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Implementation decision support system in determining suppliers using wsm method

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ABSTRACT

PT. Asia Sakti Foods Wahid Manufacturing is a company engaged in food production. For the sake of smooth production activities, the company needs suppliers, but in selecting suppliers, PT. Asia Sakti Foods Wahid Manufacturing still always gets suppliers who are less professional in their work, for example, delivery is not on time, prices are more expensive than market prices and so on, so things like this will have a negative impact on production continuity. The solution to the above problems is PT. Asia Sakti Foods Wahid Manufacturing requires a decision support system that can assist in making decisions on selecting new suppliers using the Weight Sum Model (WSM) method. It is hoped that this system can help overcome problems that exist in the company. The result of this system is a report supporting the decision of a new supplier who is eligible to become a permanent supplier at PT. Asia Sakti Foods Wahid Manufacturing. This report is expected to help reduce the error rate in selecting new suppliers.

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1. INTRODUCTION

In the business world, a supplier is a term for a party or company that sells and distributes goods continuously (continuously) to one institution or company(Fitriana et al., 2020; Hasiani et al., 2021). The goods that are supplied (distributed) are usually raw materials that will be reprocessed by the company or factory into finished or semi-finished materials.

In a company like PT. Asia Sakti Foods Wahid Manufacturing supplier selection is very important because the selection of these suppliers will determine the success of the company itself. If processed raw materials and ready-to-use products provided by suppliers are of poor quality, this will greatly affect the level of customer satisfaction, and if suppliers cannot provide raw materials according to company needs, it is certain that the company's production will be disrupted, therefore the problem This problem needs to be solved by building a system that helps the supplier selection process.

To overcome the above problems, a study was conducted using a Decision Support System. Decision Support System (SPK) serves as a tool for PT. Asia Sakti Foods Wahid Manufacturing in making decisions for the selection of raw material suppliers.

Decision Support System (DSS) is a system that is able to provide problem-solving skills in the world of management for making a decision (Limbong et al., 2020; Yanto, 2021). Decision making is a systematic approach to the nature of a problem, collecting facts, careful determination of the alternatives faced, and taking the selected action is based on the results of precise calculations, and DSS is an interactive information system that provides information, modeling, and data manipulation(Poningsih et al., 2020) (Komalasari, 2018).

In DSS there are many methods that can be used to provide solutions to problem solving, and the method used as a tool for solving this case is the Weighted Sum Model (WSM). The Weighted Sum Model (WSM) method is the simplest and most widely used MADM (Multi Attribute Decision Making) method(Hasibuan, 2019) (Murtina, 2020). This method is also the easiest method to apply and is a method with simple weight addition, because it has an algorithm that is not too complicated (Amalia et al., 2019). The Weighted Sum Model (WSM) method is often also known as the weighted sum method. The basic concept of the Weighted Sum Model (WSM) method is to find the weighted sum of the performance ratings for each alternative on all attributes. The Weighted Sum Model (WSM) method requires the process of normalizing the decision matrix (X) to a scale that can be compared with all existing alternative ratings (Min et al., 2019; Sudipa et al., 2019).

2. RESEARCH METHODS

The Weighted Sum Model (WSM) method is a very general method, and is widely applied to assist decision makers in making a decision. The WSM method is one of the simplest and easiest to understand methods because in concept this method only multiplies between the criteria weight (Wj) and the alternative value (Xij). This method is part of the MCDM (Multi-Criteria Decision Making) method in evaluating the value of each alternative.The completion algorithm of this method is as follows:

a. Step 1: First identify the criteria and alternatives used in solving the problem.
b. Step 2 : Calculating the WSM-Score value. The formula used in this method is:

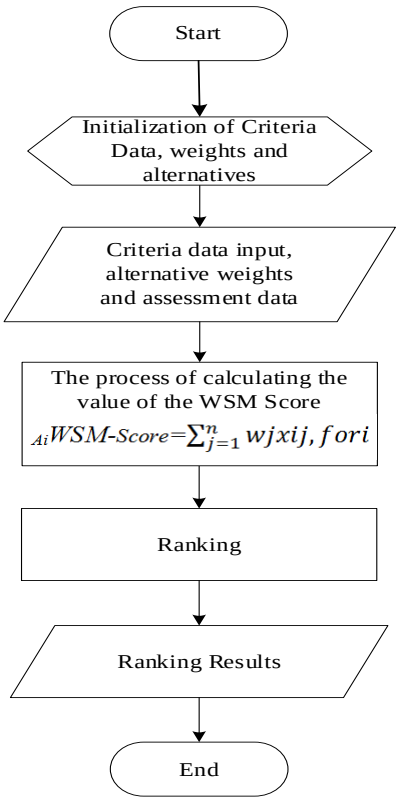
   AiWSM-Score=∑_(j=1)^n▒〖wjxij,for i=1,2,3〗 ,.....(2.1)

