Selection Of Raw Materials For Leather Jacket Using The Analytical Hierarchy Process (Ahp) Method

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Abstract: Cow leather, sheep leather, goat leather and buffalo leather are the raw materials for making leather jackets at PT X umkm. The selection of raw materials determines the quality of the leather jacket product with the appropriate criteria to meet quality standards. PT X has determined the best criteria in the production of leather jackets including physical, color, texture and moisture content as parameters for determining decision making. The end result of this study is which leather type best fits the required criteria. Determination of alternative choices for leather jacket raw materials using the Analytical Hierarchy Process (AHP) method. Determining the texture and moisture content is a decision that can be obtained for the multicriteria decision making materials for choice and identification of problems to develop in finding or formulating alternative problems using the Analytical Hierarchy Process method (AHP) documentation from a library study from the calculation of cowhide with the results obtained that cow leather ranks first in all aspects of the criteria, starting from physical criteria, color, texture, and moisture content, with these results cowhide is in a higher texture and content. superior with total weight of cow leather1.66, sheep leather 1.07, goat leather 0.84 and buffalo leather 0.43. However, research continues to improve the addition of criteria and alternatives in the hope of increasing choices.

Key word: Analytical Hierarchy Process (AHP), Raw Material

1. Introduction

Every company has the goal of producing quality products. Factors that affect the quality of an item are raw materials, therefore companies must choose quality raw materials in order to produce quality products. Every company has established criteria so that the quality of a product produced is achieved. A product is also an important thing for companies to consumers. A product to be traded must have good quality, otherwise the company will receive complaints from consumers (Hasdi, et al. 2014). Consumers expect good quality from a production result so that the company gets *feedback* goodfrom consumers (Ria, 2014). A quality item is based on an assessment of its conformity with predetermined measurement standards (Handoko, 2005).

One of the industries that is greatly influenced by raw materials for the finished product is the handicraft industry, one of which is the leather industry. Leather craft is a product that can be developed because of its excellence (Heti 2010). Animal skins that are most often used as raw material for handicrafts include cow leather, sheep leather, buffalo leather, even snake leather. These animal leather are usually used as handicrafts such as bags, shoes, wallets, jackets, and souvenirs. Selection of the correct raw material will determine the quality of the finished product. The method that can be done to determine the quality of the skin is using texture analysis (Kwon et al. 2004). The way to make decisions is by classifying the leather based on the tanner (Wang et al. 2007; Duygu, 2019).

Another method that can be done in selecting the raw material for leather is by using themethod *Analytical Hierarchy Process (AHP)*. AHP can make it easier for a company to make decisions. AHP can solve complex problems based on several criteria (Siti, 2016; Isabirye & Molo, 2019). AHP can assist companies in making decisions based on criteria that have been determined by the company (Yosep et al, 2013). AHP can also be used to objectively determine decisions in an option (Rani et al. 2017; Hove & Troskie, 2019). Using this method, it is hoped that the company can determine the best raw materials for the production of leather jackets. Therefore, if the selection of raw materials is not carried out with objective data, the results will not be objective, this is done by small and medium enterprises (MSMEs), leather jacket manufacturers in Garut. The use of the AHP method is expected to assist companies in determining the best raw materials to be selected in the production of leather jackets.

2. Literature study

1. Decision Support System

Decision support system is a system that can assist in decision making by means of information from data that has been processed in a relevant way to make a decision in a problem quickly and accurately (Eko Darmanto, et al. 2014). The method that can assist in decision making is the *Analytic Hierarchy Process (AHP).*

2. Analytic Hierarchy Process (AHP)

The Analytical Hierarchy Process (AHP) method is a method of assisting in multicriteria decision making where logic, experience and knowledge, emotions and feelings can be optimized into a systematic process (Ria Eka Sari, 2014). AHP is a method that can be used in solving complex and unstructured problems that can be divided into several group and then the group could be arranged into a hierarchy, then enter numerical values to perform relative comparisons (Saaty 1993). The highest priority is determined by the elements of a hypothesis. The function of AHP is AHP can assist in decision making with the aim of obtaining objective decision recommendations (Mursanto, et al. 2011). The weakness of AHP is that the number of criteria and sub-criteria has been predetermined so that it is not dynamic (Mursanto et al. 2011; Athiyaman & Magapa, 2019; Collet et al., 2019; Aydin et al.,. 2019). There are also advantages of AHP according to (Suryadi, et al. 1998; Adanali & Mete, 2019; Altintas & Karaaslan, 2019), namely:

a. The structure is a hierarchical form of criteria to sub criteria as a consequence.
b. Validity is considered to the extent of tolerance for inconsistencies.
c. Can take into account the robustness of sensitivity analysis in decision making.

