Application Of The Profile Matching Method For A Decision Support System In Selecting The Quality Of Fresh Fruit Marks (FFB) Of Oil Palm Worth Harvesting

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Abstract.

Oil palm has an important role for the country's economy and is one of the commodity crops for Indonesian plantations. The oil content in palm oil has benefits for everyday life such as cooking oil, processed food, cosmetics and so on. Selection of quality fresh fruit bunches (FFB) for oil palm suitable for harvest requires a method to determine which fresh fruit bunches (FFB) are very suitable. One way to do this is by using the profile matching method. The profile matching method is a method of making decisions by assuming that there is an ideal variable level. The results of the study concluded, among others: the decision support system used to assist in selecting the quality of fresh fruit bunches (FFB) of oil palm worth harvesting. The application of the profile matching method can make decisions in selecting the quality of fresh fruit bunches worth harvesting based on ranking for the 30 samples used. TBS20 with a value of 4.9 is ranked first and TBS16 with a value of 3 is ranked last.

Keywords: *Profile Matching, Decision, Fresh Fruit Bunches (FFB) and Oil Palm.*

I. INTRODUCTION

Oil palm is one of the commodity crops for plantations in Indonesia and has a very important role in the Indonesian economy because it produces oil. The type of oil in the oil palm plant is divided into two types, namely crude palm oil (crude palm oil) and palm kernel oil (palm kernel oil). The process of producing oil from palm oil requires quality fresh fruit bunches (FFB) consisting of various levels of maturity and harvesting them at the right time so that the oil produced will be optimal. Selection of good oil palm fresh fruit bunches (FFB) requires criteria during the harvesting process so that the fruit has good quality oil to produce. These criteria include the color of the oil palm fruit, the quality of ripeness, the weight of the oil palm bunches, the size of the fruit and the number of loose fruit.PT Perkebunan Nusantara II (PTPN II) is one of the BUMNs engaged in the agro-industry sector. PTPN II was established in 1996 and is headquartered in Tanjung Morawa. The business units at PT Perkebunan Nusantara-II are engaged in palm oil, sugar cane and tobacco. The Limau Mungkur Plantation is a palm oil production unit at PT Perkebunan Nusantara II which is located in Lau Barus Village, STM Hilir District. The processing of crops at PT Perkebunan Nusantara II has 4 palm oil mill business units which are divided into 2 regions, namely 3 units in the north rayon district and 1 south rayon district. The four mills have a total capacity of 30 tons of fresh fruit bunches (FFB) per hour.

The method used in the decision support system is the method profile matching. Profile matching (profile matching) is a method that is often used for decision making because it is able to filter out the best alternative from several other alternatives, in this case the alternative in question is the criteria for fresh fruit bunches (FFB) that are fit for harvest. According to Apriana (2019) method profile matching this is able to determine the problem of criteria or ranking by giving weights based on the inclusion of several profiles studied based on the subject of each criterion. Process outline profile matching is comparing the actual data value on a profile to be assessed with the expected profile, so that the difference in competence (GAP) is known, the smaller the gap value produced, the greater the weighted value, which means it has a greater chance of being recommended.Baed on what has been described above on the selection the quality of oil

palm fresh fruit bunches has several standards is needed in determining the quality of fresh fruit bunches of oil plam that is suitable for harvesting standardization or criteria, namely the color of oil palm fruit, the quality of maturiry, the weight of the oil palm bunches, the size of the fruit and the number of loose fruit.

II. METHODS

The type of research used for this research is quantitative research. Quantitative is a method that is carried out by taking samples from a place and conducting interviews to obtain data that contains numbers. After the data has been collected, the next step is to process the data using the method profile matching method by mapping the gaps, determining the core factor and secondary factor values, determining the total value and dtermining the ranking (final result). The criteria used in decision making are:

X_1 : Palm Fruit Colo

Consist of:

1. Reddish Black
2. Redness
3. Shiny red
4. Orange red

X_2 : Quality of Maturity

Consist of:

1. Very raw
2. Raw
3. Less mature
4. Mature

X_3 : Weight of Oil Palm Bunches

Consist of:

1. Less than 7 kg
2. About 7 kg-19 kg
3. Approx 20 kg-31 kg
4. Over 32 kg

X_4 : Size of Oil Palm Fruit

Consist of:

1. Less than 2 cm
2. About 2 cm – 3 cm
3. Approx 4 cm - 6 cm
4. Over 6 cm

X_5 : The number of loose ends

Consist of:

1. No frills
2. 1 – 3 lozenges
3. 4 – 8 loose ends
4. More than 8 loose ends

Method completion steps profile matching on the selection of the quality of fresh fruit bunches of oil palm suitable for harvest as follows:

A. Gap mapping

$$Gap = Profile\_Subjek - Profile\_x \quad (1)$$

B. Determination of the weight of the gap value

Table 1. Gap Value Weight

Difference	Value Weight	Information
0	5	No Gaps (Competencies as required)
1	4,5	Individual competence excess of 1 level / level
-1	4	Individual competency is lacking 1 level/level

2	3,5	Individual competency excess of 2 levels/level
-2	3	Individual competence less 2 level/level
3	2,5	Individual competence excess 3 levels / levels
-3	2	Individual competence lacking 3 levels/levels

C. Determination Mark core factor (preferred criteria) and secondary factor (remaining criteria)

1) Core factor

$$NCF = \frac{\sum NC}{\sum IC} \quad (2)$$

Informations:

NCF : The average value of the core factor

NC : The total value of the core factor

IC : Number of aspects of the core factor

2) Secondary Factor

$$NSF = \frac{\sum NS}{\sum IS} \quad (3)$$

Information:

NCF : The average value of the core factor

NC : The total value of the core factor

IC : Number of aspects of the core factor

D. Calculation of the total value

$$Total\ Value = \big((x)\% \times NCF\big) + \big((x)\% \times NSF\big) \quad (4)$$

Information:

NCF : The average value of the core factor

NSF : The average value of the secondary factor

(x)% : The percent value entered

E. Ranking Determination (Final Result)

Determination of ranking relies on the calculation results obtained on the calculation of the total value.

III. RESULT AND DISCUSSION

A. Gap Mapping

Gap is the difference between the subject profile and other profilesrequired with a predetermined criterion value. In deciding the gap value can be seen in the following equation (1).Table 2 is obtained from taking 30 samples of fresh fruit bunches (FFB) from the Limau Mungkur plantation which have been given a value for each criterion and a value has also been determined for the criteria that will be used as profile_x for calculating gap mapping.

Table 2. Value Data of 30 Samples of Fresh Fruit Bunches (FFB)

Profile_Subjek	Criteria				
	x_1	x_2	x_3	x_4	x_5
FFB1	4	4	4	3	3
FFB2	4	4	3	2	3
FFB3	1	2	3	2	1
FFB4	2	2	2	3	3
FFB5	1	2	2	2	4
FFB6	3	4	2	2	4
FFB7	2	3	2	2	2
FFB8	4	4	2	3	4
FFB9	1	2	2	3	3
FFB10	1	1	2	1	1
FFB11	1	1	4	3	1
FFB12	1	1	4	1	1
FFB13	4	4	4	3	4

FFB14	3	4	2	3	2
FFB15	1	2	1	3	1
FFB16	1	1	1	1	1
FFB17	3	4	3	2	3
FFB18	3	4	1	2	3
FFB19	4	4	1	3	3
FFB20	3	4	3	3	3
FFB21	4	4	3	3	4
FFB22	4	4	2	3	4
FFB23	4	4	3	3	4
FFB24	2	3	3	3	2
FFB25	2	3	3	2	2
FFB26	4	4	2	3	4
FFB27	1	2	3	3	2
FFB28	3	4	3	2	2
FFB29	1	2	3	3	1
FFB30	1	2	1	2	1
Profile_x	3	4	3	3	2

The next step is to calculate the gap value by comparing it with the subject profile with the required profile, then use the formula in equation (1).

1) FFB1

$$X_1 = 4 - 3 = 1$$
$$X_2 = 4 - 4 = 0$$
$$X_3 = 4 - 3 = 1$$
$$X_4 = 3 - 3 = 0$$
$$X_5 = 3 - 2 = 1$$

The following is a table for the results of gap mapping based on the formula above:

Table 3. Gap Mapping Calculation Results

Profile_Subjek	**Criteria**				
	x_1	x_2	x_3	x_4	x_5
FFB1	1	0	1	0	1
FFB2	1	0	0	-1	1
FFB3	-2	-2	0	-1	-1
FFB4	-1	-2	-1	0	1
FFB5	-2	-2	-1	-1	2
FFB6	0	0	-1	-1	2
FFB7	-1	-1	-1	-1	0
FFB8	1	0	-1	0	2
FFB9	-2	-2	-1	0	1
FFB10	-2	-3	-1	-2	-1
FFB11	-2	-3	1	0	-1
FFB12	-2	-3	1	-2	-1
FFB13	1	0	1	0	2
FFB14	0	0	-1	0	0
FFB15	-2	-2	-2	0	-1
FFB16	-2	-3	-2	-2	-1
FFB17	0	0	0	-1	0
FFB18	0	0	-2	-1	1
FFB19	1	0	-2	0	1
FFB20	0	0	0	0	1
FFB21	1	0	0	0	2
FFB22	1	0	-1	0	2
FFB23	1	0	0	0	2
FFB24	-1	-1	0	0	0
FFB25	-1	-1	0	-1	0
FFB26	1	0	-1	0	2
FFB27	-2	-2	0	0	0

