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Research paper

Determination of the best quail eggs using simple additive weighting

Satria Abadi [1], Miftachul Huda [2], Kamarul Azmi Jasmi [2], Sulaiman Shakib Mohd Noor [2], Jimaain Safar [2], Ahmad Kilani Mohamed [2], Wan Hassan Wan Embong [2], Ahmad Marzuki Mohamad [2], Aminudin Hehsan [2], Bushrah Basiron [2], Siti Suhaila Ihwani [2], Andino Maseleno [1,3]*, Muhamad Muslihudin [1], Fiqih Satria [1], Dedi Irawan [4], Sri Hartati [1]

[1] Department of Information Systems, STMIK Pringsewu, Lampung, Indonesia
[2] Faculty of Social Sciences and Humanities, Universiti Teknologi Malaysia, Malaysia
[3]Institute of Informatics and Computing Energy, Universiti Tenaga Nasional, Malaysia
[4] Department of Islamic Education Management, STIT Pringsewu, Lampung, Indonesia
**Corresponding author E-mail: andimaseleno@gmail.com*

Abstract

Eggs are livestock products contributed greatly to the achievement of the nutritional adequacy of the public; the egg is a food that is very good for children who are growing because it contains nutrients such as a complete protein, fat, vitamins and minerals that are easy to digest. One of the eggs are much in demand by children are quail eggs. The nutritional value of quail eggs is not less than the nutritional value of eggs containing 12.8% protein and 11.5% fat. Quail eggs are good quality will have good nutritional value anyway. To determine the quality of a good quail eggs will require an expert system. The method used in determining the quality of a good quail eggs using Simple Additive weighting method. The criteria in this research that egg size, style/color of the shell, the shell thickness, shell texture, shape and cleanliness of quail eggs. With the expert system is expected to assist farmers in determining the quail eggs quail egg quality so that the people can consume quail eggs that have good nutritional value. The results of this study showed an alternative ranking first in C with a value of 0.95, ranking second D with a value of 0.7208, ranking third E with a value of 0675, ranking the fourth A with a value of 0.4542 and ranking last in the B with a value of 0.4541.

Keywords: *Expert System; Quail Eggs; simple additive weighting.*

1. Introduction

Indonesia is an agricultural country rich in natural resources. As an agricultural country, Indonesia has a great opportunity to accelerate the pace of development and economic growth through agriculture [1-3]. The livestock sector, which is part of the agriculture, has an important role [4-6]. Construction of a close farm is part of the agricultural developments that support the provision of animal origin food that is nutritious and high competitiveness, and create jobs in the field of agribusiness [7-9].

Table 1: Gross Domestic Product Over 2000 Constant Prices by Industrial Origin in the Agricultural Sector (Billion Rupiah), 2005-2007

Business field	Year		
	2006	2007	2008
Plant Food stuffs	125.801,8	129.548,6	134.075,6
Plantation crops	39.810,9	41.318,0	42.751,3
Livestock and results	32.346,5	33.430,2	34.530,7
Forestry	17.176,6	16.686,9	16.401,4
Fishery	38.745,6	41.419,1	43.827,9

Source: National Statistics (2008) [1].

Table 1 shows that the GDP (Gross Domestic Product) livestock sector and result in the last 3 years have increased from 32346.5 billion to 34530.7 billion. The sector's contribution increasing from year to year and shows the level of interest the higher of the farm field. Fields farm businesses who are currently demanding public are poultry farming [10-12]. That is because poultry farming can be done from household business scale to large scale. Poultry farming which has advantages in terms of productivity and serve as a source of food protein that is also demanding public which quail farm businesses. High productivity excellence quail into the carrying capacity that add quail farm is becoming increasingly attractive. In one year can produce 250 to 300 grains with an average weight of ten grams/item [13-15].

The number of farms nationwide quail can be seen from the quail population increase recorded in the Central Bureau of Statistics and now has reached 8,524,213 tails. These numbers increased by 22 per cent of the initial amount in the previous year those as many as 6,640,078 individuals (Table 2).

