Combination of analytical hierarchy processes with fuzzy c-means in selecting quality broiler chicken

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Abstract. One of the key points in broiler chicken farming is in the initial process of selecting chicken seeds or known as DOC. The problem that emerged in the field is there are so many options of broiler breeds available from Breeding Farm, making it difficult for farmers and companies to choose the good quality broiler chickens. This research uses Analytical Hierarchy Combination Process for knowing which sequence is influenced on choosing process, in order to produce the good quality disease-free chicken seeds with standard variables; the highest weight is 0.207, followed by normal body 0.174 then weight according to the standard with a value of 0.172. Fuzzy C-Means is used for cluster processes in monitoring the quality levels of each chicken breeding process with results divided into 3 clusters. They are cluster 1 with as many as 410 breeders (96.70%), cluster 2 with 12 breeders (2.83%) and clusters 3 with 2 farmers (0.47%). With this method, companies can reduce losses caused by mistakes from these three parts and company profits increases.

1. Introduction
Broiler is one of the sources of animal protein needed by Indonesian people, because the price is relatively affordable and the growth of broiler chickens is relatively faster with a shorter life cycle compared to other meat producers [1]. PT. Sekawan Sinar Surya (S3) Bogor Region is one of the companies engaged in animal husbandry with partnership business patterns. Having a population of approximately 800,000 chickens, the company must be selective and smart in choosing broiler or DOC (Day Old Chick) seeds that will be cultivated by farmers. Chicken seeds or DOC have a significant contribution in broiler chicken farming. There are several factors that can affect the growth of chicken seedlings, including the feed that is needed, the ideal location for farm locations, air temperature and they are free of diseases.
Figure 1. Per capita consumption of livestock products per 2015-2016.

Consumption of the meat in Indonesia increases every year as long as with the level of the economy of the community. The national meat consumption is dominated by poultry meat, especially chicken meat. Based on the livestock statistics and animal health, broiler meat consumption in 2015 was 4797 kg per capita, while in 2016 it increased to 5110 kg per capita [2].

Figure 2. Year poultry population 2013 – 2017.

The increase of public demand in consumption of chicken meat makes many people or entrepreneurs turn to the broiler breeders. It can be seen in figure 2 the increase in broiler or broiler livestock population from 2013 to 2017. The increase in broiler chicken population causes the demand for nursery companies
to continue to increase, but the quality of chicken seedlings produced is less than optimal. One of the main keys to broiler farming is to choose DOC (day old chick) or chicken seeds. The large number of broiler seedlings available in breeding farms makes it difficult for farmers and companies to choose quality broiler breeders, especially because farmers have limited ability to choose broiler chicken seeds by seeing manually without using a system. Many failures in cultivating broiler chickens are due to the limited ability of farmers to choose broiler chicken seeds. The selection of good seeds must consider a variety of criteria; free from diseases, especially pullorum (white defecate), originating from a parent that is old enough and from experienced breeders, chicken seedlings look active, bright eyes and agile, big feet and wet like oily, bright fur and not dull, the anus is clean and there is no dirt, normal body condition, and the weight is in accordance with the standard of the strain. The Fuzzy C-Means method produces the best testing around 82.812% and K-Means around 73.438% [3]. While for the ranking process of each variable, AHP method is used. The two methods are compared with the perspective match percentage level of 30 respondents using internet service packages with a match value of around 84.62%, while Simple Additive Weighting only gets 76.92% [4]. The combination of the two methods is expected to provide a solution in the selection of quality chicken seeds by ranking the weight of each criterion and can map clusters of broiler chickens according to the expected results. The clustering can be produce the level of superiority of seeds in accordance with determined criteria. This research contributes to breeders and companies by providing criteria for quality broiler chickens that will be cultivated, so it is expected to be used as a benchmark for choosing quality chicken seeds so as to minimize the loss of broiler chicken production.

2. Literature review

The method used is Analytical Hierarchy Process that produces an objective and effective decision model to choose the most appropriate strategy to be developed in determining the strategy and criteria of the sector of small milk companies with each weight percentage criteria: Increase 0.25% Milk Usage, Increase Health Awareness 0.23%, Increase Brand awareness 0.3%, Positioning Strategy 0.15% and Message Sharing 0.18% [5]. The problem is the lack of collection of genetic plant data sets caused by large collection sizes and large costs due to maintenance for research. The F-C Means method used in this study resulted in F-C means being successfully applied to classify lentil genotypes in terms of agronomy by grouping them into four groups based on 10 numerical agromorphological descriptors. The main component is used for dimension reduction and also avoids the adverse effects of linear descriptors. The appropriate number of clusters is obtained with the help of validity steps [6]. An important problem that occurs is that it requires problem solving in identifying patterns and trends in large volumes of data. This will provide benefits in the efficiency of the application made. We made comparison between the K-Means method and F-C Means use to produce the best model, with the results obtained, even though k-means is better than Fuzzy C Means dealing with problems related to understanding pattern capabilities, incomplete/noisy data, mixed media information, but F-C means found a better solution in terms of association rules and functional dependencies and shooting [7]. The problem of sleeping mats for broiler producers, where they need bedding that is environmentally friendly, and must be efficient, cost-effective, reduce NH3 emissions that interfere with the sustainability of broiler chicken production such as wounds, foot disorders and soon. AHP is used in this study to analyze the decision to choose broiler chicken bedding. Where wood shavings are the top priority from Central West Brazil for economic reasons and are efficient and environmentally friendly [8].
2.1. Conceptual frame