FFB28	0	0	0	-1	0
FFB29	-2	-2	0	0	-1
FFB30	-2	-2	-2	-1	-1

B. Determination of Gap Value Weight

Determining the weight of this gap value is determined by the value of each criterion using the weight value that has been assigned to each criterion it self. This stage is determined based on the value of the difference from the calculation of the gap mapping in Table 2 and then looks at the weight of the value based on Table 1. The results from Table 4 are obtained in a way that is in Table 3 for TBS1 the value $x_1 = 1$ then the weight of the gap value is 4,5 based on table 1 , for $x_2 = 0$ then the weight of the gap value is 5 which is based on table 1, $x_3 = 1$ then the weight of the gap value is 4.5 then $x_4 = 0$ then the weight of the gap value is 5 and $x_5 = 1$ then the weight of the gap value is 5. The following is a table for the results of determining the weight of the gap value.

Table 4. Gap Value Weight Results

Profile_Subjek	Criteria				
	x_1	x_2	x_3	x_4	x_5
FFB1	4,5	5	4,5	5	4,5
FFB2	4,5	5	5	4	4,5
FFB3	3	3	5	4	4
FFB4	4	3	4	5	4,5
FFB5	3	3	4	4	3,5
FFB6	5	5	4	4	3,5
FFB7	4	4	4	4	5
FFB8	4,5	5	4	5	3,5
FFB9	3	3	4	5	4,5
FFB10	3	2	4	3	4
FFB11	3	2	4,5	5	4
FFB12	3	2	4,5	3	4
FFB13	4,5	5	4,5	5	3,5
FFB14	5	5	4	5	5
FFB15	3	3	3	5	4
FFB16	3	2	3	3	4
FFB17	5	5	5	4	5
FFB18	5	5	3	4	4,5
FFB19	4,5	5	3	5	4,5
FFB20	5	5	5	5	4,5
FFB21	4,5	5	5	5	3,5
FFB22	4,5	5	4	5	3,5
FFB23	4,5	5	5	5	3,5
FFB24	4	4	5	5	5
FFB25	4	4	5	4	5
FFB26	4,5	5	4	5	3,5
FFB27	3	3	5	5	5
FFB28	5	5	5	4	5
FFB29	3	3	5	5	4
FFB30	3	3	3	4	4

C. Determination of Core Factor and Secondary Factor Values

The core factor is the most prioritized criterion or croterion that most prioritized in a determination studied. This aspect of the core factor is expected to be able to produce optimal performance. Secondary factor is a criterion value that is in addition to the core factor criteria.The calculation of this core factor first determines which criterion is the most important and will later be used as a core factor while the remaining criteria will be used as a secondary factor. The criteria used as the core factor are x_1 which is the color of the oil palm fruit, x_2 which is the quality of maturity, and x_5 which is the amount of loose fruit.The criteria for the secondary factor are x_3 namely the west of the oil palm bunches and x_4 namely the size of the oil palm fruit.

1) Core Factor

The criteria included as core factors are x_1, x_2 and x_5 calculated using equation 2.

$NC = X_1$, X_2 and X_5

Where X_1 = the color of the fruit of the oil palm

X_2 = maturity quality

X_5 = amount of loose fruit

- FFB1

$$NCF = \frac{4{,}5 + 5 + 4{,}5}{3} = 4{,}67$$

- FFB2

$$NCF = \frac{4{,}5 + 5 + 4{,}5}{3} = 4{,}67$$

- FFB3

$$NCF3\frac{3 + 5 + 4}{3} = 3{,}3$$

2) Secondary Factor

The criteria included as secondary factor namely and calculated using equation 3.

$NS = X_3$ and X_4

Where X_3 = weight of the oil palm bunches

X_4 = size of oil palm fruit

- FFB1

$$NSF = \frac{4{,}5 + 5}{2} = 4{,}75$$

- FFB2

$$NSF = \frac{5 + 4}{2} = 4{,}5$$

- FFB3

$$NSF = \frac{5 + 4}{2} = 4{,}5$$

The following is a table of value score factor and secondary factor for 30 samples.

