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# Strategy to Improve the Quality of Corn Kernels Through the Analytical Hierarchical Process Approach

**Miranti Putry[1], Ayu Puspitasari [2]**

[1,2]Department of Industrial Engineering, Universitas Primagraha, Serang, Indonesia

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**ABSTRACT**

Corn is the main component of the feed industry, 50% of corn production in Indonesia is used to meet the needs of the feed industry, while only about 30% is for consumption. And the rest is for other industrial needs. The quality of corn harvested by farmers is important for feed producers to produce quality feed according to applicable quality standards. For this reason, it is necessary to apply an appropriate quality improvement strategy using the AHP (Analytical Hierarchical Process) method. The results of the analysis of factors that affect the quality of corn Kernels are harvesting techniques, and one alternative that needs to be done in controlling the quality of corn Kernels is the application of quality control.



***Corresponding Author:***

Miranti Putry,
Department of Industrial Engineering,
Universitas Primagraha,
Jl. Trip Jamaksari 1A, Serang, 42111, Indonesia
Email: mirantiputri84@gmail.com

# INTRODUCTION

Indonesian farmers have long grown corn which is the main crop after rice. The demand for corn for food and animal feed will continue to increase along with the growth and development of the population in Indonesia. The rapid development of the livestock industry has also changed the map of maize consumption throughout the country.

Corn is the main ingredient in the feed industry, with a feed ratio of 60%. This is why more than 50% of corn production in Indonesia is used for the needs of the feed industry, while the use for food consumption is estimated at 30%. While the rest is for other industrial needs.[1]

As the main raw material for animal feed, the quality of corn kernels harvested by farmers will certainly be a key parameter to create quality animal feed so that it is safe for livestock health. Therefore, each feed producer has set quality standards for corn kernels supplied by farmers. The quality standards set usually include moisture, dead Kernels, moldy Kernels, rotten Kernels, dirt, and aflatoxin content[2].

The quality of corn Kernels harvested by farmers is the main indicator for feed producers to produce quality feed according to applicable quality standards. Given the importance of improving the quality of corn kernels based on a priority scale, a system is needed that can assist in making decisions to improve the quality of shelled corn in Serang Regency. The decision support system allows farmers to determine what steps are more important to improve the quality of corn kernels quickly and accurately. A decision support system is a systematic approach that starts with the

problem of making business decisions, gathering facts, and establishing a set of decision criteria to select the most appropriate alternative course of action as a decision solution [3].

This study uses the Analytic Hierarchy Process (AHP) method in the form of a decision-making tool consisting of several criteria for pairwise comparisons with eigenvalues and a methodology to calibrate numerical measurement scales to quantitative and qualitative performance [4] strategies for improving the quality of corn kernels in Serang Regency, Province of Banten. The main hierarchical formulation in AHP was first proposed by [5].

This research using the AHP method was inspired by previous findings. The use of pairwise comparisons in AHP has been widely used, for example in the fields of energy [6], [7], finance [8]–[10], manufacturing [11], risk assessment [12], supply chain [13], banking [14]. , the supplier [15], technology management [16], customer satisfaction [17], selection of software requirements [18].

# RESEARCH METHODS

The approach used for the assessment shows the level of weighting used as a reference in filling out the questionnaire, namely the fundamental scale in the form of numbers 1 (equal importance) to 9 (Extreme importance)[19]. The importance value indicates that the higher a particular interest, the higher the importance[20], [21]. The rating scale used in the assessment of the level of importance can be seen in Table 1 below.

