Decision Support System to Determine Qualified Corn using TOPSIS Method

Serly Dwy Lestary, Nongmaithem Ajith Singh, P. Nagaraja, K. Shankar, Wahidah Hashim, Elena V. Smirnova, Andino Maseleno

Abstract: ***Corn is a staple food ingredient, one of the areas where people consume corn instead of rice is Southeast Sulawesi. Qualified corn is one of the superior seeds, while some types of superior corn are hybrid corn and composite corn. The TOPSIS method is one of the multi criteria decision-making methods with simple concepts and efficient competition and has the ability to measure relative performance and alternative decisions in mathematical form. To make it easier to find qualified corn, the Technique for Order preference method is used. Similarity to Ideal Solution. This is facilitating corn farmers to choose good and productive corn crop quality, applying the TOPSIS method (Technique for Order Preference by Similarity to Ideal Solution) in determining quality, to help provide alternatives in m determine qualified corn plants. Based on the results of research conducted on 10 qualified corn alternatives that had been tested, a result is obtained: V1 = 0.577350 V2 = 0.474992 V3 = 0.510529 V4 = 0.463630 V5 = 0.609622 V6 = 0.435983 V7 = 0.533048 V8 = 0.373977 V9 = 0.530333 V10 = 0.448275 From the results it can be concluded that V5 = 0.609622 had fulfilled the requirements and can be said to be good qualified corn.***

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I. INTRODUCTION

Indonesia is a country with a very strategic geographical location, it is very beneficial for Indonesian citizen because almost all plants can be planted in Indonesia. Especially is corn crop, because corn plants have a very important role in order to increase the national food security in particular corn plant, corn has become a major commodity after Rice (Purwono et al., 2011). [1] For Indonesian people corn is a staple food ingredient. One of the areas that people consume corn as rice substitution is Sulawesi Tenggara. Planting with spacing aims to make the plant population to get the same parts of nutrients and sunlight. Planting distance is good used in the corn plant is 50 cm x 40 cm with 1 plant [2].

Qualified corn is one of the superior seeds, as for some kinds of superior corn one of them is hybrid corn, composite corn, corn that will be made as seedlings must be derived from the fertile corn and free of pests , corn derived from the fruit of corn must be dried from the tree, the corn whose flowers have been discarded, corn must also come from the corn that have big cogs, after that it can be said as good qualified corn, corn is a second important food ingredient after Rice. Besides being a staple food, corn is used for various kinds of processed including: vegetables, flour, ethanol, cooking oil, sugar, livestock feed, and industrial raw materials. [3]

Based on the previous research conducted by FridollinGratio. P. Raya Ola, (2013) stated that the data used in this research is primary data. Primary data obtained through field surveys. The results of previous research that the effect of planting distance to the production of corn 50x40 couldn't increase the production of corn cultivation, with the administration of 50x60 could give the best influence on the production of corn. [4] Based on previous research conducted by YudaPranata, HuripSantoso and Benjamin Widyamoko, obtained the results of research showing that the performance of corn products in Tanggamus District has not been efficient.[5]

The research is more interested to make observating using TOPSIS Method (Technique for Order Preference by Similarity to Ideal Solution) . Research further develops the existing problems and improve the system that is already running. Therefore, it requires special knowledge regarding corn quality, so it is needed a decision support system that is able to provide information and recommendations to the corn farmers about good qualified corn. Researchers will use the method TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) in designing a decision support system.

This research needs problem limitations to match with what is already planned so that this research objective could be achieved. The limitations of the problem discussed in this research was using TOPSIS method, data sample that conducted for this research derived from interview or dialog to corn farmer so it would be very easy to get Information directly from the corn farmer.

A. The Formulation of Problem

As for the formulation of problems in this research are as follows:

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a. How to design a corn plant development system using TOPSIS method ((*Technique for Order Preference by Similarity to Ideal Solution*)

b. How to conduct rank to score weight that taken from variables that already conducted with using a method so the decisions taken is objective

c. How this system give alternative options that can be reference for consumers in selection of superior and qualified corn.

B. Objective and Benefit

The objectives for this research were:

a. To make it easier for corn farmers to choose good and productive corn crop quality.

b. To Apply the TOPSIS (*Technique for Order Preference by Similarity to Ideal Solution*) method in the determining quality.

To provide an alternative in determining qualified corn plants.

II. THE FOUNDATION OF THEORY

A. Decision Support System

According to Ahmad Abdul Chamid (2016), Decision support System is an interactive computer-based information system, by processing data with various models to solve unstructured problems that can provide information to be used by the Decision makers in making a decision. In a decision support system, an intellectual resource owned by a person is combined with computer capabilities to help improve the quality of the decisions taken. Decision making is a process of selecting an action among several alternatives, so the expected goal can be achieved. [6]

B. Corn Corp

Corn is one of the grain crops of the herbaceous family. This plant is one of the important food crops, in addition to wheat and rice. The corn plants originated in America that spread to Asia and Africa through business activities of European people to America. Around the 16th century Portugal spread to Asia including Indonesia. [7]

C. Stages of Decisions Making

According to Zulkifli (2016)stages that must that must be passed through decisions making process as follows[8]:

1. Intelligence Stage

This stage is the search process and the approach of problem scope and problem recognition process. Input data is obtained, processed, tested to identify the problem.

2. Design Stage

This stage is the process of developing and seeking alternative actions or solutions that can be taken is a simplified representation of real events, so the validation and verification process is required to know the accuracy model in researching existing problems.

3. Selection Stage

This stage is conducted to various alternative solutions that are raised at planning phase to be determined or to concern with criteria based on the objectives.

4. Implementation Stage

This stage is applied to the design of systems that have been made in the planning and implementation of alternative actions that have been selected at the selection stage..

D. FMADM

Fuzzy Multiple Attribute Decision Making (FMADM) is a method that used to search alternative from some alternative with predefined criteria. The essence of the FMADM method is to determine the score of the weights for each attribute, so then ranking process will select specified alternative. There are basically three approaches to find the score of attribute weights namely the subjective approach, the objective approach, and the integration approach between subjective and objective. Each approach has its strengths and weaknesses.

There are several methods that can be used to solve FMADM problems namely:

a. Simple Additive Weighting Method (SAW)

b. Weighted Product (WP)

c. ELECTRE

d. Technique for Order preference any Similarity to Ideal Solution (TOPSIS)

e. Analytic Hierarchy Process (AHP).[9]

III. RESEARCH METHOD

A. Data Collection Stages

1) Observation Methods

At this stage of observation researchers conducted a direct observation about corn plantation in the Tanggamus District, then it was continued with the process of scoring of corn that became the object of research. From the observation results the researchers found some corn from the alternative corn that had been determined which can be categorized as the best corn, by comparing the score of each alternative corn.

2) Interview Method

In this stage, researchers performed an approach to the community, especially corn farmers, which are used as research objects to obtain a data or information needed to help determine the judgment of good qualified corn in accordance with predefined criteria. By way of interviewing or interviews which then the results gained will be compared with the score of each other alternative.