   Where:
   n : the number of criteria
   wj : weight of each criterion
   xij : value matrix x
c. Step 3 : Calculating the Ranking value.
   The following is an image of a flowchart or flowchart diagram that displays the steps and decisions for carrying out a process of a program. The flowchart image can be seen in the image below.

$$(TN) = \sum_{j=i}^{m} (RKij)^{TKKj} ,1 \le i \le n/$$

With :
TNi = Total value of the i-th alternative
Rkij = Degree of relative importance of the jth criterion in the choice decision i
TKKj = Degree of importance of the j-th decision criteria; TKKj>0; round

Determining the level of importance of the criteria is done by means of interviews with experts or through brainstorming agreements. While the determination of alternative scores on certain criteria is done by giving each alternative a value based on the criterion value.



For Example: A marketing company engaged in the field of technology devices wants to expand and develop market share in various regions. The technological devices that are being analyzed are mobile phones. There are 3 types of cellphones that will be analyzed to see how far consumers have been able to absorb these 3 types of cellphones. The following is a property table of the mobile phone. The types we call HP1, HP2, and HP3. The factors and criteria used as a reference are shown in the table below, namely:

Table 1. The Weighted Criteria Of Wsm Methode (Wj)

No	Criteria Name	Weight Value (Wj)
1	Camera (C2)	0.45
2	Memory (C3)	0.25
3	Weight (C4)	0.15
4	Uniqueness (C5)	0.1
5	Price (C1)	0.05

And based on the results of the assessment by respondents, the following is a table of values for each alternative:

Table 2. Assessment Of Each Alternative Of Wsm Methode

No	Alternative	C1	C2	C3	C4	C5
1	HP1	Cheap	Good	Excellent	Good Enough	Excellent
2	HP2	Cheap	Excellent	Good	Good Enough	Good Enough
3	HP3	Cheap	Good	Good	Good	Excellent

Completion: Normalize data using fuzzy (optional). For example, alternative value data is converted to fuzzy numbers with the following provisions:

Table 3. Terms For Criteria (C1)

No	Description	The value of the Fuzzy
1	Exoensive	0.5
2	Standard	0.75
3	Cheap	1

Table 4. Terms For Criteria (C2, C3, C4, And C5)

No	Description	Nilai Bilangan Fuzzy
1	Excellent	1
2	Good	0.75
3	Good Enough	0.5
4	Not Good	0.25
5	Very Not Good	0

Then the following is the result of normalization :

Table 4. Normalization Result

No	Alternative	C1	C2	C3	C4	C5
1	HP1	1	0.75	1	0.5	1
2	HP2	0.5	1	0.75	0.5	0.5
3	HP3	0.5	0.75	0.75	0.75	1

Calculating the WSM Score value of each alternative WSM Value-Score HP-1 (Alternative 1) = (0.45*1) + (0.25*0.75) + (0.15*1) + (0.1*0.5) + (0.05*1) = 0.888
WSM Value-Score HP-2 (Alternative 2) = (0.45*0.5) + (0.25*1) + (0.15*0.75) + (0.1*0.5) + (0.05*0.5) = 0.663
WSM Value -Score HP-3 (Alternative 3) = (0.45*0.5) + (0.25*0.75) + (0.15*0.75) + (0.1*0.75) + (0.05*1) = 0.650.

2.3 Ranking the WSM Score Results

Table 6. Ranking Of The Weight Product Method

No	Alternative	Preference Weight Value	Descriotion
1	HP1	0.888	Rangking 1
2	HP2	0.663	Rangking 2
3	HP3	0.650	Rangking 3

3. RESULTS AND DISCUSSION

3.1 Criteria Data Initiallization

To carry out an assessment, several criteria are needed which will be used as reference material in the decision-making process. The criteria can be seen in the following table:

Table 7. Criteria Weight

No	Criteria Code	Criteria Name	Description
1	C1	Price	The bid price offered by the supplier
2	C2	Delivery Lead Time	The length of time from the PO issued until the goods arrive at the warehouse
3	C3	On Time Delivery	Timeliness of delivery
4	C4	Fleksibelitas	Respond to change requests and fulfill
5	C5	Quality	Quality of goods/defect/reject

3.2 Criteria Weight

After determining the criteria, the next step is to determine the weight of the criteria. The following is a table of weight criteria.

Table 8. The Weighted Criteria Of Wsm Methode (Wj)

No	Criteria Code	Criteria Name	Weight Value (Wj)
1	C1	Price	0.35
2	C2	Delivery Lead Time	0.10
3	C3	On Time Delivery	0.20
4	C4	Flexibility	0.20
5	C5	Quality	0.15

3.3 Sub Criteria Data

After determining the weight value of the criteria, the next step is to determine the sub-criteria. The following is a table of sub criteria.