3. Stages of Analytic Hierarchy Process (AHP)

The AHP stages mentioned according to (Ria Eka Sari, 2014) in solving a problem are as follows:

1. Determination of objectives and identification of problems. This stage is a development in finding or formulating alternative solutions to problems.
2. Arranging the problem into a hierarchical structure so that the problem can be reviewed in detail and measurable.
3. Prioritization for each problem element in each hierarchy. Pairwise comparison matrix between elements of the same hierarchy produces a priority.
4. Testing the consistency in the comparisons of between elements contained at each level of the hierarchy.

To determine the level of consistency in AHP, a Consistency Index (CI) must be calculated. After the CI was obtained, the results were compared with the Random Consistency Index (CR) (Saaty, 1980). The weighting interpretation is presented as follows according to *Saaty's scale.*

Table 1 AHP's Scale

Skala	Definisi dari "Importance"
1	*Equal Importance* (Sama Penting)
3	*Slightly more Importance* (Sedikit lebih penting)
5	*Materially more Importance* (Jelas lebih penting)
7	*Significantly more Importance* (Sangat jelas penting)
9	*Absolutely more Importance* (Mutlak lebih penting)
2,4, 6,8	*Compromise values* (Ragu-ragu antara dua nilai yang berdekatan)

Source: Saaty, TL The Analytical Hierarchy Process: Planning, Priority Setting, Resource Allocation
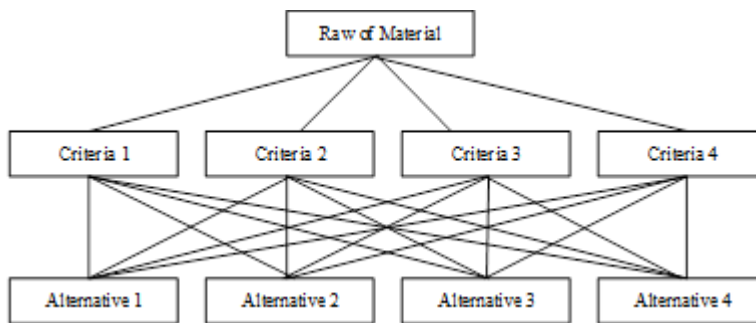
Figure 1 AHP Hierarchical Structure

3. Research methods

The determination of objectives is based on the problems faced by PT X, namely determining alternative decisions in the selection of raw material for leather jackets. Figure 2 illustrates how the research method of selecting alternative raw material for leather jackets for PT X.
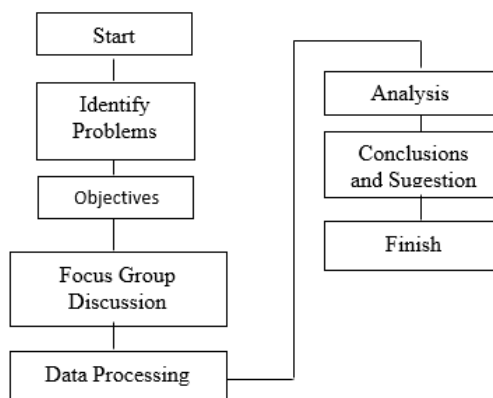

Figure 2 Research Methods

Data collection for the AHP procedure used a focus group discussion moderated by the author. The members of the FGD consisted of 10 people from company members who had knowledge of the raw material of leather and discussed each question item on the questionnaire and recorded only one answer that was approved by the group. Then the data that has been obtained is processed using the method using the *Analytical Hierarchy Process* (AHP) MS Excel 2007 spreadsheet software. The data processing process in this study is to compare one criterion to another until the most appropriate criteria are obtained, then determine the alternative selection of the most suitable raw materials. in accordance with the results of the predetermined criteria (Jabarullah, 2019). After obtaining the results in data processing, then the data is analized before it can be concluded which type of leather is selected as per standard that has been obtained from the data analysis. Then provide suggestions for further research in the form of adding alternative criteria and research using application assistance.