B. TOPSIS Method

According to Tri Susilowati (2018) , TOPSIS is one of the multi criteria or alternative choice decision making methods which is an alternative that has the smallest distance from the ideal positive solution and the largest distance from the ideal negative solution from a geometric point of view with using a distance of Euclidean. However, alternatives that have the smallest distance from an ideal positive solution, don't have to have the largest distance from the ideal negative solution. Therefore, TOPSIS consider both, the distance to ideal positive solution and the distance to the ideal negative

solution simultaneously. The optimal solution in the TOPSIS method is obtained by determining the relative proximity of an alternative to the ideal positive solution. TOPSIS will rank the alternative based on the relative proximity value priority of an alternative to the ideal positive solution. The alternatives that have been ranked are used as a reference for decision makers to choose the best solution that is desired. The TOPSIS method is one of the Fuzzy Multiple Attribute Decision Making (FMADM) Method which is a method used to find the optimal alternatives of a number of alternatives with certain criteria [10].

The stages of this TOPSIS method are as follows:

1. TOPSIS starts by building a decision matrix, the X decision matrix refers to the alternative which will be evaluated based on the criteria

$$x = \begin{pmatrix} A_1X_{11}X_{12}X_{12} \ldots . X_{1n} \\ A_2X_{11}X_{22}X_{23} \ldots . X_{2n} \\ A_3X_{31}X_{32}X_{33} \ldots . X_{3n} \\ A_mX_{m1}X_{m2}XX_{m3} \ldots . X_{mn} \end{pmatrix}$$

where A_i (i=1,2,3, ….m) is the possible alternative, X_j (j=1,2,3,….n) is attribute where an alternate performance is measured, X_{ij} is an alternate Ai performance with the reference to the X_j attribute.

2. Create normalized matrix decision

$$^{rij}\sqrt{\sum_{i=1}^{m} x^2 j}$$

with i= 1,2,…,m
j = 1,2,…,n
where,
r_{ij}= normalized matrix[i][j]
X_{ij}= decision matrix[i][j]

3. Create normalized, weighted matrix decision $V_{ij} = w_i r_{ij}$; with i= 1,2,…,m; and j = 1,2,…,n.
where,
V_{ij} = Elements of a weighted normalized decision matrix V
w_i = j^{th} criteria weight
r_{ij}= Normalized decision matrix elements R

4. Ideal positive solution A+ and ideal negative solution A- can be determined based on normalized weight rating (y_{ij}) as:

$$A^+ = \left(y_1^+, y_{2,\ldots,} y_n^+, \right);$$
$$A^- = \left(y_1^-, y_{2,\ldots,} y_n^-, \right);$$

where,
V_j^+ = max Y_{ij} j is benefit attribute Min Y_{ij} if j is cost attribute
V_j^-= min yij, if j is benefit attribute max yij, if j is cost attribute

5. Distance between Ai alternative and ideal positive solutions:

$$^{D\pm}\sqrt{\sum_{i-1}^{n} (Y_i^+ - Yij)\,2}$$

where,
D_i^+ = Distance between A_i alternative and ideal positive solutions
Y_j^+= Ideal positive solutions [i]
Y_{ij} = normalized matrix [i][j]
i = 1,2,…m
where,
D_i^- = Distance A_i alternative with ideal negative solutions
Y_j^-= ideal negative solution [i]
Yij = normalized matrix [i][j]

6. The preference score for each alternative (Vi) is given as:

$$V_i = \frac{D_i^-}{D_i^- + D_i^+}$$
i = 1,2,…m

Vi = Proximity of each alternative to the ideal solution
D_i^+ = Distance between Ai alternative and ideal positive solutions
D_i^- = Distance between Ai alternative and ideal negative solutions

A larger score of Vi indicates that an alternative Ai is preferred.

C. Criteria and Weight

In this research it needs the criteria that will be calculated in determining the best and qualified corn for the farmers so the higher water content the better the corn gained, the lower water content it will produce not good corn. The ranking table used for each criterion is as below table.

Table-I: Alternative score for every criterion.

Code criteria	*Criteria*	*Score*
C1	Water content	10%
C2	Deformed Corn seed	15%
C3	Corn waste	15%
C4	Corn color	15%
C5	Corn species	10%
C6	Number of grains	15%
C7	Corn Cob	20%
Total		100%

Table-II: Score

Score	*Description*
1	Very bad
2	Bad
3	Good enough
4	Good
5	Very good

Table-III: Deformed corn seed weight score(C2)

Deformed corn seed	*Score*	*Weight*
Because of disease	2	Bad
Because of worm	3	Good enough

Table –IV: Corn waste weight score(C3)

Corn waste	*Score*	*Weight*
Straw	3	Good enough
Cob	2	Bad
Klobot	4	Good
Corn skin	1	Very bad

Table-V: Corn color weight score (C4)

Corn color	*score*	*Weight*
Yellow	4	Good
Orange	5	Very good
White	2	Bad

Table-VI: Corn species weight score(C5)

Corn species	*score*	*Weight*
Sweet corn	3	Good enough
Pearl corn	2	Bad
Local corn	3	Good enough

Table-VII. Number of grains weight score (C6)

Number of Grains	*Score*	*Weight*
Per line/cob max 35 grains	4	Good
Per line/cob min 15-20 grains	3	Good enough
Per seed/cob 560 grains	4	Good

Table-VIII. Corn cob weight score (C7)

Corn cob	*score*	*weight*
Corn fruit	3	Good enough
Corn skin	2	Bad

D. Research Framework

Framework in this research explains about how to select or choose qualified corn for farmers using TOPSIS method. This identification conducted by assessment form then the data collection process, and then next process is selection of qualified corn support system. In designing the decision support system of this qualified corn, a first analysis is conducted as well as to collect data from the farmers so that we know that in the selection of this qualified corn there are criteria and weight score that can prove qualified corn. Fig. 1 shows the description using a flowchart.

1. In this research is conducted identification of the objects of some corn that will be used as a research object.
2. Determined the criteria according to the title of our research using the TOPSIS method.
3. To make it easier for us to do research that we are encouraged to collect data according to what we want to be thorough.
4. In this stage we have entered in the discussion where we calculate or determine the criteria of each alternative.
5. Perform calculation manually starting with the calculations via Ms. Excel to make it easier and for the results to be the same as the calculations we do manually.
6. After determining the calculation of criteria of each alternative of course we will be able to find the best results for qualified corn.
7. Once finished will be re-checked by trying or testing it.

IV. EXPLANATION

A. Manual Test

Alternative Table of all criteria is needed in the research obtained from the results of analysts of several alternates and existing criteria, so that it is obtained the matrix of the weighted decision to perform the calculation manually or computerized.

