**Scientific Journal of Informatics**
Vol. x, No. x, Nov 20xx
p-ISSN 2407-7658 http://journal.unnes.ac.id/nju/index.php/sji e-ISSN 2460-0040

# Comparison Between SAW and TOPSIS Methods in Selection of Broiler Chicken Meat Quality

**Pungky Tri Kisworo Adi[1], Endang Sugiharti[2], Alamsyah[3]**

[1,2,3]Computer Science Department, FMIPA, Semarang State University
Email: [1]pungky.tri.ka08@gmail.com, [2]endangsugiharti@mail.unnes.ac.id, [3]Alamsyah@mail.unnes.ac.id

**Abstract**

Decision support system is a system that can assist semi-structured and unstructured decision making, in which no one knows exactly how decisions should be made. Broiler Chicken farm production is growing very rapidly along with the increasing market demand for Broiler Chicken. Broiler Chickens have fast growth in a relatively short time. The purpose of this research is the selection of chicken meat quality by applying comparison of SAW and TOPSIS method. The variables used are age, ration conversion, weight of chicken weight, and water consumption. The system is created using PHP framework Code Ignitier and database MySQL using waterfall method. That is analyze the user needs on the system, do the database design, by doing a coding and testing the system whether it is what is expected. The result of this research is the application of comparison between SAW and TOPSIS method each consist of 5 criteria. Comparison of these algorithms can facilitate the breeders in choosing a good quality broiler chicken meat.The results of the best farmer recommendation according to comparative method of SAW and TOPSIS. In SAW method of breeder 1 The biggest value is at V2 = 0,341, so alternative A2 is alternatives chosen as good alternative. Breeder 2 The biggest value is at V3 = 0.033, so alternative A3 is the alternative chosen as a good enough alternative. Breeder 3 The biggest value is at V1 = 0.005, so alternative A1 is the alternative chosen as an excellent alternative. Topsis Method of Breeders 1 is the largest value at V2 = 9.98, so alternative A2 is the alternative chosen as a good alternative. Breeder 2 is the biggest value at V3 = 0.372, so alternative A3 is the alternative chosen as a good enough alternative. Breeder 3 is the biggest value at V3 = 0.982, so alternative A3 is the alternative chosen as a good enough alternative. This system uses only 5 criteria, it would be nice if you add other criteria that support the selection of broiler chicken meat quality.

**Keywords**: Decision support system, broiler chicken, Simple Additive Weight, Technique for Order Preference by Similarity to Ideal Solution.

## 1. INTRODUCTION

Along with the development of Information and Communication Technology (ICT), the computer has the ability to process data, but more than that the computer can support in the decision making process. Solving a problem that was originally done manually, now it can be done systematically through the application [1]. Decision Support System (DSS) is an interactive information system that provides information, modeling, and data manipulation. This system is used to assist decision making in semi-structured situations and unstructured situations, where no one knows exactly how decisions should be made [2]. Decision support systems have been widely applied in various fields to help solve problems and to evaluate profits [3]. Decision Support System (DSS) can be used for decision making process. Two methods are often used to make the decision process is the method of Simple Additive Weight

(SAW) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). Both of these methods are incorporated into he MADM (Multi-Attribute Decision Making) model and require a decision matrix and weight value to perform calculations [4].

System is a business entity consisting of parts that relate to each other that seeks to achieve a goal in a complex environment. A system may consist of systems of other parts or often called subsystems. [5]. The system can be called as a network consists of elements that are interconnected to perform an activity and complete the steps to be achieved. Systems analysis relies heavily on general system theory as a conceptual foundation. The goal is to improve the various functions in the running system to become more efficient, change the target system running, design or replace the output that is being used to achieve the goal [6].

Broiler Chicken farm production is growing very rapidly along with the increasing market demand for Broiler Chicken. Broiler Chicken is one source of animal protein that is widely consumed by the community. Broiler Chickens have fast meat growth in a relatively short time. Ease of maintenance is also easy to cultivate, so many people are interested in Broiler Chicken cultivation.