![Conceptual frame diagram]

**Figure 3.** The proposed frame of mind.

3. Methodology

In this study we use two methods namely Analytical Hierarchy Process (AHP) and Clustering of Data Mining, where each method has its own personal function. This study also uses the comparative methods of the AHP and clustering with FCMeans as follows:

Determining the best formula can be completed by using AHP:

1. Matched Matrices, CR Value, CR value is a step to test the consistency of the matrix in pairs, where with this step later matrix paired tested Whether the value <= 0.1 then the elements have been grouped homogeneously and the relations between the criteria mutually justify the logic, but if otherwise, the configuration of the matrix in pairs must be reset. Calculating the Consequence Ratio (CR) by the formula [9]. Priority Vectors, determination of the priority vector of each row of parameters that exists with the equation below.
2. As for the sum of each line follow the equation
3. Evaluation of Matrix
4. Weight each criterion and the last ranking process [10].

The best formula is determined by using Fuzzy C-Means for cluster processes in monitoring the quality levels of each chicken breeding:
1. Input the data to be cloned is the data of varieties in the form of a matrix measuring
2. Limit the number of clusters in this research using 3 clusters
3. Generating random numbers
4. Calculating the center of the cluster
5. Calculate the objective function in the iteration $t$
6. Calculate changes to the partition matrix
7. Check the stop condition [11]

4. Results
The result of Weighting Process using the Analytical Hierarchy Process (AHP) method is shown in figure 4 below.

![Selecting of Quality Broiler Chicken Seeds with AHP](image)

**Figure 4.** Results of ranking using the AHP method.

From the picture above it appears that the criteria for disease-free rank first, followed by normal body, weight according to standards and so on. This is because breeders generally see the condition of chickens that will be cultivated on arrival, namely from health, the actual weight of chickens received, the physical completeness of the chicken seeds and where they come from superior brand. In addition to the 4 most important factors above, some farmers will understand and accept other factors.
Figure 5. Dendogram cluster.

The dendogram above shows 3 clusters formed, where cluster 1 consists of samples from 1 to 424 in the order in the dendogram. Cluster 2 consists of samples from 110 to 367. And cluster 3 consists of samples from 180 to 363. And soon, members can easily be seen in each cluster according to the desired number of clusters.

Figure 6. Use case diagram.

The use case in figure 6 above consist of two users, namely as admin and user as decision maker. Admin in this system has the right to carry out all activities in the system. Where as decision makers have the right to add breeders data but cannot change or delete it, but can only see the results of decisions obtained in the form of clustering and ranking.
Class Diagrams consist of admin tables and decision making tables consisting of username and password, breeder registration table is chick in data in the form of code, farmer name, doc type, population, information and period. The criteria data table which is the criteria determined by decision maker consist of number, criteria names and ranking. AHP and clustering data is filled manually to determine the result of broiler chicken breeds that are said to be of good quality or not.
System implementation is created by entering the existing parameters and analysis result using AHP and Fuzzy C-Means which can be seen in the displayed field.

5. Conclusion

The use of a combination of fuzzy c-means method with analytic hierarchy process in this study can be divided into 3 different clusters and provide ranking results according to existing criteria. The determined cluster level gets optimal results with the existing criteria divided into 3 clusters, namely cluster 1 as many as 410 farmers (96.70%). Cluster 2 is 12 farmers (2.83%) and cluster 3 are 2 breeders (0.47%). The results of ranking criteria with the AHP method are disease-free with a weight of 0.207 (1), a normal body with a weight of 0.174 (2), weight according to the standard weighing 0.172 (3), originating from a superior parent with a weight of 0.141 (4), active chicken seedlings with weight 0.134 (5), large and wet feet weighing 0.076 (6), bright feathers weighing 0.068 (7) and clean anus weighing 0.028 (8). Applications that are made are expected to be used by farmers and management in choosing quality broiler chickens.

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