Analysis of farmer purposes in raising local beef cattle breed: 
An Analytical Hierarchy Process (AHP) approach

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Abstract. Farmers raise cattle for various purposes, such as a source of cash income, investment function, and socio-cultural function. The research objective was to analyze farmers' preferences in raising Peranakan Ongole (PO) as local beef cattle breed based on the purpose of raising livestock. This study involved 8 farmers from Klaten District, Central Java. Klaten Regency was chosen as a research location because it received PO cows as a grant from the Ministry of Agriculture. Respondents were selected purposively according to the criteria of being a livestock group administrator and being experience in raising PO as local beef cattle breed for ≥10 years. Analytical Hierarchy Process (AHP) was applied to determine the priority of beef cattle criteria that are used by farmers to develop their business. There were three criteria and six factors used in this analysis. These criteria were cash income, investment function, and socio-culture function. Whereas, the six factors used were cattle breed, selling price, adaptability, reproductive ability, body size, and the physical appearance of the livestock. The results revealed that the reproductive ability has main preference among farmers due to the investment function was the main purpose in raising PO cattle.

1. Introduction

Peranakan Ongole cattle is one of the Indonesian local cattle breed that have been established based on the Decree of the Minister of Agriculture No. 2907/Kpts/OT.140/6/2011 [1]. Local breed livestock is an important Animal Genetic Resource for rural communities. The important advantages of local breed livestock are the ability to reproduce and adapt well to traditional livestock condition [2,3]. However, PO cattle are decreased in population and genetic quality [4]. This is reinforced by the results of previous studies regarding the dynamics and population estimation of PO cattle conducted in several districts in Indonesia. The dynamics of the PO cattle population in Kebumen fluctuated with an average decrease of 4.8% since 2010-2014 [5]. The estimated population of PO cattle for 2018, 2019, and 2020, respectively in Tanjung Sari District, South Lampung has decreased successively by 1,761 heads, 1,435 heads, and 1,110 heads [6].

Livestock are reared with various functions. There are as cash income from sales of animals or their products; non-income or investment function, e.g. savings, insurance, and capital accumulation; and social and cultural function that provide status and identity for farmers [7]. Each function has its own factors related to the species or breed of livestock kept as shown in Table 1 [7]. This study has used cash
income, investment function, and socio-cultural function as criteria and cattle breed, selling price, adaptability, reproductive ability, body size, and physical appearance as factors.

**Table 1. Livestock function for livelihood and factors that differentiate between species and breeds**

| Livestock function for livelihood                                                                 | Factors that differentiate between species and breeds                                                                 |
|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Regular cash income from sales of animals, their products, or hiring of animal services.       | Consumers may prefer products from specific species and/or breeds and are ready to pay a higher buying price. For hiring of animal services: specific services best provided by species and breeds with requested typical (size, power, docility), and adapted to the environment (heat tolerance, walking ability, water requirements). |
| Investment function, savings, insurance, and capital accumulation.                              | The ability to survive from disease and climate. In addition, the reproductive rate is important to realize the function of livestock as an asset accumulation. |
| Social and cultural function that provide status and identity for farmers.                      | The appearance of important traits, such as skin and coat color, horn size and shape, body shape, etc.                   |

AHP has been used as an analytical tool in this study. This analysis is a measurement theory that uses comparisons based on the assessment of experts using a priority scale [8]. AHP is a mathematical method for analyzing complex decision problems using several criteria. This analysis can handle qualitative attributes as well as quantitative ones [9]. AHP utilizes the experience and knowledge of farmers to establish priority options, thus addressing the weaknesses that often occur in agriculture in developing countries, for instance the lack of reliable quantitative agricultural data and the existence of agricultural decisions involving a complex network of qualitative factors. [10]. AHP has been used as a tool for decision making in business [8,11,12], preference analysis [10,13], and forest management planning [9]. In livestock studies, AHP has been used to determine consumption patterns and preferences consumption priority for animal protein sources [13]. In addition, AHP is also used in a SWOT analysis in a study on the development and conservation strategy of local cattle breeds in Germany [14]. Studies on purpose in raising PO cattle as local breed involving farmers’ assessment as an "expert" has never been done before. Therefore, the research objective was to analyze farmers’ preferences in raising PO as local cattle breed based on the purpose of raising livestock.

2. Materials and methods
The research was conducted in Klaten Regency, Central Java in March 2021. Klaten Regency was chosen as a research location due to received PO cows as a grant from the Ministry of Agriculture. This study involved 8 respondents who are members of the Mukti Andini livestock group 1, 2, 3, and 4. Respondents were selected purposively with certain qualifications, including farmers who are livestock group administrators and have experience in raising PO cattle for 10 years. Research data were collected through in-depth interviews using structured questionnaire. Process Hierarchy Analysis was applied as an analytical tool. STATA16 software was used to perform a descriptive analysis of the respondents' characteristics. Meanwhile, Microsoft Excel is used to perform AHP analysis.