Broiler chickens have been developed with genetic potential for faster growth rates to achieve desired body weight in the shortest possible time. This genetic potential can not be fully exploited or can be explained if an appropriate or optimal environment is not provided, as it means that the animal must be adequately supplied with nutrients [7]. Based on the above description, the researchers are interested to compare the method of SAW and TOPSIS in choosing the quality of broiler chicken meat.

## 2. METHOD

### 2.1. SAW

The basic concept of the SAW method is to find the weighted sum of performance ratings on each alternative on all attributes. The SAW method requires the process of normalizing the decision matrix (X) to a scale comparable to all existing alternative ratings [8]. Simple Additive Weighting (SAW), also known as the weighted and simple weighted scoring method most commonly used for multiple decision attribute (MADM) tools [9]. The difference between the SAW method and the other method lies in the factor of value. The value of SAW method is done simply by matching alternative condition to criterion. Another difference is also found in the determination factor of weight vector values. The determination of the priority value of the weighted vector is performed in accordance with the policy of the manager giving the value of the weight vector directly [10]. The basic concept of the SAW method is to find the weighted sum of performance ratings on each alternative of all attributes. The SAW method requires the proces of normalizing the decision matrix (x) to a scale comparable to all existing alternative ratings [11].

$$r_{ij} = \begin{cases} \frac{Xij}{\max Xij}, if\ j\ is\ a\ benefit\ attribute\ (benefit) \\ \frac{\min Xij}{Xij}, if\ j\ is\ a\ cost\ attribute\ (cost) \end{cases} \quad (1)$$

where as:

rij = normalized performance rating from alternative Ai on attribute Cj where i = 1, 2, ..., m and j = 1, 2, ..., n.

The preference value for each alternative (Vi) is given according to Equation 2.

$$\boldsymbol{V_i}=\sum_{\boldsymbol{j=1}}^{\boldsymbol{n}} \boldsymbol{w_j r_{ij}} \quad (2)$$

Where as:

$A_i$ = Alternative
$C_j$ = Criteria
$W_i$ = Weight preference
$V_i$ = Preference value for each alternative
$X_{ij}$ = Alternate value of each criterion.

A larger value of Vi indicates that Ai's alternatives are preferred. As for the criteria is divided into two categories namely for positive values included in the criteria of profit and the negative value included in the cost criteria.

The following is briefly the SAW method algorithm:

1. Normalize the decision matrix by calculating the normalized performance rating *($r_{ij}$)* value of alternative $A_i$ on criterion $C_j$ by using Equation 1.
2. The result of a normalized performance rating *($r_{ij}$)* values a normalized matrix as in Equation 3.

$$\mathbf{R} = \begin{bmatrix} \mathbf{R11} & \cdots & \mathbf{R1j} \\ \vdots & \ddots & \vdots \\ \mathbf{Ri1} & \cdots & \mathbf{Rij} \end{bmatrix} \quad (3)$$

3. The final result of the preference value ($V_i$) is obtained from the summing of the matrix row element matrix (R) with the corresponding weight of preference (W) of the matrix column element (W). The value of preference uses Equation 2.
4. Greater $V_i$ score calculations indicate that the alternative Ai is the best alternative.

### 2.2. TOPSIS

TOPSIS was developed by Hwang and Yoon in 1981, the TOPSIS method for choosing alternatives that simultaneously had the shortest distance from the ideal ideal solution and the furthest distance from the ideal ideal solution. A positive ideal solution maximizes the benefit criteria and minimizes the cost criteria, while the ideal negative solution maximizes the cost criteria and minimizes the benefit criteria. To apply this technique, attribute values must be numerical, monotonically increasing or decreasing, and having equivalent units [12]. TOPSIS method is widely used in some models of Multiple Attribute Decision Making (MADM) because this method has several advantages [13] namely:

1. The concept is simple and easy to understand.
2. Computing is efficient.
3. Have the ability to measure the relative performance of decision alternatives in simple mathematical form.