Below Figure 3 is an illustration of the hierarchical structure of the criteria and alternatives for leather jacket raw materials.
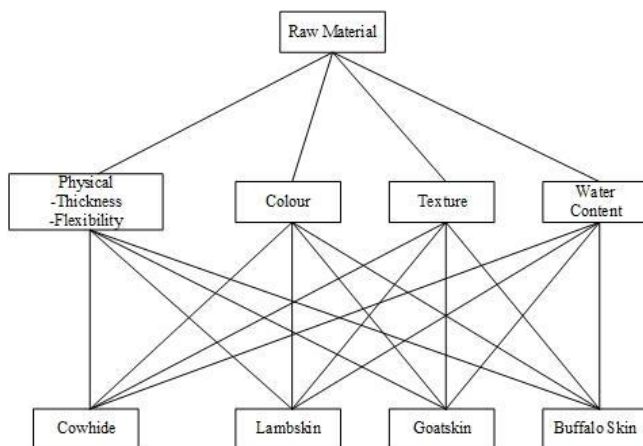
Figure 3 Hierarchical Structure of Raw Material

Table 2 The Raw Material Criteria

Criteria	Sub Criteria
Physical	Thickness
	Flexibility
Colour	Dark
Texture	Soft
Moisture Content	14%

In the manufacture of leather jackets, there are several alternative choices of raw material for leather jackets, including cow leather, sheep leather, goat leather and buffalo leather. These leathers are chosen in alternative choices because each of these leathers has good quality as a raw material for making leather jackets. The choice of raw material for leather jackets is based on several predetermined criteria, including physical, color, texture and moisture content. Therefore it's necessary to including the qualified leather that has been predetermined in the list of criteria above as well so that the resulting of the product will have the best quality.

4.   Results and discussion

To perform data processing, the authors conducted a survey of workers in leather jacket manufacturing companies. This FGD was conducted to find out which criteria are more important than other criteria. Based on the questionnaire that has been obtained, then the data is processed using the AHP method. Table 3 is a table that describes the importance value of each criterion comparison.

Table 3 The Comparison Of Criteria

Criteria	Physic	Color	Texture	Moisture Content
Physic	1	2	3	2
Color	0,5	1	2	2
Texture	0,33	0,5	1	1
Moisture Content	0,5	0,5	1	1
Total	2,33	4	7	6

After making a value for the comparison of criteria, then the authors make a standard criteria matrix, which can be seen in table 4, in this table the goal is to determine the weight of each criterion.

Table 4 Standard Matrix of Criteria

	Physic	Color	Texture	Moisture Content	Weight
Physic	0,43	0,50	0,43	0,33	0,42
Color	0,21	0,25	0,29	0,33	0,27
Texture	0,14	0,13	0,14	0,17	0,14
Moisture Content	0,21	0,13	0,14	0,17	0,16

Table 5 The Calculation of CI and CR

	Physic	Color	Texture	Moisture Content	Total	Total/Weight
Fisik	0,42	0,54	0,43	0,32	1,72	4,07
Warna	0,21	0,27	0,29	0,32	1,10	4,04
Tekstur	0,14	0,14	0,14	0,16	0,58	4,04
Kadar Air	0,21	0,14	0,14	0,16	0,65	4,03

Table 6 is a table of the result of CI and CR

Table 6 Criteria Comparison Result

CI	0,02
CR	0,02

After calculating the criteria, the leather raw materials that are closest to the criteria are obtained, namely cowhide, sheepskin, goat skin, and buffalo skin. To find out each index consistency of criteria against alternatives. The first criterion is physical, the calculations can be seen in table 7, table 8, table 9, and table 10.