Table 2: The Quail Population in 2007-2008 (Per Province)

No	Province	2007	2008
1.	Sumatera Utara	84.846	87.392
2.	Sumatera Barat	8.906	9.084
3.	Bengkulu	11.520	12.385
4.	Lampung	104.790	186.561
5.	Jawa Tengah	4.166.213	5.832.598
6.	Jawa Timur	1.471.704	1.564.421
7.	Bali	1.866	3.505
8.	Nusa Tenggara Barat	6 .601	7 .261
9.	Kalimantan Barat	13.000	27.390
10.	Kalimantan Tengah	200	27.390
11.	Sulawesi Utara	1.965	1.965

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12.	Bangka Belitung	4.791	749
13.	Kepulauan Riau	2.200	2.222
	Total number	6.640.078	8.524.213

Source: Central Bureau of Statistics (Susenas 2008)[1]

The amount of livestock sector's contribution to employment in the field of livestock can be seen in the Gross Domestic Product (Table 1).
Eggs are livestock products contributed greatly to the achievement of the nutritional adequacy of the public. From an egg we can get perfectly adequate nutrition because it contains nutrients such as a complete protein, fat, vitamins and minerals that are easily digested. Therefore, eggs are an excellent food for children who are growing because they require large amounts of protein. The nutritional value of quail eggs is not less than the nutritional value of eggs this can be seen in Table 3 below:

Table 3: Nutritional Content Quail Eggs and Some Types of Poultry Eggs [3]

Types of Poultry	Protein (%)	Fats (%)	Carbohydrates (%)
Chicken	12,7	11,3	0,9
Free -range chicken	13,4	10,3	0,9
Duck	13,3	14,5	0,7
Turkey	13,2	11,8	1,7
Goose	13,9	13,3	1,5
Quail	13,1	11,1	1,0
Dove	13,8	12,0	0,8

Quail eggs with good quality will contain nutrients that good anyway. However the quality of the quail eggs is never noticed by the breeder quail eggs. Quail breeder only pays attention to the large number of eggs that can be generated each day.
An expert system is a computer system that can emulate and imitate the ability of an expert. To determine the quality of a good quail eggs will require an expert system that will be able to help farmers quail eggs make it easier to identify a good quality quail eggs.

2. Literature review

2.1. Expert system

According to Durkin, the expert system is a computer program designed to model problem-solving ability is what an expert [15-17]. Expert system is a computer system that can emulate and imitate the ability of an expert [18-20]. In this view, the entire attempts using artificial intelligence refers to enhance the machine with smart tool, usually through the digital devices [21-23] such as computer and other electronic device [24-26] that can perform a task when the task is done by humans will need an intelligence to do [27-29]. With this regard, the entire attempts into the expert System is a computer-based system that uses knowledge, facts and reasoning techniques in solving problems that normally can only be solved by an expert in the field [30-32]. So from the above understanding of the expert system can be interpreted that the expert system is a computer program designed to model the ability of solving problems and imitate the ability of an expert [33-35].

2.2. Quail

Quail is a nation of wild birds. In Indonesia, especially in Java, quail called “gemuk”. Quail is one type of flightless bird, has a relatively small body size, has short legs, can be pitted and is cannibals. Initially quail is a wild bird. 1870 in the United States began farmed quail. After that period, the quail became known and bred in late 1979. The quail is a bird species are quite productive and begin to lay eggs at the age of 35-42 days or 5-6 weeks and will be in full production at the age of 50 days. The quail will be productive until the age of 16 months if well-maintained and can lay as many as 250-300 eggs / year. The quail were poorly maintained productive period only up to six or eight months.