As for the steps in completing a MADM case with TOPSIS [10] as follows:

1. Make a normalized decision matrix using Equation 4.

$$\boldsymbol{r_{ij}} = \frac{\boldsymbol{X_{ij}}}{\sqrt{\sum_{\boldsymbol{i=1}}^{\boldsymbol{m}} \boldsymbol{X_{ij}}^{\boldsymbol{2}}}} \quad (4)$$

Where as:
$r_{ij}$ = the normalized value of the decision matrix
$x_{ij}$ = the original value of the decision matrix

2. Create a normalized weighted decision matrix using Equation 5.

$$\boldsymbol{y_{ij} = w_j r_{ij}} \quad (5)$$

Where:
$y_{ij}$ = a weighted normalized decision matrix
$w_i$ = weighting against criterion *i*
$r_{ij}$ = the normalized value of the decision matrix

3. Determine the matrix of positive ideal solutions and the ideal negative solution matrix by using Equations 6 and 7.

$$\boldsymbol{A^+ = (y_1{}^+, y_2{}^+, \dots, y_n{}^+)}; \quad (6)$$

$$\boldsymbol{A^- = (y_1{}^-, y_2{}^-, \dots, y_n{}^-)}; \quad (7)$$

$$y_1{}^+ = \begin{cases} max_{iyij} \; ; \; if \; j \; is \; a \; benefit \; attribute \; (benefit) \\ min_{iyij} \; ; if \; j \; is \; a \; cost \; attribute \; (cost) \end{cases}$$

$$y_1{}^- = \begin{cases} max_{iyij} \; ; \; if \; j \; is \; a \; benefit \; attribute \; (benefit) \\ min_{iyij} \; ; if \; j \; is \; a \; cost \; attribute \; (cost) \end{cases}$$

Where:
$A^+$ = Positive idea solution $A^+$ matrix
$A^-$ = Matrix solution negative idea $A^-$
$y_1{}^+$ = Max $y_{ii}$ if *j* is a benefit attribute *(benefit)*
*Max* $y_{ii}$ = if j is a cost attribute *(Cost)*
$y_1{}^-$ = Min $y_{ii}$ if *j* is a benefit attribute *(benefit)*
*Min* $y_{ij}$ = if *j* is the cost attribute *(Cost)*

4. Determine the distance between the value of each alternative with the matrix of positive ideal solutions and the ideal negative solution matrix using Equations 8 and 9

$$\boldsymbol{D_i{}^+ = \sqrt{\sum_{j=1}^{n}(y_i{}^+ - y_{ij})^2}} \quad (8)$$

$$\boldsymbol{D_i{}^- = \sqrt{\sum_{j=1}^{n}(y_{ij} - y_i{}^-)^2}} \quad (9)$$

Where:
$D_i{}^+$ = Distance to a positive ideal solution
$D_i{}^-$ = Distance to the ideal solution negative

5. Determine the preference value for each alternative by using Equation 10.

$$\boldsymbol{V_i = \frac{D_i{}^-}{D_i{}^- - D_i{}^+}} \quad (10)$$

The preference value is the final value used to rank all previously assessed alternatives. The preference value of an alternative is the ratio between the distance from the ideal ideal solution and the amount of distance to the ideal positive sousi. If the value Vi represents the greatest value, it indicates that the alternative Ai has been appropriately selected.

**2.3 Planed Proccesses**

Steps in the making process:

1) Preliminary Studies
Preliminary study was conducted to get a complete description of decision support

system problems by comparison of SAW method and TOPSIS method in decision making on broiler breeder.

2) Data Collection
   Data collection conducted by the researcher is by doing literature study. In this literature study used the relevant literature sources used to collect the necessary information in the study. Library study by collecting book resources, books, texts, papers and so forth. In this research, it is necessary to study the literature related to the existing problem that is about what is used in decision making of Broiler Chicken meat quality with comparison of Method SAW and Topsis Method which will be utilized to help menyeselaikan existing problem.
3) Data Analysis
   The data analysis describes the technique of solving the method used in the research.
4) System Development Phase
   Development of the implementation of SAW method comparison with TOPSIS method as a decision support system to determine the quality of broiler meat using Waterfall Model approach. Waterfall model is a software development that is sequential. This waterfall model is divided into 4 interrelated and influencing phases. Four stages are the analysis of needs (analysis), design (design), coding (Code) and testing (test) [14]. The four stages of the waterfall model can be explained as follows.
   a) Needs Analysis (analysis)
      The needs analysis stage is the entire software format, identifying all the needs and outlines of the system to be created [15].
   b) System Design (design)
      Create a web-based application program (website) that interesting and interactive, then before it must be designed in advance so that the results achieved in accordance with predetermined objectives [1].
   c) System Design (design)
      Create a web-based application program (website) that interesting and interactive, then before it should be designed in advance so that the results achieved in predetermined objectives [16].
   d) Testing (Test)
      This stage is tested against the software that has been produced. Testing is done to ensure that the application is made in accordance with the design and all functions can be used properly without any errors.

