


# Decision Support System For The Specification Of The Best Quality Corn Kernels With Multi Attribute Utility Theory Method

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Article Info	ABSTRACT
<b>Keywords:</b> Decision Support System Corn Seeds Multi Attribute Utility Theory	Farmers sell corn kernels to the company PT Charoen Pokphan Indonesia Tbk Medan, the corn kernels are used for a mixture of feed raw materials in order to fulfill the protein and nutritional value of the feed to be of quality. The company PT Charoen Pokphan Indonesia Tbk Medan buys corn seeds to farmers with the best quality corn seed specifications, so that they know the total price of the corn seeds according to the quality needed. This research determines the criteria for the best quality corn kernels and how to apply the Multi Attribute Utility Theory Method to the decision support system to determine the quality of these corn kernels, to be able to help the company PT charoen pokphan indonesia tbk Medan in determining the quality of corn kernels. Based on the criteria that have been set at the company PT Charoen Pokphan Indonesia Tbk Medan to get the best quality corn seed value using grade 1 to grade 4 and ranking. The result of testing these methods is that a decision is made on an alternative with a total value of 86.7%. So this method is needed to evaluate the determination of the best quality corn kernel specifications so as to produce the best decision.
This is an open access article under the <a href="https://creativecommons.org/licenses/by-nc/4.0/">CC BY-NC</a> license 	<b>Corresponding Author:</b> Chairul Imam Universitas Battuta Medan, Sumatera Utara, Indonesia <a href="mailto:chairulimam313@gmail.com">chairulimam313@gmail.com</a>

## INTRODUCTION

The increasing technology created by humans to improve the ability to carry out their work, then a person's management will be faced with a lot of decision making such as decisions on planning, implementation, supervision and assessment. Decision making from a problem, be it a simple or complex problem, requires comprehensive and accurate information, the ability to analyze and process information and the right solution method.

The rapid advancement of technology and supported by the development of communication has given birth to a hope and revolution of a new technology. Innovations that utilize computer technology and combine communication technology have produced a technology, namely internet technology.

This computer technology has been able to process large amounts of data in a

short time. Computer technology also has data storage media that can store large amounts of data. These things above make computer technology very reliable to support company operations.

Decision Support Systems are characterized by interactive computer-based systems that help decision makers utilize data and models to solve a problem. Basically, the Decision Support System is designed to assist in the decision-making process starting from selecting relevant data, identifying problems, determining the approach used in decision making to evaluating the selection. This decision support system is not used as a tool for making all decisions, but only helps to provide considerations for making a decision (Roisdiansyah H.R.M., Widodo W.A., Hidayat N., 2017).

The Multi Attribute Utility Theory method is a decision-making process that allows its practitioners to evaluate various competing alternatives in order to achieve certain goals. In the Multi Attribute Utility Theory Method we try to compare the specifications divided into 3 parts, namely grade 1, grade 2, grade 3, grade 4 and ranking. Each grade has different specifications from each grade also has a different price. At This grade lets farmers know what grade maize they are under and the selling price they get (Jannah R., Lusiana., 2015).

Based on the description above, it is necessary to build a "Decision Support System for Best Quality Corn Seed Specifications with the Multi Attribute Utility Theory Method" which is expected to facilitate the company PT Charoen Pokphand Indonesia Tbk Medan in making a decision to determine the best quality corn seed specifications.

## METHOD

The stages of the process of this research flow according to a logical flow, the aim is to provide clear, organized and systematic instructions. The arrangement of these stages greatly affects the quality of the results to be obtained. The stages of this research can be seen in Figure 3.1 below:

### 1. Defining the Problem

The problems found will then be analyzed. Steps in the problem analysis process

### 2. Analyzing the Problem

The step of analyzing the problem is a step to be able to understand the problem that has been determined in its scope or limits.

### 3. Define Objectives

Based on an understanding of the problems that have been analyzed, the next step is to determine the objectives to be achieved in this study.

### 4. Studying the Literature

This research was conducted to complete the treasury of rules, concepts, theories that support in solving the problems in this study.

### 5. Collecting Data

Collecting data for training and testing Multi Attribute Utility Theory. The more data

obtained, the better insolving the problem at hand.