AHP consists of 4 stages, including (1) making pairwise comparisons; (2) priority vector calculation; (3) calculation of the consistency ratio (consistency ratio); and (4) ranking of alternative choices [11]. Decision-making involves criteria and sub-criteria/factors used to rank alternative decision choices [8]. The criteria used in this study are the purposes of farmers in rearing PO as local cattle, such as cash income, investment function, and socio-cultural function. Meanwhile, the alternative choices include cattle breed, selling price, adaptability, reproductive ability, body size, and physical appearance. The AHP scheme in this study showed in Figure 1.
After pairwise comparisons were performed, consistency testing was performed by determining the consistency index (CI). CI is calculated using the formula: 
\[ CI = \frac{\lambda_{\text{max}} - n}{n - 1} \]
After that, the consistency ratio (CR) value is determined using the formula 
\[ CR = \frac{CI}{RI} \]
where RI is the ratio index. CR measures the consistency of the assessment conducted by the respondent and the value not exceed 0.1. The Ratio Index showed in Table 2.

### Table 2: Ratio index

| n  | RI   |
|----|------|
| 1  | 0.00 |
| 2  | 0.00 |
| 3  | 0.58 |
| 4  | 0.90 |
| 5  | 1.12 |
| 6  | 1.24 |
| 7  | 1.32 |
| 8  | 1.41 |
| 9  | 1.45 |
| 10 | 1.49 |

### 3. Results and discussion

The characteristics of farmers who participated in this study were presented in Table 3. Table 3 showed that the average age of farmers is 57.88 years old and the average education was 13.88 years. This means that the average farmer has completed a high school education. The average number of family members owned by farmers was 3-4 people. Farmers in this study manage land either by themselves or by rent. The average land ownership managed by farmers was 1,559 m², while the land rented by farmers was an average of 610 m². Farmers' experience in raising PO cattle was an average of 19.88 years with average cattle ownership of 1 AU. Age, education level, and the number of family members are internal factors inherent in a person. Meanwhile, land ownership and managed livestock are external factors that may influence decision-making [15]. Farming experience can make farmers more independent and skilled in managing their businesses, and make it easier for farmers to make decisions [16].

### Table 3: Descriptive statistics of the respondents

| Variable                  | Mean   | Std. Dev. |
|---------------------------|--------|-----------|
| Age (year)                | 57.88  | 12.32     |
| Education (year)          | 13.88  | 3.72      |
| Family Member (person)    | 3.62   | 1.19      |
| Own Land (m²)             | 1559.25| 1399.68   |
| Rent Land (m²)            | 610.75 | 827.75    |
| Farming Experience (year) | 19.88  | 16.98     |
| Animal Unit (AU)          | 1.38   | 0.57      |

The calculation of the pairwise comparison matrix on the criteria and factors produced a weight vector which was shown in Table 4 and Table 5. The results of the weight vector were then ranked...
starting from the largest weight to the smallest weight. The largest weight vector indicates the main strategy. The overall results of the AHP calculation were showed consistent results with the consistency ratio value $< 0.1$.

**Table 4. Weight vector of criteria**

| Criteria                  | Weight Vector | Rank |
|---------------------------|---------------|------|
| Cash Income               | 0.2651        | 3    |
| Investment Function       | 0.4223        | 1    |
| Socio-Cultural Function   | 0.3127        | 2    |

As presented in Table 4, the Investment Function were priority criteria for farmers. This means that farmers raising PO cattle are prioritized for investment purposes. The investment function is the function of livestock as savings, insurance, loan guarantees, capital accumulation, and buffer stocks in the event of crop failure. Smallholder farmers in Indonesia raise beef cattle not only for meat production and supporting agriculture by using manure as fertilizer and energy use, but also as assets, such as savings, insurance, and cultural aspects [17]. The next priority for maintaining PO is as a socio-cultural function and as cash income, respectively. The socio-cultural function is a function of livestock that provides status and identity for farmers. Meanwhile, cash income is income derived from the sale of livestock.

**Table 5. Weight vector of factor**

| Factor                  | Weight Vector | Rank |
|-------------------------|---------------|------|
| Cattle Breed            | 0.089         | 6    |
| Selling Price           | 0.129         | 4    |
| Adaptability            | 0.161         | 3    |
| Reproductive Ability    | 0.309         | 1    |
| Body Size               | 0.104         | 5    |
| Physical Appearance     | 0.166         | 2    |

The calculation of the weight vector in Table 5 showed that the first rank was the reproductive ability (0.309), then ranks 2 and 3 were livestock physical appearance (0.166) and adaptability (0.161). This means that farmers pay more attention to the reproductive ability factor in raising PO cattle than other factors. Reproductive ability is the ability of livestock to reproduce. While physical appearance is usually associated with the appearance of important traits, such as skin and coat color, horn size and shape, conformation, and other exteriors in livestock. Then, adaptability is the ability to survive against disease and climate. Most smallholder farmers keep breeding stock rather than fattening cattle, as they aim to have animals for longer period to provide progeny to be sold [17]. Thus, reproductive ability being a priority or an important factor for them.

4. Conclusion
The ranking of factors that were considered in raising PO cattle showed that reproductive ability was relatively more considered by farmers. Since, farmers made the investment function as the main purpose in raising PO cattle. PO cows with good reproductive ability will produce calve that are useful as assets for farmers. Calve can be sold when the farmer needs cash.

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