## 3. RESULT AND DISCUSSION

### 3.1. Result

In this study, interviews were conducted to find relevant data from reliable sources. The results of interviews that have been obtained then conducted a manual calculation experiment using comparison of SAW method and TOPSIS method.

a) SAW Method
There are 5 criteria that can be seen in Table 1.

Table 1. Quality Criteria

| No | Criteria | Criteria Name |
|---|---|---|
| 1 | $C_1$ | Age |
| 2 | $C_2$ | DOC Ration Conversion |
| 3 | $C_3$ | Feed Ration Conversion |
| 4 | $C_4$ | Weight Chicken Weight |
| 5 | $C_5$ | Water Consumption |

The intensity importance of the criteria used in this system is based on the survey that has been done. Assessment made as an indicator of the quality of chicken meat in each criterion against the comparison value can be seen in Table 1.

Table 2. Category of Quality of Chicken Meat

| The Quality of Chicken Meat | Information |
|---|---|
| A1 | Very good |
| A2 | Good |
| A3 | Pretty Good |
| A4 | Not Good |
| A5 | Not Good |

There are 4 steps calculation SAW method, here is a weighting step with SAW method:

Step 1
Define matrix in pairs between criteria. From the intensity of criterion importance in Table 2 above, it can be concluded the comparison between each criteria in Table 2.

Table 3. Matched Comparison Matrices Between Match Ratings Every Alternative On Any Criteria

| Alternative | Criteria | | | | |
|---|---|---|---|---|---|
| | Age | Doc | Feed | Weight Chicken Weight | Water Consumption |
| A1 | 4 | 5 | 3 | 2 | 2 |
| A2 | 1 | 1 | 2 | 1 | 1 |
| A3 | 7 | 2 | 5 | 3 | 5 |
| A4 | 1 | 4 | 2 | 4 | 2 |
| A5 | 1 | 1 | 2 | 5 | 3 |

Step 2
Normalized decision matrix by calculating the normalized performance rating value. From the calculation results obtained matrix ternomalisasi R as follows.

$$R = \begin{Bmatrix} 0{,}142 & 0{,}125 & 0{,}025 & 0{,}016 & 0{,}033 \\ 0{,}571 & 0{,}625 & 0{,}037 & 0{,}033 & 0{,}066 \\ 0{,}081 & 0{,}312 & 0{,}015 & 0{,}011 & 0{,}013 \\ 0{,}571 & 0{,}156 & 0{,}037 & 0{,}008 & 0{,}033 \\ 0{,}571 & 0{,}625 & 0{,}037 & 0{,}006 & 0{,}022 \end{Bmatrix}$$

Step 3

Determining percentage percentage criteria can be seen in table 4.

Table 4. Weight Criteria

| Criteria of Percentage Weight | % | |
|---|---|---|
| Age | 25 | 0,25 |
| DOC | 15 | 0,15 |
| Feed | 30 | 0,30 |
| Weight Chicken Weight | 25 | 0,25 |
| Water Consumption | 5 | 0,05 |

Step 4

Find for the best alternative using the following equation.

$V_1$ = (0,25x0,142)+(0,15x0,571)+(0,30x0,081)+(0,25x0,571)+(0,05x0,571)
= 0,035+0,085+0,024+0,142+0,028 = 0,314

$V_2$ = (0,25x0,125)+(0,15x0,625)+(0,30x0,312)+(0,25x0,156)+(0,05x0,625)
= 0,031+0.093+0,093+0,039+0,031 = 0,341

$V_3$ = (0,25x0,025)+(0,15x0,037)+(0,30x0,015)+(0,25x0,037)+(0,05x0,037)
= 0,004+0,004+0,004+0,009+0,001 = 0,022

$V_4$ = (0,25x0,016)+(0,15x0,033)+(0,30x0,011)+(0,25x0,008)+(0,05x0,006)
= 0,004+0,004+0,003+0,002+0,003 = 0,016

$V_5$ = (0,25x0,033)+(0,15x0,066)+(0,30x0,013)+(0,25x0,033)+(0,05x0,022)
= 0,008+0,009+0,003+0,008+0,001 = 0,029

The greatest value is in $V_2$, so alternative A2 is the alternative chosen as a good alternative.

b) TOPSIS Method

There are 4 steps calculation method TOPSIS, here is step method TOPSIS:

Step 1

Create a normalized decision matrix using Equation 4.