2.3. Simple additive weighting

Simple additive weighting method is commonly known as a weighted summation method [8]. The basic concept is to find the SAW method of rating the performance of a weighted sum of each alternative on all attributes [9-10]. States that the total change in value generated by SAW method more so the SAW method is very relevant to solve the problem of decision making. SAW method is also a method that is the most simple and easy to use [11-12]. Here is the formula of simple additive weighting method [13-15]

$$rij = \begin{cases} \frac{xij}{Max(xij)}(benefit) \\ \frac{Min(xij)}{xij}(cost) \end{cases} \quad (1)$$

Preference value for each alternative (Vi) is given as:

$$Vi = \sum_{j=1}^{n} wjrij \quad (2)$$

3. Research method

3.1. Data collection

Data collection methods used in this study are:

a) Observation, this study comes directly quail breeders in North Pringsewu.
b) Studies Library the writer is a method to collect theoretical data by reading books, courses, references, journals, papers, articles and other writings.
c) The interview was conducted by asking a few questions to the informant as a material to develop research that is being done by the writer.

3.2. Analysis and logic simple additive weighting method

To determine the quality of the best quail eggs used decision support systems with Simple Additive weighting method. To obtain the best quail eggs, it would require some analysis of the data, the following data is needed:

1) Data Criteria

In this decision-making method of data required criteria. The criteria are:

C1 = Size of Eggs

C2 = Styling / Color Eggshell

C3 = Eggshell Thickness

C4 = Texture Shells

C5 = Shape Egg

C6 = Cleanliness eggshell

2) Data Weight

From each of these criteria will be determined weights. In the Simple Additive weighting method weights consist of five numbers, namely Very Low (SR), Low (R), Medium (S), High (TI), and Very High (ST).
From the picture above numbers Simple Additive weighting can be converted into numbers more clear crips for weighting the data formed in the table 4 below:

Table 4: Weight Value Criteria

Criteria	Weight
C1	25%
C2	20%
C3	25%
C4	10%
C5	10%
C6	10%
Total	100%

Based on the criteria and rating the suitability of each alternative on each criteria that have been determined, then the translation of the weight of each criterion that has been converted to the number Simple Additive weighting.

4. Discussion

4.1. Determining the weight value criteria

Criteria for egg size are determined by the weight of eggs per egg so that each egg weight will be determined the value of weight to the following table 5, table 6, table 7, table 8, table 9, and table 10.

Table 5: Egg Size (C1)

Egg size (grams / item)	Weight	Value
0 – 3 gram	Very Low (SR)	0 – 0.24
4 – 5 gram	Low (R)	0.25
6 – 7 gram	Medium (S)	0.5
8 – 9 gram	Height (T)	0.75
10 – 11 gram	Very High (ST)	1

Table 6: Styling Color Eggshell (C2)

Egg size (grams / item)	Weight	Value
Plain white	Low (R)	0.25
Yellow	Medium (S)	0.5
Brown spots	High (T)	0.75

Table 7: The Shell Thickness (C3)

Egg size (grams / item)	Weight	Value
0.1 mm - 0.12 mm	Very Low (SR)	0 – 0.24
0.13 mm – 0.2 mm	Low (R)	0.25
0.21 mm – 0.225 mm	Medium (S)	0.5
0.226 mm – 0.234 mm	Height (T)	0.75
0.235 mm – ≥ 0.302 mm	Very High (ST)	1

Table 8: Texture Shells (C4)

Egg Size (Grams / Item)	Weight	Value
Cracked	Low (R)	0.25
Rude	Medium (S)	0.5
Smooth / Flat	Very High (ST)	1

Table 9: Shape of Eggs (C5)

Shape (C2)	Weight	Value
Ovoid	Medium (S)	0.5
Round	Height (T)	0.75
Oval	Very High (ST)	1

Table 10: Cleanliness Eggshell (C6)

Shape (C2)	Weight	Value
Dirty	Low (R)	0.25
Clean	Height (T)	0.75

The next step determines suitability rating as shown in Table 11.