After the weights for the criteria obtained, the next process is carried out rank by using the TOPSIS method stages performed on the TOPSIS method are as follows:

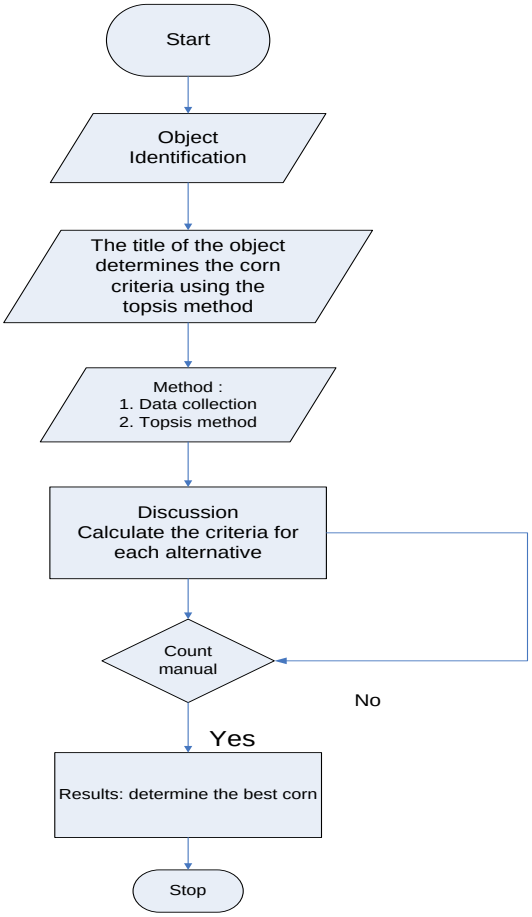

Fig 1. Flowchart Diagram

Table-IX: Decisions Matrix

Alternative	C1	C2	C3	C4	C5	C6	C7
A1	3	4	1	3	3	2	3
A2	3	3	1	4	3	1	2
A3	1	2	3	2	2	4	2
A4	1	1	3	3	1	2	3
A5	4	2	4	4	4	2	2
A6	3	2	4	1	1	2	2
A7	4	4	3	2	2	3	1
A8	2	1	2	2	1	1	3
A9	2	3	1	3	2	4	2
A10	2	2	3	2	3	2	2

. Create normalized matrix decision

$$(X_1) = \sqrt{3^2 + 3^2\ 1^2 + 1^2 + 4^2 + 3^2 + 4^2 + 2^2 + 2^2 + 2^2}$$
$$= 8{,}544003$$
$$r_{11} = \frac{X_{11}}{|X_1|} = \frac{3}{8{,}544003} = 0{,}351123$$
$$r_{21} = \frac{X_{21}}{|X_1|} = \frac{3}{8{,}544003} = 0{,}351123$$

$$r_{31} = \frac{X_{31}}{|X_1|} = \frac{1}{8,544003} = 0,117041$$
$$r_{41} = \frac{X_{41}}{|X_1|} = \frac{1}{8,544003} = 0,117041$$
$$r_{51} = \frac{X_{51}}{|X_1|} = \frac{4}{8,544003} = 0,351123$$
$$r_{61} = \frac{X_{61}}{|X_1|} = \frac{3}{8,544003} = 0,351123$$
$$r_{71} = \frac{X_{71}}{|X_1|} = \frac{4}{8,544003} = 0,468164$$
$$r_{81} = \frac{X_{81}}{|X_1|} = \frac{2}{8,544003} = 0,234082$$
$$r_{91} = \frac{X_{91}}{|X_1|} = \frac{2}{8,544003} = 0,234082$$
$$r_{101} = \frac{X_{10}}{|X_1|} = \frac{2}{8,544003} = 0,234082$$

$$(X_2) = \sqrt{4^2 + 3^2 + 2^2 + 1^2 + 2^2 + 2^2 + 4^2 + 1^2 + 3^2 + 2^2}$$
$$= 8,246211$$

$$r_{12} = \frac{X_{12}}{|X_2|} = \frac{4}{8,246211} = 0,485071$$
$$r_{22} = \frac{X_{22}}{|X_2|} = \frac{3}{8,246211} = 0,363803$$
$$r_{32} = \frac{X_{32}}{|X_2|} = \frac{2}{8,246211} = 0,242535$$
$$r_{42} = \frac{X_{42}}{|X_2|} = \frac{1}{8,246211} = 0,121267$$
$$r_{52} = \frac{X_{52}}{|X_2|} = \frac{2}{8,246211} = 0,242535$$
$$r_{62} = \frac{X_{62}}{|X_2|} = \frac{2}{8,246211} = 0,242535$$
$$r_{72} = \frac{X_{72}}{|X_2|} = \frac{4}{8,246211} = 0,485071$$
$$r_{82} = \frac{X_{82}}{|X_2|} = \frac{1}{8,246211} = 0,121267$$
$$r_{92} = \frac{X_{92}}{|X_2|} = \frac{3}{8,246211} = 0,363803$$
$$r_{102} = \frac{X_{102}}{|X_2|} = \frac{2}{8,246211} = 0,242535$$

$$(X_3) = \sqrt{1^2 + 1^2\ 3^2 + 3^2 + 4^2 + 4^2 + 3^2 + 2^2 + 1^2 + 3^2}$$
$$= 8,660254$$

$$r_{13} = \frac{X_{13}}{|X_3|} = \frac{1}{8,660254} = 0,115470$$
$$r_{23} = \frac{X_{23}}{|X_3|} = \frac{1}{8,660254} = 0,115470$$
$$r_{33} = \frac{X_{33}}{|X_3|} = \frac{3}{8,660254} = 0,346410$$
$$r_{43} = \frac{X_{43}}{|X_3|} = \frac{3}{8,660254} = 0,346410$$
$$r_{53} = \frac{X_{53}}{|X_3|} = \frac{4}{8,660254} = 0,461880$$
$$r_{63} = \frac{X_{63}}{|X_3|} = \frac{4}{8,660254} = 0,461880$$
$$r_{73} = \frac{X_{73}}{|X_3|} = \frac{3}{8,660254} = 0,346410$$
$$r_{83} = \frac{X_{83}}{|X_3|} = \frac{2}{8,660254} = 0,230940$$
$$r_{93} = \frac{X_{93}}{|X_3|} = \frac{1}{8,660254} = 0,115470$$
$$r_{103} = \frac{X_{103}}{|X_3|} = \frac{3}{8,660254} = 0,346410$$

$$(X_4) = \sqrt{3^2 + 4^2\ 2^2 + 3^2 + 4^2 + 1^2 + 2^2 + 2^2 + 3^2 + 2^2}$$
$$= 8,717797$$

$$r_{14} = \frac{X_{14}}{|X_4|} = \frac{3}{8,717797} = 0,344123$$
$$r_{24} = \frac{X_{24}}{|X_4|} = \frac{4}{8,717797} = 0,458831$$
$$r_{34} = \frac{X_{34}}{|X_4|} = \frac{2}{8,717797} = 0,229415$$
$$r_{44} = \frac{X_{44}}{|X_4|} = \frac{3}{8,717797} = 0,344123$$
$$r_{54} = \frac{X_{54}}{|X_4|} = \frac{4}{8,717797} = 0,458831$$
$$r_{64} = \frac{X_{64}}{|X_4|} = \frac{1}{8,717797} = 0,114707$$
$$r_{74} = \frac{X_{74}}{|X_4|} = \frac{2}{8,717797} = 0,229415$$
$$r_{84} = \frac{X_{84}}{|X_4|} = \frac{2}{8,717797} = 0,229415$$
$$r_{94} = \frac{X_{94}}{|X_4|} = \frac{3}{8,717797} = 0,344123$$
$$r_{104} = \frac{X_{104}}{|X_4|} = \frac{2}{8,717797} = 0,229415$$

$$(X_5) = \sqrt{3^2 + 3^2\ 2^2 + 1^2 + 4^2 + 1^2 + 2^2 + 1^2 + 2^2 + 3^2}$$
$$= 7,615773$$