Table 5. Mark Core Factor and Secondary Factor

Profile_Subjek	Criteria	
	NFC	NSF
FFB1	5	4,75
FFB2	4,67	4,5
FFB3	3,3	4,5
FFB4	3,83	4,5
FFB5	3,167	4
FFB6	4,5	4
FFB7	4,3	4
FFB8	4,3	4,5
FFB9	3,5	4,5
FFB10	3	3,5
FFB11	3	4,75
FFB12	4,3	4,5
FFB13	4,3	4,75
FFB14	5	4,5
FFB15	3,3	4
FFB16	3	3
FFB17	5	4,5
FFB18	4,83	3,5
FFB19	4,67	4
FFB20	4,83	5

FFB21	4,3	5
FFB22	4,3	4,5
FFB23	4,3	5
FFB24	4,3	5
FFB25	4,3	4,5
FFB26	4,3	4,5
FFB27	3,67	5
FFB28	5	4,5
FFB29	3,3	5
FFB30	3,3	3,5

D. Calculation of Total Value

Calculation of the total value for each criterion is obtained from calculation of the core factor and secondary factor which wuill later be added up percentage based. Percentage given from the result of the core calculation factors and secondary factors are expected to influence performance on each criterion.The calculation of the total value is based on a percentage core factor and secondary factor, for core factor the percentage is 60% because each criterion is in core factor $X_1 =$ the color of the fruit of the oil palm is worth 20%, $X_2 =$ maturity quality is worth 20%, and $X_5 =$ amount of loose fruit is worth 20%. Whereas for secondary factor the percentage is 40%. $X_3 =$ weight of the oil palm bunches is worth 20% and $X_4 =$ size of oil palm fruit is worth 20%. Calculation of the total value use formula in equation 4.

- FFB1

$$Total\ Value = (60\% \times 4{,}67) + (40\% \times 4{,}75)$$
$$= 2{,}8 + 1{,}9$$
$$= 4{,}7$$

- FFB2

$$Total\ Value = (60\% \times 4{,}67) + (40\% \times 4{,}5)$$
$$= 2{,}8 + 1{,}8$$
$$= 4{,}6$$

- FFB3

$$Total\ Value = (60\% \times 3{,}3) + (40\% \times 4{,}5)$$
$$= 1{,}98 + 1{,}8$$
$$= 3{,}78$$

And so on to get the total value of FFB4 to FFB30

E. Ranking Determination (Final Result)

The final result of the calculation proxess uses the profile matching method are the sequences of the results studied which will later produce rankings.The ranking process (final result) is the determination of quality and fit for harvest fresh fruit bunches (FFB) based on 30 samples. The value data is based on the results of determine total value.The total value in Table 6 is the end result of the method profile matching entered based on the calculation determines the total value and the calculation results are used for ranking.

Table 6. Final Result Method Profile Matching

Sample FFB	Total Value	Information
FFB20	4,9	Rank 1
FFB14	4,8	Rank 2
FFB17	4,8	Rank 3
FFB28	4,8	Rank 4
FFB1	4,7	Rank 5
FFB2	4,6	Rank 6
FFB21	4,6	Rank 7
FFB23	4,6	Rank 8
FFB24	4,6	Rank 9
FFB13	4,5	Rank 10
FFB8	4,4	Rank 11
FFB19	4,4	Rank 12
FFB22	4,4	Rank 13
FFB25	4,4	Rank 14

FFB26	4,4	Rank 15
FFB6	4,3	Rank 16
FFB18	4,3	Rank 17
FFB7	4,2	Rank 18
FFB27	4,2	Rank 19
FFB4	4,1	Rank 20
FFB29	4	Rank 21
FFB9	3,9	Rank 22
FFB3	3,8	Rank 23
FFB11	3,7	Rank 24
FFB15	3,6	Rank 25
FFB5	3,5	Rank 26
FFB30	3,4	Rank 27
FFB12	3,3	Rank 28
FFB10	3,2	Rank 29
FFB16	3	Rank 30

IV. CONCLUSION

This decision support system uses the profile matching method and has 5 criteria in selecting the quality of fresh fruit bunches suitable for harvest. Based on calculations that have been carried out from 30 samples of fresh fruit bunches (FFB), a ranking for fresh fruit bunches (FFB) is obtained based on predetermined criteria, namely oil palm fruit color, ripeness quality, oil palm fruit weight, oil palm fruit size and number fruit fritters. TBS 20 with a value of 4.9 is ranked first in the selection of quality fresh fruit bunches (FFB) for harvestable oil palm. Ranked second on TBS14 with a value of 4.8. Ranked third on TBS17 with a value of 4.8. Ranked fourth on TBS28 with a value of 4.8. Ranking fifth on TBS1 with a value of 4.7 and last ranking on TBS16 with a value of 3.

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