Step 2

Determining Positive Ideal Solutions (A +) and Negative Ideal Matrix (A-).
From the above calculation results obtained matrix ternomalisasi R as follows.

$$R = \begin{Bmatrix} 0,34 & 0,37 & 0,58 & 0,4 & 0,24 \\ 0,80 & 0,50 & 0,35 & 0,4 & 0,49 \\ 0,23 & 0,37 & 0,70 & 0,6 & 0,49 \\ 0,23 & 0,63 & 0,23 & 0,4 & 0,24 \\ 0,34 & 0,25 & 0,23 & 0,4 & 0,62 \end{Bmatrix}$$

Step 3

Determining Criteria Weight Percentage can be seen in table 4.

Step 4

Determine the maximum and minimum values and calculate the ideal positive solution distance (D +) and the ideal ideal solution (D-).

| | | | | | |
|---|---|---|---|---|---|
| **A+** | 0,80 | 0,63 | 0,70 | 0,6 | 0,62 |
| **A-** | 0,23 | 0,25 | 0,23 | 0,4 | 0,24 |

Finding the preference value for each alternative (Vi) as follows.

$$V_1 = \frac{0{,}334}{0{,}334 + 1{,}835} = 0{,}154$$
$$V_2 = \frac{0{,}579}{0{,}579 + 1{,}289} = 0{,}309$$
$$V_3 = \frac{0{,}7208}{0{,}7208 + 1{,}216} = 0{,}372$$
$$V_4 = \frac{0{,}173}{0{,}172 + 1{,}168} = 0{,}129$$
$$V_5 = \frac{0{,}173}{0{,}172 + 1{,}505} = 0{,}130$$

The greatest value is on $V_3$, so alternative A3 is the alternative chosen as a good enough alternative.

### 3.2. Discussion

Many obstacles are often faced by broiler breeders, all because of the lack of knowledge gained in the process of cultivation. The process of broiler cultivation is difficult-easy bump, as long as we understand the characteristics of each type of chicken meat, it can be guaranteed that the cultivation will be successful. The chicken meat quality selection system is needed in assisting the livestock process, by weighting and calculating the accuracy using decision support system of SAW and TOPSIS method comparison with age criteria comparison, doc ration conversion, feed ration conversion, chicken weight weight, water consumption. The first phase of this research is data collection. The data were collected by literature study, interview and data gathering. The SAW and TOPSIS method test is done with the existing data, then the data is weighted with SAW and TOPSIS method by comparing the importance of each criterion. In the weighting stage using SAW and TOPSIS method will be generated the weight value of each criterion. The weight values for each of the known criteria, then calculated by the ranking stage of SAW and TOPSIS methods. Criteria that have the highest value, then it is a good recommendation.

## 4. CONCLUSION

The application of comparison between SAW and TOPSIS methods works well using 53 chickens data each consisting of 5 criteria. Comparison of these algorithms facilitate the breeders in choosing good quality broiler chicken meat. Decision support system of quality selection of broiler meat made with programming language PHP framework CI and MySQL database. In making the system using waterfall method. This waterfall model is divided into 4 stages. The first stage, needs analysis, which is analyzing what can be utilized by users of the system. The second stage is design, by designing ERD, database table structure and database schema. The third stage is implementation, start coding by realizing the results of needs analysis and system design. The fourth stage is testing, by testing the functional system whether in accordance with the expected or not. Results of the best farmer recommendation according to comparative method of SAW and TOPSIS. In SAW method of breeder 1 The biggest value is at V2 = 0,341, so alternative A2 is alternatives chosen as good alternative. Breeder 2 The biggest value is at V3 = 0.033, so alternative A3 is the alternative chosen as a good enough alternative. Farmer 3 The biggest value is at V1

= 0.005, so alternative A1 is the alternative chosen as an excellent alternative. Topsis Method of Breeders 1 The largest value is at V2 = 9.98, so alternative A2 is the alternative chosen as a good alternative. Breeder 2 The biggest value is at V3 = 0.372, so alternative A3 is the alternative chosen as a good enough alternative. Farmer 3 The biggest value is at V3 = 0.982, so alternative A3 is the alternative chosen as a good enough alternative.