$$r_{15} = \frac{X_{15}}{|X_5|} = \frac{3}{7,615773} = 0,393919$$
$$r_{25} = \frac{X_{25}}{|X_5|} = \frac{3}{7,615773} = 0,393919$$
$$r_{35} = \frac{X_{35}}{|X_5|} = \frac{2}{7,615773} = 0,262612$$
$$r_{45} = \frac{X_{45}}{|X_5|} = \frac{1}{7,615773} = 0,131306$$
$$r_{55} = \frac{X_{55}}{|X_5|} = \frac{4}{7,615773} = 0,525225$$
$$r_{65} = \frac{X_{65}}{|X_5|} = \frac{1}{7,615773} = 0,131306$$
$$r_{75} = \frac{X_{75}}{|X_5|} = \frac{2}{7,615773} = 0,262612$$
$$r_{85} = \frac{X_{85}}{|X_5|} = \frac{1}{7,615773} = 0,131306$$
$$r_{95} = \frac{X_{95}}{|X_5|} = \frac{2}{7,615773} = 0,262612$$
$$r_{105} = \frac{X_{105}}{|X_5|} = \frac{3}{7,615773} = 0,393919$$

$$(X_6) = \sqrt{2^2 + 1^2\ 4^2 + 2^2 + 2^2 + 2^2 + 3^2 + 1^2 + 4^2 + 2^2}$$
$$= 7,937253$$

$$r_{16} = \frac{X_{16}}{|X_6|} = \frac{2}{7,937253} = 0,251976$$
$$r_{26} = \frac{X_{26}}{|X_6|} = \frac{1}{7,937253} = 0,125988$$
$$r_{36} = \frac{X_{36}}{|X_6|} = \frac{4}{7,937253} = 0,503953$$
$$r_{46} = \frac{X_{46}}{|X_6|} = \frac{2}{7,937253} = 0,251976$$
$$r_{56} = \frac{X_{56}}{|X_6|} = \frac{2}{7,937253} = 0,251976$$
$$r_{66} = \frac{X_{66}}{|X_6|} = \frac{2}{7,937253} = 0,251976$$
$$r_{76} = \frac{X_{76}}{|X_6|} = \frac{3}{7,937253} = 0,377964$$
$$r_{86} = \frac{X_{86}}{|X_6|} = \frac{1}{7,937253} = 0,125988$$
$$r_{96} = \frac{X_{96}}{|X_6|} = \frac{4}{7,937253} = 0,503953$$
$$r_{106} = \frac{X_{106}}{|X_6|} = \frac{2}{7,937253} = 0,251976$$

$$(X_7) = \sqrt{3^2 + 2^2\ 2^2 + 3^2 + 2^2 + 2^2 + 1^2 + 3^2 + 2^2 + 2^2}$$
$$= 7,211102$$

$$r_{17} = \frac{X_{17}}{|X_7|} = \frac{3}{7,211102} = 0,416025$$
$$r_{27} = \frac{X_{27}}{|X_7|} = \frac{2}{7,211102} = 0,277350$$
$$r_{37} = \frac{X_{37}}{|X_7|} = \frac{2}{7,211102} = 0,277350$$
$$r_{47} = \frac{X_{47}}{|X_7|} = \frac{3}{7,211102} = 0,416025$$
$$r_{57} = \frac{X_{57}}{|X_7|} = \frac{2}{7,211102} = 0,277350$$
$$r_{67} = \frac{X_{67}}{|X_7|} = \frac{2}{7,211102} = 0,277350$$
$$r_{77} = \frac{X_{77}}{|X_7|} = \frac{1}{7,211102} = 0,138675$$
$$r_{87} = \frac{X_{87}}{|X_7|} = \frac{3}{7,211102} = 0,416025$$
$$r_{97} = \frac{X_{97}}{|X_7|} = \frac{2}{7,211102} = 0,277350$$
$$r_{107} = \frac{X_{107}}{|X_7|} = \frac{2}{7,211102} = 0,277350$$

From calculation results above obtained normalized matrix (R):

$$R = \begin{pmatrix} 0{,}351123 & 0{,}485071 & 0{,}115470 & 0{,}344123 & 0{,}393919 \\ 0{,}351123 & 0{,}363803 & 0{,}115470 & 0{,}458831 & 0{,}393919 \\ 0{,}117041 & 0{,}242536 & 0{,}346410 & 0{,}229415 & 0{,}262612 \\ 0{,}117041 & 0{,}121268 & 0{,}346410 & 0{,}344123 & 0{,}131306 \\ 0{,}351123 & 0{,}242536 & 0{,}461880 & 0{,}458831 & 0{,}525225 \\ 0{,}351123 & 0{,}242535 & 0{,}461880 & 0{,}114707 & 0{,}131306 \\ 0{,}468165 & 0{,}485071 & 0{,}346410 & 0{,}229415 & 0{,}262612 \\ 0{,}234082 & 0{,}121267 & 0{,}230940 & 0{,}229415 & 0{,}131306 \\ 0{,}234082 & 0{,}363803 & 0{,}115470 & 0{,}344123 & 0{,}262612 \\ 0{,}234082 & 0{,}242535 & 0{,}346410 & 0{,}229415 & 0{,}393919 \end{pmatrix}$$

$$R = \begin{pmatrix} 0{,}351123 & 0{,}485071 & 0{,}115470 & 0{,}344123 & 0{,}393919 \\ 0{,}351123 & 0{,}363803 & 0{,}115470 & 0{,}458831 & 0{,}393919 \\ 0{,}117041 & 0{,}242536 & 0{,}346410 & 0{,}229415 & 0{,}262612 \\ 0{,}117041 & 0{,}121268 & 0{,}346410 & 0{,}344123 & 0{,}131306 \\ 0{,}351123 & 0{,}242536 & 0{,}461880 & 0{,}458831 & 0{,}525225 \\ 0{,}351123 & 0{,}242535 & 0{,}461880 & 0{,}114707 & 0{,}131306 \\ 0{,}468165 & 0{,}485071 & 0{,}346410 & 0{,}229415 & 0{,}262612 \\ 0{,}234082 & 0{,}121267 & 0{,}230940 & 0{,}229415 & 0{,}131306 \\ 0{,}234082 & 0{,}363803 & 0{,}115470 & 0{,}344123 & 0{,}262612 \\ 0{,}234082 & 0{,}242535 & 0{,}346410 & 0{,}229415 & 0{,}393919 \end{pmatrix}$$