**Table 1.** The fundamental scale of absolute numbers

| Intensity of Importance | Definition | Explanation |
|---|---|---|
| 1 | Equal Importance | Two activities contribute equally to the objective |
| 2 | Weak or slight | |
| 3 | Moderate importance | Experience and judgment slightly favor one activity over another |
| 4 | Moderate plus | |
| 5 | Strong importance | Experience and judgment strongly favor one activity over another |
| 6 | Strong plus | |
| 7 | Very strong or demonstrated importance | An activity is favored very strongly over another; its dominance demonstrated in practice |
| 8 | Very, very strong | |
| 9 | Extreme importance | The evidence favoring one activity over another is of the highest possible order of affirmation |
| Reciprocals of above | If activity I has one of the above non-zero numbers assigned to it when compared with activity j, then j has the reciprocal value when compared with i | A reasonable assumption |
| 1.1–1.9 | 1.1–1.9 | May be difficult to assign the best value but when compared with other contrasting activities the size of the small numbers would not be too noticeable, yet they can still indicate the relative importance of the activities |

After doing pairwise comparisons between criteria and between alternatives, it is necessary to do a synthesis of priority, namely pairwise comparisons on criteria and alternatives. The calculation of weights and priorities is changed in the form of a matrix, where the results obtained are Logical Consistency. Consistency is obtained using the Consistent Index, which is a random matrix with a rating scale (1-9) and its opposite as the Random Index (RI) [13]. With the formula:

$$CI = \frac{\lambda_{maks} - n}{n-1} \quad (1)$$

Where $\lambda_{maks}$ is the maximum eigenvalue of the matrix and n is the order of the matrix [22]. After that, determine the Consistency Ratio (CR), which measures the consistency of pairwise comparisons. [23]

$$CR = \frac{CI}{RI} \quad (2)$$

Casio Ratio (CR) measures consistency in pairwise comparisons. the acceptable CR value is 0.1 or less than 0.1, if the value is higher than the acceptable value, it is necessary to recalculate or redevelop the assessment.

**Table 2.** Random Consistency Index

| Orde Matriks | Random Index |
|---|---|
| 1,2 | 0 |
| 3 | 0,58 |
| 4 | 0,9 |
| 5 | 1,12 |
| 6 | 1,24 |
| 7 | 1,32 |
| 8 | 1,41 |
| 9 | 1,45 |
| 10 | 1,49 |
| 11 | 1,51 |
| 12 | 1,48 |
| 13 | 1,56 |
| 14 | 1,57 |
| 15 | 1,59 |

# RESULT AND DISCUSSION

The data collected is in the form of secondary data, such as reports from the Central Statistics Agency and related agencies at the provincial and district levels, while the process of gathering knowledge through in-depth consultation interviews with experts (respondents), identifies respondents as experts based on a) Reputation, location, and credibility relevant to the research subject, b) Have experience in the researched field, c) Willing to be interviewed.

Based on these criteria, three experts/respondents were selected, which are agroindustrial experts with special expertise in agriculture in Serang Regency.

**Determining Quality Improvement Factors in the Company**

In this study, the factors developed are harvesting techniques, drying techniques, shelling techniques, and storage techniques. The selection of these four techniques was based on the results of a study [24] which stated that these techniques played an important role in the character of the quality of the beans

From the results of interviews with the three corn experts, four things need to be done to improve the quality of corn kernels in Serang District. That is :

a) Harvesting technique
   Harvesting corn when the corn has not yet seen a black layer (black layer) at the base of the Kernels so that the corn Kernels are not yet ripe [25]
b) Drying Technique

The drying process is still traditional, although currently there are drying machines rented by the government, they are limited in number [26]

c) Shell Technique
The shelling of corn in corn kernels which has a moisture content of 25-35% and a long machine age causes the Kernels to crack and do not meet SNI standards. [26]

d) Storage Techniques
Corn that has been shelled is stored in sacks that still have a moisture content of 25-35% making the corn susceptible to mold. [25]

To solve these problems, a goal is needed to achieve an increase in the quality of corn kernels, where the objectives are: Improve Quality, Increase Competitive, Increase Volume.

Strategies that are carried out to improve the quality of corn Kernels, it is necessary to have the right strategy, namely: HR Training, Implementation of quality control, Information development, Application of technology

After the elements at each hierarchical level have been determined, the AHP hierarchical structure can be formed, which can be seen in the image below.