Table 7 The Comparison of Physic Criteria

Physic	Cow Leather	Sheep Leather	Goat Leather	Buffalo Leather
Cow Leather	1	2	3	3
Sheep Leather	0,5	1	3	2
Goat Leather	0,33	0,33	1	3
Buffalo Leather	0,33	0,5	0,33	1
Total	2,17	3,83	7,33	9

Table 8 Standard Matrix of Physic Criteria

	Cow Leather	Sheep Leather	Goat Leather	Buffalo Leather	Weight
Cow Leather	0,46	0,52	0,41	0,33	0,43
Sheep Leather	0,23	0,26	0,41	0,22	0,28
Goat Leather	0,15	0,09	0,14	0,33	0,18
Buffalo Leather	0,15	0,13	0,05	0,11	0,11

Table 9 The Calculation of CI and CR

	Physic	Color	Texture	Moisture Content	Total	Total/Weight
Cow Leather	0,43	0,56	0,53	0,33	1,86	4,30
Sheep Leather	0,22	0,28	0,53	0,22	1,25	4,45
Goat Leather	0,14	0,09	0,18	0,33	0,75	4,20
Buffalo Leather	0,14	0,14	0,06	0,11	0,45	4,12

Table 10 CI and CR Physic Criteria

CI	0,09
CR	0,10

The results of the above discussion show that the one who gets the greatest value is physical, because physical is very influential for the processing process, in this physical criterion there are results of CI and CR which are 0.02, meaning the calculation results consistent.

Calculations to determine CI and CR are performed for each criterion in the same way as for the physical criteria. After calculating all the criteria, the overall weight results are obtained as in table 11.

Table 11 The Comparison of Color Criteria

Color	Cow Leather	Sheep Leather	Goat Leather	Buffalo Leather
Cow Leather	1	2	2	4
Sheep Leather	0,5	1	3	2
Goat Leather	0,5	0,33	1	3
Buffalo Leather	0,25	0,5	0,33	1
Total	2,25	3,83	6,33	10

Table 12 Standard Matrix of Color Criteria

	Cow Leather	Sheep Leather	Goat Leather	Buffalo Leather	Weight
Cow Leather	0,44	0,52	0,32	0,4	0,42
Sheep Leather	0,22	0,26	0,47	0,2	0,29
Goat Leather	0,22	0,09	0,16	0,3	0,19
Buffalo Leather	0,11	0,13	0,05	0,1	0,10

Table 13 The Calculation of CI and CR

	Physic	Color	Texture	Moisture Content	Total	Total/Weight
Cow Leather	0,42	0,58	0,38	0,39	1,78	4,23
Sheep Leather	0,21	0,29	0,58	0,20	1,27	4,40
Goat Leather	0,21	0,10	0,19	0,30	0,79	4,14
Buffalo Leather	0,11	0,14	0,06	0,10	0,41	4,18

Table 14 CI and CR Color Criteria

CI	0,08
CR	0,09

The Criteria include the most important criteria in the selection of raw materials. In this criterion, the alternative color for the leather raw material that best fits the criteria is cowhide, because cowhide has a dark color so it is suitable as a raw material for leather jackets. The color of the other three alternative raw materials is not suitable and too light, so that in the color criteria, Cow's skin is the closest to the criteria for the required raw material.

After calculating the color criteria, the texture criteria are calculated as follows.

Table 15 The Comparison of Texture Criteria

Texture	Cow Leather	Sheep Leather	Goat Leather	Buffalo Leather
Cow Leather	1	2	1	2
Sheep Leather	0,5	1	2	3
Goat Leather	1	0,5	1	3
Buffalo Leather	0,5	0,33	0,33	1
Total	3	3,83	4,33	9

Table 16 Standard Matrix of Texture Criteria

	Cow Leather	Sheep Leather	Goat Leather	Buffalo Leather	Weight
Cow Leather	0,33	0,52	0,23	0,22	0,33
Sheep Leather	0,17	0,26	0,46	0,33	0,31
Goat Leather	0,33	0,13	0,23	0,33	0,26
Buffalo Leather	0,17	0,09	0,08	0,11	0,11

Table 17 The Calculation of CI and CR

	Physic	Color	Texture	Moisture Content	Total	Total/Weight
Cow Leather	0,33	0,61	0,26	0,22	1,42	4,33
Sheep Leather	0,16	0,31	0,51	0,33	1,31	4,30
Goat Leather	0,33	0,15	0,26	0,33	1,07	4,16
Buffalo Leather	0,16	0,10	0,09	0,11	0,46	4,18

Table 18 CI and CR Texture Criteria

CI	0,08
CR	0,09

The calculation result is show that the cow leather is having the highest result because of its soft texture that match the predetermined criteria, its shows that the cow leather is the best material that can be transformed inti a good and comfortable jacket to wear. Other types of leather have rougher texture, making them less suitable for leather jacket.