Table 9. Range Value Of Price Criteria (C1)

No	Description	Nilai
1	Prices are cheaper than market prices	1
2	Standard Price with market price	0.5
3	Prices are more expensive than market prices	0.25

Table 10. Range value of delivery lead time criteria (C2)

No	Description	Nilai
1	Fast	1
2	Enough	0.75
3	Long	0.5
4	Very Long	0.25

Table 11. Range Value Of On Time Delivery Criteria (C3)

No	Description	Nilai
1	On Time	1
2	A little out of time	0.5
3	Not on time	0.25

Table 12. Range Value Of Flexibility Criteria (C4)

No	Description	Nilai
1	Comply with the change request	1
2	Not comply with the change request	0.5

Table 13. Range Value Of Quality Criteria (C5)

No	Description	Nilai
1	The quality of the goods is very good	1
2	The quality of the goods is quite good	0.75
3	The quality of the goods is not good	0.5
4	The quality of the goods is not good	0.25

3.4 Alternative Value

After completing determining the sub criteria, the next step is to evaluate each supplier. In this case there are 10 suppliers that will be assessed.

Table 14. Alternative Value

No	Supplier	Kode Kriteria				
		C1	C2	C3	C4	C5
1	CV. Makmur Abadi	0.5	0.25	0.25	1	0.25
2	CV. Bintang Kejora	0.5	0.5	0.5	0.25	0.5
3	CV. Mekar Sari	0.5	0.25	0.25	0.25	1
4	PT. Golden Kreasi	0.5	0.5	0.5	0.25	0.5
5	PT. Jaya Utama	0.5	0.25	0.25	1	0.25
6	PT. Indo Makmur	0.5	0.25	0.25	1	0.5

7	CV. Laris Jaya	1	1	0.5	1	1
8	PT. Kurnia Indah	0.5	0.5	0.5	0.5	1
9	CV. Bintang Timur	1	0.5	1	0.25	0.5
10	CV. Mr Cake Medan	0.5	0.25	1	0.25	1

3.5 Calculating The WSM Score

WSM Score for CV. Makmur Abadi
= (0.35 * 0.5) + (0.10 * 0.25) + (0.20 * 0.25) + (0.20 * 1) + (0.15 * 0.25)
= 0.4375
WSM Score for CV. Bintang Kejora
= (0.35 * 0.5) + (0.10 * 0.5) + (0.20 * 0.5) + (0.20 * 0.25) + (0.15 * 0.5)
= 0.475
WSM Score for CV. Mekar Sari
= (0.35 * 0.5) + (0.10 * 0.25) + (0.20 * 0.25) + (0.20 * 0.25) + (0.15 * 1)
= 0.4
WSM Score for PT. Golden Kreasi
= (0.35 * 0.5) + (0.10 * 0.5) + (0.20 * 0.5) + (0.20 *0.25) + (0.15 * 0.5)
= 0.475
WSM Score for PT. Jaya Utama
= (0.35 * 0.5) + (0.10 * 0.25) + (0.20 * 0.1) + (0.20 * 1) + (0.15 * 0.1)
= 0.4375
WSM Score for PT. Indo Makmur
= (0.35 * 0.5) + (0.10 * 0.25) + (0.20 * 0.25) + (0.20 *1) + (0.15 * 0.25)
= 0.45
WSM Score for CV. Laris Jaya
= (0.35 * 1) + (0.10 * 1) + (0.20 * 0.5) + (0.20 * 1) + (0.15 * 1)
= 0.925
WSM Score for PT. Kurnia Indah
= (0.35 * 0.5) + (0.10 * 0.5) + (0.20 * 0.5) + (0.20 * 0.5) + (0.15 * 1)
= 0.525
WSM Score for CV. Bintang Timur
= (0.35 * 1) + (0.10 * 0.5) + (0.20 * 1) + (0.20 * 0.25) + (0.15 * 0.5)
= 0.775
WSM Score for CV. Mr. Cake Medan
= (0.35 * 0.5) + (0.10 * 0.25) + (0.20 * 1) + (0.20 * 0.25) + (0.15 * 1)
= 0.5125

3.6 Ranking

Table 15. Ranking Result Of Wsm Method

No	Supplier Name	Preference Weight Value	Description
1	CV. Makmur Abadi	0.4375	Not Worthy
2	CV. Bintang Kejora	0.475	Not Worthy
3	CV. Mekar Sari	0.4	Not Worthy
4	PT. Golden Kreasi	0.475	Not Worthy
5	PT. Jaya Utama	0.4375	Not Worthy
6	PT. Indo Makmur	0.45	Not Worthy
7	CV. Laris Jaya	0.925	Worthy
8	PT. Kurnia Indah	0.525	Not Worthy
9	CV. Bintang Timur	0.775	Not Worthy
10	CV. Mr Cake Medan	0.5125	Not Worthy

4. CONCLUSION

From the results of the ranking above, the appropriate supplier to supply bread-making ingredients to PT. Asia Sakti Wahid Foods Manufacture namely CV. Laris Jaya because it has the biggest rank value of 0.925.

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