Table 11: Suitability Rating

Alternative (egg)	Result					
	C1	C2	C3	C4	C5	C6
A	0.25	0.5	0.5	0.5	0.5	0.25
B	0.5	0.25	0.25	0.25	0.75	0.75
C	1	0.75	1	0.5	1	0.75
D	0.75	0.75	0.5	1	0.75	0.25
E	0.25	0.75	0.75	0.5	0.75	0.75

It then performs the decision matrix formed from:

$$X=\begin{pmatrix} 0.25 & 0.5 & 0.5 & 0.5 & 0.5 & 0.25 \\ 0.5 & 0.25 & 0.25 & 0.25 & 0.75 & 0.75 \\ 1 & 0.75 & 1 & 0.5 & 1 & 0.75 \\ 0.75 & 0.75 & 0.5 & 1 & 0.75 & 0.25 \\ 0.25 & 0.75 & 0.75 & 0.5 & 0.75 & 0.75 \end{pmatrix}$$

Normalize of each alternative.
The formula used as follows:

$$V_i = \sum_{j=1}^{n} w_j r_{ij}$$

Assign a value to each of the following criteria:

W1=25%, W2=20%, W3=25%, W4=10%,W5=10%, W6= 10%
W= [0.25, 0.2, 0.25, 0.1, 0.1, 0.1]

The results obtained as follows:

V_1 = (0.25)(0.25)+(0.2)(0.667)+(0.25)(0.5)+ (0.1)(0.5)+(0.1)(0.5) +(0.1)(0.333)

=0.0625+0.1334+0.125+0.05+0.05+0.0333 = 0.4542

V_2 = (0.25)(0.5)+(0.2)(0.333)+(0.25)(0.25)+ (0.1)(0.25)+(0.1)(0.75) +(0.1)(1) = 0.125+0.0666+0.0625+0.025+0.075+0.1 = 0.4541

V_3 = (0.25)(1)+(0.2)(1)+(0.25)(1)+ (0.1)(0.5)+(0.1)(1) +(0.1)(1) = 0.25+0.2+0.25+0.05+0.1+0.1 = 0.95

V_4 = (0.25)(0.75)+(0.2)(1)+(0.25)(0.5)+ (0.1)(1)+(0.1)(0.75) +(0.1)(0.333) = 0.1875+0.2+0.125+0.1+0.075+0.0333 = 0.7208

V_5 = (0.25)(0.25)+(0.2)(1)+(0.25)(0.75)+ (0.1)(0.5)+(0.1)(0.75) +(0.1)(1) = 0.0625+0.2+0.1875+0.05+0.075+0.1 = 0.675

Table 12: Final Result

Alternative	Value	Ranking
A	0.4542	IV
B	0.4541	V
C	0.95	I
D	0.7208	II
E	0.675	III

Based on the table above it can be seen that alternative C quail eggs with getting the greatest value and gain the first rank with a value of 0.95.

5. Reflection and Some Implications

Attempts to determine the best quality of particular product should begin with committing the process itself [36] [37] [38] referring to the procedural stage in cooperating the initiative to enhance an insightful value in expanding the core components about the certain product [39-41]. With this regard, get access into the expert through valuing the potential attribution has to be involved with expanding the role and order to make sure in enabling the controlling program in selecting the one with most appropriate form [42-45]. As a result, identifying such elements in ensuring the process of determining the particular product or service in the right performance needs to obtain the initial value of accuracy in managing the good result from the good process as well [46-49]. Through professional enhancement and ethical skills [50-52], the wide range of approaches with comprehensive effort [53-55] together with an innovative basis [56-58] is widely a valuable insight into integration between the instrumental context and the medium used to deliver the process [59-61]. In featuring the process to be more accurate, the necessity to fulfill some requirements followed into the particular contribution [62-64] would have a good point in enhancing the potential value in delivering the appropriate part in

giving insights into the best one from selection, evaluation and re application [65-67]. Such here could be engaged in attempting the procedural stage with more appropriate into the particular means to apply for following the components with determining the application context [68-69].

6. Conclusion

The conclusion of this study are to determine the quality of quail eggs viewed from the size of the eggs, the style/ color of the shell, the shell thickness, the texture of the egg shell, egg shape and cleanliness. The characteristics of quality quail eggs are egg size/weight reached 10-11 grams, style/color eggs brownish black spots, the shell thickness reaches 0:21 mm to 0302 mm, shell texture smooth/flat, oval shape, and the shells are clean from blood spots and dirt. Expert systems are required to assist in identifying qualified quail eggs which are systems that present the data are accurate and reliable based on the criteria that have been determined.

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