After obtained normalized matrix (R), then calculate V matrix based on equation:

$$V_{IJ} = W_J X_{IJ}$$

$V_1 = W_1 R_{11}$ = (0,1)(0,351123) = 0,035112

$V_{12} = W_2 R_{12}$ = (0,15)(0,485071) = 0,072761

$V_{I3} = W_3 R_{13}$ = (0,15)(0,115470) = 0,017321

$V_{14} = W_4 R_{14}$ = (0,15)(0,344123) = 0,051619

$V_{I5} = W_5 R_{15}$ = (0,1)(0,393919) = 0,039392

$V_{I6} = W_6 R_{16}$ = (0,15)(0,251976) = 0,037796

$V_{I7} = W_7 R_{17}$ = (0,20)(0,416025) = 0,083205

$V_{21} = W_1 R_{21}$ = (0,1)(0,351123) = 0,035112

$V_{22} = W_2 R_{22}$ = (0,15)(0,363803) = 0,054570

$V_{23} = W_3 R_{23}$ = (0,15)(0,115470) = 0,0173205

$V_{24} = W_4 R_{24}$ = (0,15)(0,458831) = 0,068824

$V_{25} = W_5 R_{25}$ = (0,1)(0,393919) = 0,393919

$V_{26} = W_6 R_{27}$ = (0,15)(0,125988) = 0,018898

$V_{27} = W_7 R_{27}$ = (0,20)(0,277350) = 0,055470

$V_{31} = W_1 R_{31}$ = (0,1)(0,117041) = 0,011704

$V_{32} = W_2 R_{31}$ = (0,15)(0,242535) = 0,036380

$V_{33} = W_3 R_{33}$ = (0,15)(0,346410) = 0,051961

$V_{34} = W_4 R_{34}$ = (0,15)(0,229415) = 0,034412

$V_{35} = W_5 R_{35}$ = (0,1)(0,262612) = 0,262612

$V_{36} = W_6 R_{36}$ = (0,15)(0,503953) = 0,075593

$V_{37} = W_7 R_{37}$ = (0,20)(0,277350) = 0,055470

$V_{41} = W_1 R_{I41}$ = (0,1)(0,117041) = 0,0117041

$V_{42} = W_2 R_{42}$ = (0,15)(0,121267) = 0,018190

$V_{43} = W_3 R_{43}$ = (0,15)(0,346410) = 0,051961

$V_{44} = W_4 R_{44}$ = (0,15)(0,344123) = 0,051618

$V_{45} = W_5 R_{45}$ = (0,1)(0,131306) = 0,131306

$V_{46} = W_6 R_{46}$ = (0,15)(0,251976) = 0,037796

$V_{47} = W_7 R_{47}$ = (0,20)(0,416025) = 0,083205

$V_{51} = W_1 R_{51}$ = (0,1)(0,468164) = 0,046816

$V_{52} = W_2 R_{52}$ = (0,15)(0,242535) = 0,036380

$V_{53} = W_3 R_{53}$ = (0,15)(0,461880) = 0,069282

$V_{54} = W_4 R_{54}$ = (0,15)(0,458831) = 0,068824

$V_{55} = W_5 R_{55}$ = (0,1)(0,525225) = 0052525

$V_{56} = W_6 R_{56}$ = (0,15)(0,251976) = 0,037796

$V_{57} = W_7 R_{57}$ = (0,20)(0,277350) = 0,055470

$V_{61} = W_1 R_{61}$ = (0,1)(0,351123) = 0,035112

$V_{62} = W_2 R_{62}$ = (0,15)(0,242535) = 0,036380

$V_{63} = W_3 R_{63}$ = (0,15)(0,461880) = 0,069282

$V_{64} = W_4 R_{64}$ = (0,15)(0,114707) = 0,017206

$V_{65} = W_5 R_{65}$ = (0,1)(0,131306) = 0,013130

$V_{66} = W_6 R_{66}$ = (0,15)(0,251976) = 0,037796

$V_{67} = W_7 R_{67}$ = (0,20)(0,277350) = 0,055470

$V_{71} = W_1 R_{71}$ = (0,1)(0,468164) = 0,046816

$V_{72} = W_2 R_{72}$ = (0,15)(0,485071) = 0,072760

$V_{73} = W_3 R_{73}$ = (0,15)(0,346410) = 0,051961

$V_{74} = W_4 R_{74}$ = (0,15)(0,229415) = 0,034412

$V_{75} = W_5 R_{75}$ = (0,1)(0,262612) = 0,026261

$V_{76} = W_6 R_{76}$ = (0,15)(0,377964) = 0,056695

$V_{77} = W_7 R_{77}$ = (0,20)(0,138675) = 0,027735

$V_{81} = W_1 R_{81}$ = (0,1)(0,234082)
= 0,023408

$V_{82} = W_2 R_{82}$ = (0,15)(0,121267)
= 0,018190

$V_{83} = W_3 R_{83}$ = (0,15)(0,230940)
= 0,034641

$V_{84} = W_4 R_{84}$ = (0,15)(0,229415)
= 0,034412

$V_{85} = W_5 R_{85}$ = (0,1)(0,131306)
= 0,013130

$V_{86} = W_6 R_{86}$ = (0,15)(0,125988)
= 0,018898

$V_{87} = W_7 R_{87}$ = (0,20)(0,416025)
= 0,083205

$V_{91} = W_1 R_{91}$ = (0,1)(0,234082)
= 0,023408

$V_{92} = W_2 R_{92}$ = (0,15)(0,363803)
= 0,054570

$V_{93} = W_3 R_{93}$ = (0,15)(0,115470)
= 0,017320

$V_{94} = W_4 R_{94}$ = (0,15)(0,344123)
= 0,051618

$V_{95} = W_5 R_{95}$ = (0,1)(0,262612)
= 0,026261

$V_{96} = W_6 R_{96}$ = (0,15)(0,503935)
= 0,075591

$V_{97} = W_7 R_{97}$ = (0,20)(0,277350)
= 0,055470

$V_{101} = W_1 R_{101}$ = (0,1)(0,234082)
= 0,0234082

$V_{102} = W_2 R_{102}$ = (0,15)(0,242535)
= 0,036380

$V_{103} = W_3 R_{103}$ = (0,15)(0,346410)
= 0,051961

$V_{104} = W_4 R_{104}$ = (0,15)(0,229415)
= 0,034412

$V_{105} = W_5 R_{105}$ = (0,1)(0,393919)
= 0,039393

$V_{106} = W_6 R_{106}$ = (0,15)(0,251976)
= 0,037796

$V_{107} = W_7 R_{107}$ = (0,20)(0,277350)
= 0,055470

From calculation above, obtained matrix Y

$$Y = \begin{pmatrix} 0{,}035112 & 0{,}072761 & 0{,}017321 & 0{,}051619 & 0{,}039392 \\ 0{,}035112 & 0{,}054571 & 0{,}017321 & 0{,}068825 & 0{,}039392 \\ 0{,}011704 & 0{,}036380 & 0{,}051962 & 0{,}034412 & 0{,}026261 \\ 0{,}011704 & 0{,}018190 & 0{,}051962 & 0{,}051619 & 0{,}013131 \\ 0{,}035112 & 0{,}036380 & 0{,}069282 & 0{,}068825 & 0{,}052523 \\ 0{,}035112 & 0{,}036380 & 0{,}069282 & 0{,}017206 & 0{,}013131 \\ 0{,}046816 & 0{,}072761 & 0{,}051962 & 0{,}034412 & 0{,}026261 \\ 0{,}023408 & 0{,}018190 & 0{,}034641 & 0{,}034412 & 0{,}013131 \\ 0{,}023408 & 0{,}054571 & 0{,}017321 & 0{,}051619 & 0{,}026261 \\ 0{,}023408 & 0{,}036380 & 0{,}051962 & 0{,}034412 & 0{,}039392 \end{pmatrix} \begin{pmatrix} 0{,}037796 & 0{,}083205 \\ 0{,}018898 & 0{,}055470 \\ 0{,}075593 & 0{,}055470 \\ 0{,}037796 & 0{,}083205 \\ 0{,}037796 & 0{,}055470 \\ 0{,}037796 & 0{,}055470 \\ 0{,}056695 & 0{,}027735 \\ 0{,}018898 & 0{,}083205 \\ 0{,}075593 & 0{,}055470 \\ 0{,}037796 & 0{,}055470 \end{pmatrix}$$