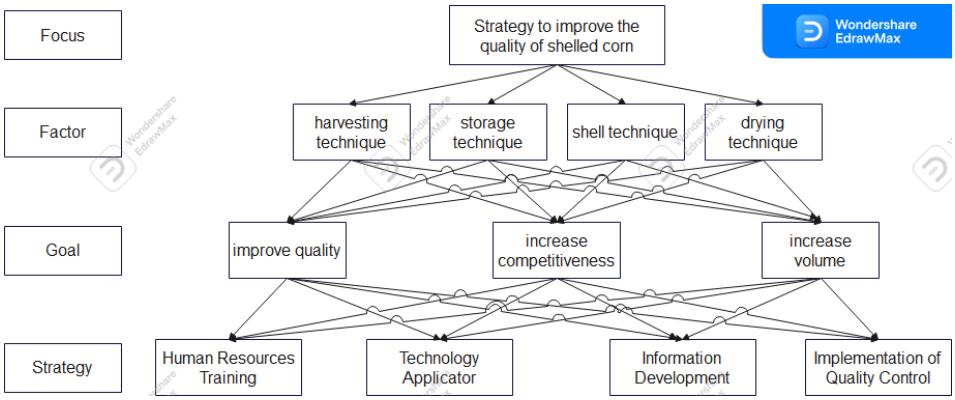


Figure 1. Hierarchical Structure of Quality Improvement Strategies

**Determine the factor level**

Based on the level of the selected factor, a comparison matrix between the elements is carried out, where the matrix value is the average value given by each respondent. After filling in the matrix, the unweighted, weighted, and limit matrix are obtained. The value in the limit matrix is a priority value that shows the weight of each factor. can be seen in table 3

**Table 3.** Priority Weight on Factor

| Name | Normalized By Cluster | Limiting |
|---|---|---|
| Drying Technique | 0.24910 | 0.077078 |
| Harvesting Technique | 0.27804 | 0.086030 |
| Shell Technique | 0.24101 | 0.074574 |
| Storage Technique | 0.23185 | 0.071738 |

**Determining the Level of Goals**

By the objectives that have been determined, it is carried out in front of the comparison between the elements. So that the weight of each element at the goal level can be seen in table 4.

**Table 4.** Priority Weight on Goal

| Name | Normalized By Cluster | Limiting |
|---|---|---|
| Improve Quality | 0.41127 | 0.142006 |

| | | |
|---|---|---|
| Increase Competitiveness | 0.30172 | 0.104180 |
| Increase Volume | 0.28702 | 0.099104 |

**Determining the Level of Strategy**

Based on the comparison matrix, the strategy for implementing the corn seed quality control system can be seen in table 5. In the table, the Implementation of Quality Control was chosen because it has the highest weight compared to the other 3 strategies, namely 0.26643 namely Implementation of Quality Control. In table 5 the Implementation of Quality Control has the highest weight compared to the other 3 strategies.

**Table 5.** Priority Weight on Factor

| Name | Normalized By Cluster | Limiting |
|---|---|---|
| Human Resources Training | 0.24764 | 0.057006 |
| Implementation of Quality Control | 0.26643 | 0.061330 |
| Information Development | 0.22855 | 0.052610 |
| Technology Applicator | 0.25738 | 0.059247 |

Implementation of Quality Control is a top priority in the strategy to control the quality of corn kernels. This priority is the right strategy to start doing quality control. With the implementation of Quality Control, quality control of corn kernels is more planned and controlled. Implementation of Quality Control can be done using the Deming Cycle, namely the PDCA (Plan, Do, Check, Action) process[27]. The explanation of the stages in the Deming cycle is as follows:

a) Plans. Setting the quality standard of corn kernels whether it is the same or higher than the standard set by the government
b) Do. The plans that have been made are carried out in stages and controlled so that all plans run well.
c) Check. Checking whether the implementation is to the plan. And compare the results of corn Kernels obtained whether it is by the standards that have been set.
d) Actions. Make adjustments related to problems that arise and establish new Steps to fix them.

# CONCLUSION

The most important factor in controlling the quality of corn kernels using the AHP method is the harvesting technique with a weight of 0.27804 or 27.8%. The Stratford in dealing with it is the Implementation of Quality Control, where this strategy is something that must be done to control the quality of corn kernels. Implementation of Quality Control can be done using the PDCA (Plan, Do, Check, Action) process.

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