After calculating the texture criteria, the moisture content criteria were calculated.

Table 19 The Comparison of Moisture Content Criteria

Moisture Content	Cow Leather	Sheep Leather	Goat Leather	Buffalo Leather
Cow Leather	1	3	3	3
Sheep Leather	0,33	1	1	2
Goat Leather	0,33	1	1	3
Buffalo Leather	0,33	0,5	0,33	1
Total	2	5,5	5,33	9

Table 20 Standard Matrix of Moisture Content Criteria

	Cow Leather	Sheep Leather	Goat Leather	Buffalo Leather	Weight
Cow Leather	0,5	0,55	0,56	0,33	0,49
Sheep Leather	0,17	0,18	0,19	0,22	0,19
Goat Leather	0,17	0,18	0,19	0,33	0,22
Buffalo Leather	0,17	0,09	0,06	0,11	0,11

Table 21 The Calculation of CI and CR

	Physic	Color	Texture	Moisture Content	Total	Total/Weight
Cow Leather	0,49	0,57	0,65	0,32	2,03	4,18
Sheep Leather	0,16	0,19	0,22	0,22	0,78	4,14
Goat Leather	0,16	0,19	0,22	0,32	0,89	4,10
Buffalo Leather	0,16	0,09	0,07	0,11	0,44	4,05

Table 22 CI and CR Moisture Content Criteria

CI	0,04
CR	0,04

The result of calculating the water content of each criterion yield very good results, because this moisture content criterion greatly affects the skin texture. The results of the processing that have been carried out produce CI and CR values with the same final value, with this final result it is concluded that the criteria for cowhide get the highest value.

Table 23 Results of Total Alternative Overall Weights

Total Weight	
Cow Leather	1,66
Sheep Leather	1,07
Goat Leather	0,84
Buffalo Leather	0,43

From the above processing results for the completion of each criterion and weight using *Analytical Process* Hierarchy (AHP). Because this method can solve each of the criteria systematically and accurately. The purpose of this research is expected to be a solution for leather craftsmen to improve the crafts that will be made by craftsmen. This research aims to improve the quality of valuable leather raw materials and this research is expected to be useful for ordinary leather craftsmen to produce objective results.

Based on the data processing that has been carried out, the results of the total weight from the highest to the lowest are obtained as follows. Among them are cow leather, sheep leather, goat leather, buffalo leather. With the

total weight obtained, the best result is cowhide, because cowhide is the most fulfilling skin based on physical, color, moisture content and texture criteria, cow leather has been selected for the company as the raw material for the production of leather jackets.

The alternative results obtained were cowhide occupying the first position with the weight value achieved, namely 1.66, the second alternative result of sheepskin with a weight value of 1.07, the third position was occupied by goat skin with a value of 0.84 and the last was occupied. by buffalo skin with a weight value of 0.43.

5.   Conclusion

Based on the data processing that has been done, the authors perform data processing using the AHP method, starting from looking for the comparison value of each criterion, looking for alternatives that match the criteria, calculating the consistency of the index for each criterion, until finding the results of the alternatives that best match the criteria to be used. leather jacket raw material.

Cow leather has a weight of 1.66 which means that cowhide is in the first position because from a physical perspective, texture, color and moisture content it has a superior weight in each criterion than its competitors. so, cowhide can be used as an alternative raw material for making leather jackets. In addition, the CI value of each criterion also does not exceed 0.1 (10%), which means that the processed data is consistent.

For further research, the authors are suggesting to add more criteria and alternatives. The use of calculating tools are also needed to avoid the error in the whole process of calculation.

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