6. Analyzing the Multi Attribute Utility Theory Method These are the steps of analyzing and solving the case study.
7. Designing the App  
 After the method analysis process at this stage, a design is carried out in accordance with the standardization profile criteria.
8. Implementation  
 Based on the results of the system design and the selected platform, it is then implemented into a decision support system for determining the appropriate path.
9. Testing  
 Displaying the results of data processing, this process is a process that will be carried out.

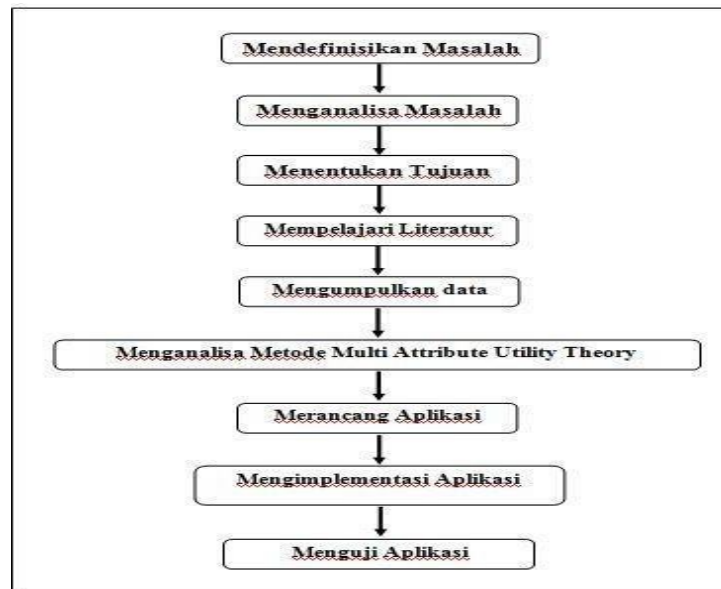


Figure 1. Research Flow Framework

## RESULTS AND DISCUSSION

### Analysis and Design Stages

The stages of system analysis and design are needed in a study to affect the quality and quantity of the system. Can be seen in Figure 1 below:

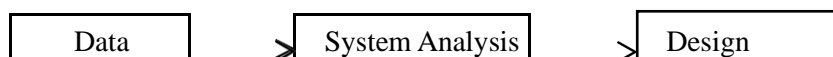


Figure 2. Stages of Analysis and Design

### Input Data

The data taken in this study is field assessment data taken from PT Charoen Pokphand Indonesia Tbk Medan. This data is used as a trial to determine the grade in the final test results by collecting scores on the company's assessment paper. The system

applied to this data is implemented to determine the superiority of the Multi Attribute Utility Theory method in selecting corn types. The data that will be processed as criteria in this case study are sample corn, moisture, broken seed, moldy seed, damage seed, foreign material, aflatoxin (ppb). The following is sample corn data at the PT Charoen Pokphand Indonesia Tbk Medan company. The following is data on the name of corn from the company PTCharoen Pokphand Indonesia Tbk Medan as a reference for assessors from the company in table 1

Table 1. Corn Name Data

Name of Corn	Moisture	Broken Seed	Moldy Seed	Seed Damage	Foreign Material	Aflatoxin (Ppb)
Yellow corn 1	12.0%	2.0%	2.0%	3.0%	1.0%	50%
Yellow corn 2	13.0%	4.0%	4.0%	6.0%	2.0%	100%
Yellow corn 3	14.0%	6.0%	5.0%	8.0%	2.0%	100%
Wet Corn	15.0%	4.0%	5.0%	8.0%	2.0%	100%

Table 2. Sample Corn Data

No.	Sample Corn	Moisture	Broken Seed	Moldy seed	Damage seed	Foreign Materials	Aflatoxin (Ppb)
A1	617	13.7	4.4	1.9	2.1	0.5	50
A2	706	17.9	4.7	2.8	16	0.7	50
A3	710	14.5	4.6	4.5	0.9	0.5	20
A4	711	12.1	4.3	2.7	8	2	15
A5	712	13.8	4.6	1.7	2.8	0.3	15
A6	714	13.9	2.8	4.7	3.6	0.2	15
A7	717	14.2	4.6	2.8	1.7	0.7	25
A8	718	13.9	5	8.52	1.8	0.3	20
A9	719	14.3	6.2	4.3	1.8	0.2	15
A10	720	14.4	0.3	18	2.7	0.3	15

Corn sample data is corn sample data randomized by the company PT Charoen PokphandIndonesia Tbk Medan.

