R. Camanho, "Criteria in AHP: A Systematic Review of Literature," *Procedia Computer Science,* vol. 55, pp. 1123-1132, 2015.

[22] V. Balali, B. Zahraie and A. Roozbahani, "A Comparison of AHP and PROMETHEE Family Decision Making Methods for Selection of Building Structural System," *American Journal of Civil Engineering and Architecture,* vol. 2, no. 5, pp. 149-159, 2014.

[23] A. Jozaghi , B. Alizadeh, M. Hatami, I. Flood, M. Khorrami, N. Khodaei and E. G. Tousi, "A Comparative Stud of the AHP and TOPSIS Techniques for Dam Site Selection Using GIS: A Case Study of Sistan and Baluchesta Province, Iran," *Geosciences,* vol. 8, no. 12, p. 494, 2018.

[24] M. M. D. Widianta, T. Rizaldi, D. P. S. Setyohadi and H. Y. Riskiawan, "Comparison of Multi-Criteria Decisio Support Methods (AHP, TOPSIS, SAW & PROMENTHEE) for Employee Placement," *Journal of Physics: Conference Series,* vol. 953, 2018.

[25] R. P. Soesanto and A. F. Rizana, "Decision Support System Design for Wedding Organizer Tradeshow Selectio using AHP and TOPSIS," *INTERNATIONAL JOURNAL OF INNOVATION IN ENTERPRISE SYSTEM,* vol. 5, 1, 2021.

[26] H.-M. Lyu, W.-H. Zhou, S.-L. Shen and A.-N. Zhou, "Inundation risk assessment of metro system using AHP a TFN-AHP in Shenzhen," *Sustainable Cities and Society,* vol. 56, 2020.

[27] D. Bogdanovic, D. Nikolic and I. Ilic, "Mining method selection by integrated AHP and PROMETHEE method *Anais da Academia Brasileira de Ciências,* vol. 84, pp. 219-233, 2012.

[28] G. POLAT, "Subcontractor selection using the integration of the AHP and PROMETHEE methods," *Journal of Civil Engineering and Management,* vol. 22, no. 8, pp. 1042-1054, 2016.

[29] B. Sennaroglu and G. V. Celebi, "A military airport location selection by AHP integrated PROMETHEE and VIKOR methods," *Transportation Research Part D: Transport and Environment,* vol. 59, pp. 160-173, 2018.