Ideal positive solution calculated based on equation:

$$A^+ = (y_1^+, y_2^+ \dots y_n^+)$$

$$y_1^+ = max \begin{Bmatrix} 0{,}035112; 0{,}035112; 0{,}011704; 0{,}011704; \\ 0{,}035112; 0{,}035112; 0{,}046816; 0{,}023408; \\ 0{,}023408; 0{,}023408 \end{Bmatrix}$$
=0,046816

$$y_2^+ = max \begin{Bmatrix} 0{,}072761; 0{,}054570; 0{,}036380; 0{,}018190; \\ 0{,}036380; 0{,}036380; 0{,}072760; 0{,}018190; \\ 0{,}054570; 0{,}036380 \end{Bmatrix}$$
= 0,072761

$$y_3^+ = max \begin{Bmatrix} 0{,}017330; 0{,}017320; 0{,}051961; 0{,}051961; \\ 0{,}069282; 0{,}069282; 0{,}051961; 0{,}034641; \\ 0{,}017320; 0{,}051961 \end{Bmatrix}$$
= 0,069282

$$y_4^+ = max \begin{Bmatrix} 0{,}051634; 0{,}068825; 0{,}034412; 0{,}051618; \\ 0{,}068825; 0{,}017206; 0{,}034412; 0{,}034412; \\ 0{,}051618; 0{,}034412 \end{Bmatrix}$$
= 0,068825

$$y_5^+ = max \begin{Bmatrix} 0{,}039392; 0{,}039392; 0{,}026261; 0{,}013131; \\ 0{,}052523; 0{,}013131; 0{,}026261; 0{,}013131; \\ 0{,}026261; 0{,}039392 \end{Bmatrix}$$
= 0,052523

$$y_6^+ = max \begin{Bmatrix} 0{,}037796; 0{,}018898; 0{,}075593; 0{,}037796; \\ 0{,}037796; 0{,}037796; 0{,}056695; 0{,}018898; \\ 0{,}075593; 0{,}037796 \end{Bmatrix}$$
= 0,075593

$$y_7^+ = max \begin{Bmatrix} 0{,}083205; 0{,}055470; 0{,}055470; 0{,}083205; \\ 0{,}055470; 0{,}055470; 0{,}027735; 0{,}083205; \\ 0{,}055470; 0{,}055470 \end{Bmatrix}$$
= 0,083205

$A^+ = (0{,}046816; 0{,}072761; 0{,}069282; 0{,}068825; 0{,}052523; 0{,}075593; 0{,}083205)$

Negative ideal solution calculated based on equation:

$$A^- = (y_1^-, y_2^- \dots y_n^-)$$

$$y_1^- = min \begin{Bmatrix} 0{,}035112; 0{,}035112; 0{,}011704; 0{,}011703; \\ 0{,}035112; 0{,}035112; 0{,}046816; 0{,}023408; \\ 0{,}023408; 0{,}023408 \end{Bmatrix}$$
= 0,011704

$$y_2^- = min \begin{Bmatrix} 0{,}072760; 0{,}054570; 0{,}036380; 0{,}018190; \\ 0{,}036380; 0{,}036380; 0{,}072760; 0{,}018190; \\ 0{,}054570; 0{,}036380 \end{Bmatrix}$$
= 0,018190

$$y_3^- = min \begin{Bmatrix} 0{,}017330; 0{,}017320; 0{,}051961; 0{,}051961; \\ 0{,}069282; 0{,}069282; 0{,}051961; 0{,}034641; \\ 0{,}017320; 0{,}051961 \end{Bmatrix}$$
= 0,017320

$$y_4^- = min \begin{Bmatrix} 0{,}051634; 0{,}068824; 0{,}034412; 0{,}051618; \\ 0{,}068824; 0{,}017206; 0{,}034412; 0{,}034412; \\ 0{,}051618; 0{,}034412 \end{Bmatrix}$$
= 0,017206

$$y_5^- = min$$

$$\begin{Bmatrix}0{,}039392; 0{,}039392; 0{,}026261; 0{,}013131;\\ 0{,}052523; 0{,}013131; 0{,}026261; 0{,}013131;\\ 0{,}026261; 0{,}039392\end{Bmatrix}$$
$$= 0{,}013131$$
$$y_6^- = min$$
$$\begin{Bmatrix}0{,}037796; 0{,}018898; 0{,}075593; 0{,}037796;\\ 0{,}037796; 0{,}037796; 0{,}056695; 0{,}018898;\\ 0{,}075593; 0{,}037796\end{Bmatrix}$$
$$= 0{,}018898$$
$$y_7^- = max$$
$$\begin{Bmatrix}0{,}083205; 0{,}055470; 0{,}055470; 0{,}083205;\\ 0{,}055470; 0{,}055470; 0{,}027735; 0{,}083205;\\ 0{,}055470; 0{,}055470\end{Bmatrix}$$
$$=0{,}027735$$
$$A^- = (0{,}011704; 0{,}018190; 0{,}017321; 0{,}017206; 0{,}013131; 0{,}018898; 0{,}027735)$$

Alternative distance Ai with positive ideal solution:

$$D1^+ = \sqrt{\begin{matrix}(0{,}035112-0{,}046816)^2+(0{,}072761-0{,}072761)^2\\(0{,}017321-0{,}069282)^2+(0{,}051619-0{,}068825)^2\\(0{,}039392-0{,}052523)^2+(0{,}037796-0{,}075593)^2\\(0{,}083205-0{,}083205)^2\end{matrix}}$$
$$= 0{,}004734$$
$$D2^+ = \sqrt{\begin{matrix}(0{,}035112-0{,}046816)^2+(0{,}054571-0{,}072761)^2\\(0{,}017321-0{,}069282)^2+(0{,}068825-0{,}068825)^2\\(0{,}039392-0{,}052523)^2+(0{,}018898-0{,}075593)^2\\(0{,}055470-0{,}083205)^2\end{matrix}}$$
$$= 0{,}007324$$
$$D3^+ = \sqrt{\begin{matrix}(0{,}011704-0{,}046816)^2+(0{,}036380-0{,}072761)^2\\(0{,}051962-0{,}069282)^2+(0{,}034412-0{,}068825)^2\\(0{,}026261-0{,}052523)^2+(0{,}075593-0{,}075593)^2\\(0{,}055470-0{,}083205)^2\end{matrix}}$$
$$= 0{,}0055$$
$$D4^+ = \sqrt{\begin{matrix}(0{,}011704-0{,}046816)^2+(0{,}018190-0{,}072761)^2\\(0{,}051962-0{,}069282)^2+(0{,}051619-0{,}068825)^2\\(0{,}013131-0{,}052523)^2+(0{,}037796-0{,}075593)^2\\(0{,}083205-0{,}083205)^2\end{matrix}}$$
$$= 0{,}007787$$
$$D5^+ = \sqrt{\begin{matrix}(0{,}046816-0{,}046816)^2+(0{,}036380-0{,}072761)^2\\(0{,}069282-0{,}069282)^2+(0{,}068825-0{,}068825)^2\\(0{,}052523-0{,}052523)^2+(0{,}037796-0{,}075593)^2\\(0{,}055470-0{,}083205)^2\end{matrix}}$$
$$= 0{,}003658$$
$$D6^+ = \sqrt{\begin{matrix}(0{,}035112-0{,}046816)^2+(0{,}036380-0{,}072761)^2\\(0{,}069282-0{,}069282)^2+(0{,}017206-0{,}068825)^2\\(0{,}013131-0{,}052523)^2+(0{,}037796-0{,}075593)^2\\(0{,}055470-0{,}083205)^2\end{matrix}}$$
$$= 0{,}007875$$
$$D7^+ = \sqrt{\begin{matrix}(0{,}046816-0{,}046816)^2+(0{,}072761-0{,}072761)^2\\(0{,}051962-0{,}069282)^2+(0{,}034412-0{,}068825)^2\\(0{,}026261-0{,}052523)^2+(0{,}056695-0{,}075593)^2\\(0{,}027735-0{,}083205)^2\end{matrix}}$$
$$= 0{,}005608$$
$$D8^+ = \sqrt{\begin{matrix}(0{,}023408-0{,}046816)^2+(0{,}018190-0{,}072761)^2\\(0{,}034641-0{,}069282)^2+(0{,}034412-0{,}068825)^2\\(0{,}013131-0{,}052523)^2+(0{,}018898-0{,}075593)^2\\(0{,}083205-0{,}083205)^2\end{matrix}}$$
$$= 0{,}010676$$
$$D9^+ = \sqrt{\begin{matrix}(0{,}023408-0{,}046816)^2+(0{,}055471-0{,}072761)^2\\(0{,}017321-0{,}069282)^2+(0{,}051619-0{,}068825)^2\\(0{,}026261-0{,}052523)^2+(0{,}075593-0{,}075593)^2\\(0{,}055470-0{,}083205)^2\end{matrix}}$$
$$= 0{,}005354$$
$$D10^+ = \sqrt{\begin{matrix}(0{,}023408-0{,}046816)^2+(0{,}036380-0{,}072761)^2\\(0{,}051962-0{,}069282)^2+(0{,}034412-0{,}068825)^2\\(0{,}039392-0{,}052523)^2+(0{,}037796-0{,}075593)^2\\(0{,}055470-0{,}083205)^2\end{matrix}}$$
$$= 0{,}005726$$