**Calculating the Comparison Matrix Value of each criterion based on the table of importance values (saaty table)**

The following is the calculation of the pairwise comparison matrix of the criteria then from the lower level the elements to be compared are taken, for example K1 to K6 in table 3 below:.

Table 3. Pairwise Comparison Matrix

	K1	K2	K3	K4	K5	K6
K1	1/1	1/3	1/5	1/7	1/7	1/9

<b>K2</b>	3/1	1/1	1/3	1/5	1/7	1/7
<b>K3</b>	5/1	3/1	1/1	1/3	1/5	1/7
<b>K4</b>	7/1	5/1	3/1	1/1	1/3	1/5
<b>K5</b>	7/1	7/1	5/1	3/1	1/1	1/3
<b>K6</b>	9/1	7/1	7/1	5/1	3/1	1/1

The summation results of the normalization of the pairwise comparison matrix in table 4 below:

**Table 4. Normalization of Pairwise Comparison Matrix**

	<b>K1</b>	<b>K2</b>	<b>K3</b>	<b>K4</b>	<b>K5</b>	<b>K6</b>
<b>K1</b>	1	0.33	0.2	0.14	0.14	0.11
<b>K2</b>	3	1	0.33	0.2	0.14	0.14
<b>K3</b>	5	3	1	0.33	0.2	0.14
<b>K4</b>	7	5	3	1	0.33	0.2
<b>K5</b>	7	7	5	3	1	0.33
<b>K6</b>	9	7	7	5	3	1
<b>TOTAL<sub>1</sub></b>	<b>32</b>	<b>23.3</b>	<b>16,5</b>	<b>9.7</b>	<b>4.8</b>	<b>1.9</b>

**Table 5. Pairwise Comparison Matrix Values**

	<b>K1</b>	<b>K2</b>	<b>K3</b>	<b>K4</b>	<b>K5</b>	<b>K6</b>
<b>K1</b>	1/32	0.33/23.3	0.2/16.5	0.14/9.7	0.14/4.8	0.11/1.9
<b>K2</b>	3/32	1/23.3	0.33/16.5	0.2/9.7	0.14/4.8	0.14/1.9
<b>K3</b>	5/32	3/23.3	1/16.5	0.33/9.7	0.2/4.8	0.14/1.9
<b>K4</b>	7/32	5/23.3	3/16.5	1/9.7	0.33/4.8	0.2/1.9
<b>K5</b>	7/32	7/23.3	5/16.5	3/9.7	1/4.8	0.33/1.9
<b>K6</b>	9/32	7/23.3	7/16.5	5/9.7	3/4.8	1/1.9

The following are the calculation results from table 6 for the pairwise comparison matrix values below:

0.03	0.01	0.01	0.01	0.03	0.06
0.09	0.04	0.02	0.02	0.03	0.07
0.16	0.13	0.06	0.03	0.04	0.07
0.22	0.21	0.18	0.10	0.07	0.10
0.22	0.30	0.30	0.31	0.21	0.17
0.28	0.30	0.42	0.52	0.62	0.52

**Calculating the criteria weight value (Wj)**

Calculate the weight value of the criteria by summing up all rows of matrix values and dividing by the number of criteria as calculated below:

$$0.03+0.01+0.01+0.01+0.03+0.06/6= 0.027$$

$$0.09+0.04+0.02+0.02+0.03+0.07/6= 0.047$$

$$0.16+0.13+0.06+0.03+0.04+0.07/6= 0.083$$

$$0.22+0.21+0.18+0.10+0.07+0.10/6= 0.148$$

$$0.22+0.30+0.30+0.31+0.21+0.17/6= 0.252$$

$$0.28+0.30+0.42+0.52+0.62+0.52/6= 0.444$$

The calculation results of the weight of the above criteria (**Wj**) = **(0.027; 0.047; 0.083; 0.148; 0.252;0.444)**. Below is to calculate the criteria weights and the results of the criteria weights to determine the number of consistent criteria results.