## 5. REFERENCES


[1] Muslim, M.A. (2012). Pengembangan Sistem Informasi Jurusan Berbasis Web Untuk Meningkatkan Pelayanan Dan Akses Informasi. *Jurnal MIPA*, 35(1): 92-98

[2] Angkat, L. S. (2015). Sistem Pendukung Keputusan Pemilihan Induk Ayam Produktif Dengan Metode Simple Additive Weight (SAW) (Studi Kasus : PT. Expravet Nasuba Farm Desa Namopuli), 9(2), 135–141.

[3] Josaputri, C. A., Sugiharti, E., & Arifudin, R. (2016). Decision Support Systems for The Determination of Cattle with Superior Seeds using AHP and SAW Method. *Scientific Journal of Informatics*, 3(2): 23-28.

[4] Mude, M. A. (2016). Perbandingan Metode SAW dan TOPSIS pada Kasus UMKM. *Jurnal Ilmiah ILKOM*, 8(2), 76–81.

[5] Laksana, T. G., & Zarkasy, M. E. (2015). Sistem Pendukung Keputusan Seleksi Supplier Pemilihan Bibit Ayam Broiler Menggunakan Metode Ahp. *Jurnal Online ICT STMIK IKMI*, 13(1).

[6] Alamsyah, & Arus, A.A. (2014). Analisis Sistem Pendaftaran pada Web Forum Ilmiah Matematika Unnes 2014. *Scientific Journal of Informatics*, 1(1):107-118.

[7] Adeyemo, G. O. (2013). *Growth Performance of Broiler Chickens Fed Fossil Shell Growth Promoter.* Food and Nutrition Sciences, 4, 16–19.

[8] Helilintar, R., Winarno, W. W., & Al Fatta, H. (2016). Penerapan Metode SAW dan Fuzzy dalam Sistem Pendukung Keputusan Penerimaan Beasiswa. *Citec Journal*, 3(2), 89–101.

[9] Shin, Y., Lee, S., Chun, S., & Chung, D. (2013*). A Critical Review of Popular Multi-Criteria Decision Making Methodologies.* Issues in Information Systems, 14(1), 358–365.

[10] Febriyati, M. N., Sophan, M. K., & Yunitarini, R. (2016). Recruitment Warga Laboratorium Teknik Informatika Di Universitas, 5(3), 133–142.

[11] Idris, S. L. (2012). Analisis Perbandingan Metode Analytical Hierarchy Process (AHP) dan Simple Additive Weighting (SAW).

[12] Hamid, R. A., & Eldin, Z. (2012). A Decision Support System for Performance Evaluation. *IJCA Special Issue on "Computational Intelligence & Information Security" CIIS*, 1–8.

[13] Mu'asyaroh, F. L., & Mahmudy, W. F. (2016). Implementasi Algoritma Genetika dalam Optimasi Model AHP dan TOPSIS untuk Penentuan Kelayakan Pengisian Bibit Ayam Broiler di Kandang Peternak. *Jurnal Teknologi Informasi Dan Ilmu Komputer (JTIIK)*, 3(4), 208–219.

[14] Pressman, Roger S. (2001). *Software Engineering: A Practitioner's Approach, 5th Edition.* Singapore: McGraw-Hill,Inc.

[15] Nugroho, Z.A., & R. Arifudin. Sistem Informasi Tracer Study Alumni Universitas Negeri Semarang Dengan Aplikasi Digital Maps. *Scientific Journal*

*of Informatics*, 1(2): 154.
[16] Purwinarko, A. (2014). Model Expertise Management System di Universitas Negeri Semarang. *Scientific Journal of Informatics*, 1(2): 178.