Alternative distance Ai with negative ideal solution:

$$D1^- = \sqrt{\begin{matrix}(0{,}035112-0{,}011704)^2+(0{,}072760-0{,}018190)^2\\(0{,}017321-0{,}017320)^2+(0{,}051619-0{,}017206)^2\\(0{,}039392-0{,}013131)^2+(0{,}037796-0{,}018898)^2\\(0{,}083205-0{,}027735)^2\end{matrix}}$$
$$= 0{,}008834$$
$$D2^- = \sqrt{\begin{matrix}(0{,}035112-0{,}011704)^2+(0{,}054571-0{,}018190)^2\\(0{,}017321-0{,}017320)^2+(0{,}068825-0{,}017206)^2\\(0{,}039392-0{,}013131)^2+(0{,}018898-0{,}018898)^2\\(0{,}055470-0{,}027735)^2\end{matrix}}$$
$$= 0{,}005995$$
$$D3^- = \sqrt{\begin{matrix}(0{,}011704-0{,}011704)^2+(0{,}036380-0{,}018190)^2\\(0{,}051962-0{,}017370)^2+(0{,}034412-0{,}017206)^2\\(0{,}026261-0{,}013131)^2+(0{,}075593-0{,}018898)^2\\(0{,}055470-0{,}027735)^2\end{matrix}}$$
$$= 0{,}005983$$
$$D4^- = \sqrt{\begin{matrix}(0{,}011704-0{,}011704)^2+(0{,}018190-0{,}018190)^2\\(0{,}051962-0{,}017370)^2+(0{,}051619-0{,}017206)^2\\(0{,}013131-0{,}013131)^2+(0{,}037796-0{,}018898)^2\\(0{,}083205-0{,}027735)^2\end{matrix}}$$
$$= 0{,}005818$$

$$D5^- = \sqrt{\begin{matrix}(0{,}046816-0{,}011704)^2+(0{,}036380-0{,}018190)^2\\(0{,}069282-0{,}017370)^2+(0{,}068825-0{,}017206)^2\\(0{,}052523-0{,}013131)^2+(0{,}037796-0{,}018898)^2\\(0{,}055470-0{,}027735)^2\end{matrix}} = 0{,}008921$$

$$D6^- = \sqrt{\begin{matrix}(0{,}035112-0{,}011704)^2+(0{,}036380-0{,}018190)^2\\(0{,}069282-0{,}017370)^2+(0{,}017206-0{,}017206)^2\\(0{,}013131-0{,}013131)^2+(0{,}037796-0{,}018898)^2\\(0{,}055470-0{,}027735)^2\end{matrix}} = 0{,}004705$$

$$D7^- = \sqrt{\begin{matrix}(0{,}046816-0{,}011704)^2+(0{,}072761-0{,}018190)^2\\(0{,}051962-0{,}017320)^2+(0{,}034412-0{,}017206)^2\\(0{,}026261-0{,}013131)^2+(0{,}056695-0{,}018898)^2\\(0{,}027735-0{,}027735)^2\end{matrix}} = 0{,}0073080$$

$$D8^- = \sqrt{\begin{matrix}(0{,}023408-0{,}011704)^2+(0{,}018190-0{,}018190)^2\\(0{,}034641-0{,}017320)^2+(0{,}034412-0{,}017206)^2\\(0{,}013131-0{,}013131)^2+(0{,}018898-0{,}018898)^2\\(0{,}083205-0{,}027735)^2\end{matrix}} = 0{,}003810$$

$$D9^- = \sqrt{\begin{matrix}(0{,}023408-0{,}011704)^2+(0{,}055471-0{,}018190)^2\\(0{,}017321-0{,}017320)^2+(0{,}051619-0{,}017206)^2\\(0{,}026261-0{,}013131)^2+(0{,}075593-0{,}018898)^2\\(0{,}055470-0{,}027735)^2\end{matrix}} = 0{,}006801$$

$$D10^- = \sqrt{\begin{matrix}(0{,}023408-0{,}011704)^2+(0{,}036380-0{,}018190)^2\\(0{,}051962-0{,}017320)^2+(0{,}034412-0{,}017206)^2\\(0{,}039392-0{,}013131)^2+(0{,}037796-0{,}018898)^2\\(0{,}055470-0{,}027735)^2\end{matrix}} = 0{,}00378$$

Determine preference score for each alternative:

$$Vi = \frac{D_I^-}{D_I^- + D_I^+}$$

$$V1 = \frac{0{,}008834}{0{,}008834+0{,}004734} = 0{,}577350$$

$$V2 = \frac{0{,}005995}{0{,}005995+0{,}007324} = 0{,}474992$$

$$V3 = \frac{0{,}005983}{0{,}005983+0{,}005500} = 0{,}510529$$

$$V4 = \frac{0{,}005818}{0{,}005818+0{,}007787} = 0{,}463630$$

$$V5 = \frac{0{,}008921}{0{,}008921+0{,}003658} = 0{,}609622$$

$$V6 = \frac{0{,}004705}{0{,}004705+0{,}007875} = 0{,}435983$$

$$V7 = \frac{0{,}007308}{0{,}007308+0{,}005608} = 0{,}533048$$

$$V8 = \frac{0{,}003810}{0{,}003810+0{,}010676} = 0{,}373977$$

$$V9 = \frac{0{,}006801}{0{,}006801+0{,}005354} = 0{,}530333$$

$$V10 = \frac{0{,}003780}{0{,}003780+0{,}005726} = 0{,}448275$$

From the result of V score obtained V5 = score 0,609622 with criteria (4, 2, 4, 4, 4, 2, 2) had the largest score and was the best solution to choose good qualified corn.