0.03	0.01	0.01	0.01	0.03	0.06	0.027	0.004
0.09	0.04	0.02	0.02	0.03	0.07	0.047	0.007
0.16	0.13	0.06	0.03	0.04	0.07 ×	0.083 =	0.013
0.22	0.21	0.18	0.10	0.07	0.10	0.148	0.024
0.22	0.30	0.30	0.31	0.21	0.17	0.252	0.040
0.28	0.30	0.42	0.52	0.62	0.52	0.444	0.071

The average value of the consistency criteria to determine the division of the results of the weight assessment of the criteria in order to get the results of the calculation of the Index Value of consistent criteria (NIRK).in table 6 below:

**Table 6. Consistency Random Index Value (NIRK)**

No.	1	2	3	4	5	6	7	8	9	10	11
RC	0,00	0,00	0,58	0,90	1,12	1,24	1,32	1,41	1,45	1,49	1,51

For n = 6, NIRK 6 = 1.24 is obtained so divide the ci result to get the normalized value weight assessment result. The CR value above is ≤ 0.1, meaning that the weight of the normalized criteria value is consistent 0.027.

**Calculating the preference weight value (Vi)**

To calculate the preference weight value, the formula is used:

This level consists of criteria for assessing or considering existing alternatives and determining these alternatives. then taken from the sample corn to calculate the results of the level of alternative level assessors A1 to A10 by calculating the value of the preference weight. In table 7. below

**Table 7 Sample Corn Criteria Assessment**

No.	Sample Corn	Moisture	Broken Seed	Moldy Seed	Damage seed	Foreign Materials	Aflatoxin (Ppb)
A1	617	13.7	4.4	1.9	2.1	0.5	50
A2	706	17.9	4.7	2.8	16	0.7	50
A3	710	14.5	4.6	4.5	0.9	0.5	20
A4	711	12.1	4.3	2.7	8	2	15
A5	712	13.8	4.6	1.7	2.8	0.3	15
A6	714	13.9	2.8	4.7	3.6	0.2	15
A7	717	14.2	4.6	2.8	1.7	0.7	25
A8	718	13.9	5	8.52	1.8	0.3	20

A9	719	14.3	6.2	4.3	1.8	0.2	15
A10	720	14.4	0.3	18	2.7	0.3	15

Criteria Weight Value (Wj) = (0.025; 0.045; 0.082; 0.148; 0.252; 0.444) this value becomes thereference for the multiplication of each criterion in the sample corn assessment below:

$$617 = (13.7 \times 0.025) + (4.4 \times 0.045) + (1.9 \times 0.082) + (2.1 \times 0.148) + (0.5 \times 0.252) + (50 \times 0.444) = 23.28$$

$$706 = (17.9 \times 0.025) + (4.7 \times 0.045) + (2.8 \times 0.082) + (16 \times 0.148) + (0.7 \times 0.252) + (50 \times 0.444) = 25.57$$

$$710 = (14.5 \times 0.025) + (4.6 \times 0.045) + (4.5 \times 0.082) + (0.9 \times 0.148) + (0.5 \times 0.252) + (20 \times 0.444) = 10.06$$

$$711 = (12.1 \times 0.025) + (4.3 \times 0.045) + (2.7 \times 0.082) + (8 \times 0.148) + (2 \times 0.252) + (15 \times 0.444) = 9.04$$

$$712 = (13.8 \times 0.025) + (4.6 \times 0.045) + (1.7 \times 0.082) + (2.8 \times 0.148) + (0.3 \times 0.252) + (15 \times 0.444) = 7.82$$

$$714 = (13.9 \times 0.025) + (2.8 \times 0.045) + (4.7 \times 0.082) + (3.6 \times 0.148) + (0.2 \times 0.252) + (15 \times 0.444) = 8.08$$

$$717 = (14.2 \times 0.025) + (4.6 \times 0.045) + (2.8 \times 0.082) + (1.7 \times 0.148) + (0.7 \times 0.252) + (25 \times 0.444) = 12.29$$

$$718 = (13.9 \times 0.025) + (5 \times 0.045) + (8.52 \times 0.082) + (1.8 \times 0.148) + (0.3 \times 0.252) + (20 \times 0.444) = 10.47$$

$$719 = (14.3 \times 0.025) + (6.2 \times 0.045) + (4.3 \times 0.082) + (1.8 \times 0.148) + (0.2 \times 0.252) + (15 \times 0.444) = 7.95$$

$$720 = (14.4 \times 0.025) + (0.3 \times 0.045) + (18 \times 0.082) + (2.7 \times 0.148) + (0.3 \times 0.252) + (15 \times 0.444) = 8.97$$