B. IMPLEMENTATION

Decision support system application determined good qualified corn with using Microsoft Excel as follows:

1. Alternatives and criteria from run system.

	C1	C2	C3	C4	C5	C6	C7
A1	3	4	1	3	3	2	3
A2	3	3	1	4	3	1	2
A3	1	2	3	2	2	4	2
A4	1	1	3	3	1	2	3
A5	4	2	4	4	4	2	2
A6	3	2	4	1	1	2	2
A7	4	4	3	2	2	3	1
A8	2	1	2	2	1	1	3
A9	2	3	1	3	2	4	2
A10	2	2	3	2	3	2	2

Fig. 2. Alternatives and criteria

2. Calculate normalized matrix decision (R)

	C1	C2	C3	C4	C5	C6	C7	AKAR
A1	3	4	1	3	3	2	3	2
A2	3	3	1	4	3	1	2	2
A3	1	2	3	2	2	4	2	2
A4	1	1	3	3	1	2	3	2
A5	4	2	4	4	4	2	2	2
A6	3	2	4	1	1	2	2	2
A7	4	4	3	2	2	3	1	2
A8	2	1	2	2	1	1	3	2
A9	2	3	1	3	2	4	2	2
A10	2	2	3	2	3	2	2	2
KUADRAT	73	68	75	76	58	63	52	
AKAR	8.544004	8.246211	8.660254	8.717798	7.615773	7.937254	7.211103	

Fig. 3. Matrix process

3. Normalize matrix results

	X1	X2	X3	X4	X5	X6	X7
X1	0.351123	0.485071	0.11547	0.344124	0.393919	0.251976	0.416025
X2	0.351123	0.363803	0.11547	0.458831	0.393919	0.125988	0.27735
X3	0.117041	0.242536	0.34641	0.229416	0.262613	0.503953	0.27735
X4	0.117041	0.121268	0.34641	0.344124	0.131306	0.251976	0.416025
X5	0.351123	0.242536	0.46188	0.458831	0.525226	0.251976	0.27735
X6	0.351123	0.242536	0.46188	0.114708	0.131306	0.251976	0.27735
X7	0.468165	0.485071	0.34641	0.229416	0.262613	0.377964	0.138675
X8	0.234082	0.121268	0.23094	0.229416	0.131306	0.125988	0.416025
X9	0.234082	0.363803	0.11547	0.344124	0.262613	0.503953	0.27735
X10	0.234082	0.242536	0.34641	0.229416	0.393919	0.251976	0.27735

Fig. 4. Normalized matrix results

4. Percentage of each criterion

0,1	0,15	0,15	0,15	0,1	0,15	0,2

Fig 4. Percentage

5. Y Matrix score

WJ	0.1	0.15	0.15	0.15	0.1	0.15	0.2
V1	0.035112	0.072761	0.017321	0.051619	0.039392	0.037796	0.083205
V2	0.035112	0.054571	0.017321	0.068825	0.039392	0.018898	0.05547
V3	0.011704	0.03638	0.051962	0.034412	0.026261	0.075593	0.05547
V4	0.011704	0.01819	0.051962	0.051619	0.013131	0.037796	0.083205
V5	0.035112	0.03638	0.069282	0.068825	0.052523	0.037796	0.05547
V6	0.035112	0.03638	0.069282	0.017206	0.013131	0.037796	0.05547
V7	0.046816	0.072761	0.051962	0.034412	0.026261	0.056695	0.027735
V8	0.023408	0.01819	0.034641	0.034412	0.013131	0.018898	0.083205
V9	0.023408	0.054571	0.017321	0.051619	0.026261	0.075593	0.05547
V10	0.023408	0.03638	0.051962	0.034412	0.039392	0.037796	0.05547

Fig. 5. Y Matrix score

6. Calculate distance of ideal positive solution (D+)(and ideal negative solution (D-)

D	POSITIF	NEGATIF	AKAR +	AKAR -
D1	0.004734	0.008834	0.068804	0.093988
D2	0.007324	0.005995	0.085579	0.077426
D3	0.0055	0.005983	0.074159	0.077349
D4	0.007787	0.005818	0.088245	0.076278
D5	0.003658	0.008921	0.060484	0.094453
D6	0.007875	0.004705	0.088738	0.068594
D7	0.005608	0.007308	0.074886	0.085486
D8	0.010676	0.00381	0.103325	0.061725
D9	0.005334	0.006801	0.073033	0.082466
10	0.005726	0.00378	0.07567	0.061481

Fig . 6. Ideal positive solution(D+) and ideal negative solution (D-)

7. Calculated preference score for each alternative

D	POSITIF	NEGATIF	AKAR +	AKAR -	(+)+(-)	HASIL	RANKING
D1	0.004734	0.008834	0.068804	0.093988	0.162793	0.57735	2
D2	0.007324	0.005995	0.085579	0.077426	0.163006	0.474992	6
D3	0.0055	0.005983	0.074159	0.077349	0.151508	0.510529	5
D4	0.007787	0.005818	0.088245	0.076278	0.164523	0.46363	7
D5	0.003658	0.008921	0.060484	0.094453	0.154937	0.609622	1
D6	0.007875	0.004705	0.088738	0.068594	0.157333	0.435983	9
D7	0.005608	0.007308	0.074886	0.085486	0.160372	0.533048	3
D8	0.010676	0.00381	0.103325	0.061725	0.16505	0.373977	10
D9	0.005334	0.006801	0.073033	0.082466	0.155499	0.530333	4
10	0.005726	0.00378	0.07567	0.061481	0.137151	0.448275	8

Fig. 7. Alternative preference

8. Ideal Matrix score (Max and Min)

MAX	0.046816	0.072761	0.069282	0.068825	0.052523	0.075593	0.083205
MIN	0.011704	0.01819	0.017321	0.017206	0.013131	0.018898	0.027735
KUADRAT	2	2	2	2	2	2	2

Fig. 8. Ideal Max, Min Matrix

C. ANALYSIS RESEARCH RESULTS

Testing results of the implementation of the TOPSIS method with the calculation manually, resulting rank in the weight of the criteria so obtained alternative 5 was chosen as good qualified corn with a score of V5 = 0.609622.

V. CLOSING

A. Conclusion

Decision support system using Technique For Order Preference By Similarity To Ideal Solution is a method that can help and facilitate in solving a problem, so it can help us in determining Good and qualified corn based on predefined criteria namely water content, deformed corn seed , corn waste, corn color , corn species, number of grains, corn cob. And using alternatives were tested then the alternative V5 with a score of 0.609622 was as good quality.

Suggestion

The following consists of some suggestions for further development of the following research:

1. The need to develop on other criteria so that the data obtained more accurately
2. In solving the multi criteria problem of the TOPSIS method is not the only decision making method that can be used, it is good to further study replace or compare with other methods such as AHP, WP etc.
3. Further research is suggested to make website-based applications more effective.

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