### Ranking

Ranking is done by taking the highest value from the results of the alternative calculations above. Table 8 shows the ranking data and grade in the calculation results below

**Table 8. Ranking Results**

No.	Sample Corn	Nil.pref	Ranking	Grade
1	712	7.82	Rank 1	Grade 1
2	719	7.95	Rank 2	Grade 1
3	714	8.08	Rank 3	Grade 1
4	720	8.97	Rank 4	Grade 1
5	711	9.04	Rank 5	Grade 1
6	710	10.06	Rank 6	Grade 1
7	718	10.47	Rank 7	Grade 1

8	717	12.29	Rank 8	Grade 2
9	617	23.28	Rank 9	Rejected
10	706	25.57	Rank 10	Rejected

### CONCLUSIONS

After analyzing and designing the Decision Support System for the specifications of the best quality corn kernels with the multi attribute utility theory method, several conclusions can be drawn that the Design of a Decision Support System can help in determining the specifications of corn kernels selected for grade and ranking. The application of the multi attribute utility theory method can be applied in this Decision Support System. the results of calculations using the attribute utility theory method of the best quality corn grain specifications, obtained manual accuracy results and with 86.7% accuracy software so that using this method will make it easier to solve problems on the best quality corn grain specifications atPT Charoen Pokphand Indonesia Tbk.

### REFERENCE

Moh Andriawan Adikara, Muhammad Tanzil Furqon, Achmad Arwan (2018). Decision Support System for Selection of Superior Varieties of Hybrid Corn Using AHP-SMART Method. Journal of Information Technology and Computer Science Development Vol. 2, No. 10, October 2018.

Fitriyani. (2016). Decision Support System for Selection of Outstanding Students at STMIK Atma Luhur Pangkalpinang Using the Analytical Hierarchy Process (AHP) Method. TEKNOSI, Vol. 02, No. 02, August 2016.

Novri Hadinata. (2018). Implementation of the Multi Attribute Utility Theory (MAUT) Method in the Decision Support System in Determining Credit Recipients. SISFOKOM Journal, Volume 07, Number 02, September 2018.

[Abdul Halim Hasugian, Hendra Cipt H. (2018). Analysis and Design of a Life Partner Selection Decision Support System According to Karo Culture Using the Method Analytical Hierarchy Process (AHP). Journal of Computer and Information Science Volume: 02, Number : 01, April 2018

Nia Komalasari. (2018). Flightworthiness Decision Support System (SPK2T).Journal of Electrical and Aviation Industry 4 (1), 2018. 52, 2018.

Eka Andrita Gusdha M, Asep Wahyudin, Eddy Prasetyo Nugroho (2016). Employee Promotion System with Analytical Hierarchy Process (AHP) and Multi-Attribute Utility Theory (MAUT) Methods (Case Study at PT. Ginsa Inti Pratama). Journal of Computer Science volume: 01, Number: 02, March 2016.

Wahyu Halifathur Rachman, Joan Angelina Widians, Masnawati. (2017). Support System Decision on the Selection of Cayenne Pepper Seedlings Using the Web-Based Simple

Additive Weighting (SAW) Method. Proceedings of Computer Science and Information Technology Seminar Vol. 2, No. 1, March 2017

Ramadiani Ramadiani, Auliana rahmah. (2019). Decision Support System for selecting exemplary health workers using the Multi Attribute Utility Theory method. Scientific Journal of Information Systems Technology 5 (1) 2019 1-12

Chairun Nas, Sarjon Defit, Julius Santony. (2018). Evaluation of Mutasai Position of Police Members Using Profile Matching Method and Multi Attribute Utility Theory. Journal of Science, Vol. 16, No. 1, December 2018.