Hayami method application in the evaluation process of farmers who produce wet and dry corn seeds

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Abstract. Corn is one of the strategic and economic value commodities, and has the opportunity to be developed because of its position as the main source of carbohydrates and protein after rice, besides that corn acts as animal feed, industrial raw materials and households. The purpose of this study was to determine the factors that explain the reason farmers sell wet and dry corn seeds. The data analysis method used is the Hayami Method which includes added value, a comparison of the income of farmers who sell wet seeds by selling dry seeds. Factors that influence corn farmers that produce wet and dry corn seeds are the need for fast refunds, weather, labor wages, high selling prices and availability of storage. There is an added value of Rp136.55 / Kg obtained by dry corn seed farmers from processing wet corn seeds. The results of the Independent Sample Test analysis showed that the corn farmers who sell wet seeds with farmers who sell dry seeds that the value of Sig (0.014) <(0.025), meaning that there is a difference in income of wet seed farmers with dry seed farmers.

Keyword: Hayami method, corn seeds, farmers

1. Introduction

Corn is one of the strategic and economic value commodities, and has the opportunity to be developed because of its position as the main source of carbohydrates and protein after rice, besides that corn acts as animal feed, industrial and household raw materials [1-5]. The use of corn for animal feed reaches 50% of the total needs. Corn consumption for feed tends to increase with an average annual growth of 11.52%, while production growth is only 6.11%. Besides for animal feed, corn is also used for food and beverage industries and other uses. An alternative conditioned corn is difficult to produce for human food needs shifted with increased use of animal feed so as to increase the feed industry. From the market opportunity aspect, corn plants have bright prospects to cultivate, because domestic consumer demand and export opportunities continue to increase [6]. Corn plants come from the tropics and can adapt to the environment outside the area. Corn can grow in areas that are located between 50 ° LU-40 ° LS [7].

In Indonesia, in 2000, the use of corn was 50% for food and food industries, while 50% was for the feed industry. The tendency of this proportion will change by 2020 where the feed industry requires corn of around 76.2% [8]. Farmers generally harvest corn in the rainy season with humid environmental conditions and high rainfall. The results showed that the level of corn water harvested in the rainy season was still high, ranging from 25-35%. If it is not handled properly, corn is likely to be infected with fungi that produce aflatoxin mycotoxins. Increased corn production in Indonesia has not been followed by good post-harvest handling. The result is that the quality of corn produced is not
maximized. Therefore, farmers in some corn development areas still do not feel the added value with the increasing quality of corn seed products. Law No. 7 of 1996 concerning food safety. Several countries such as China, Malaysia and Singapore have imposed very strict quality standards for corn products [9-13].

The difference in the average cost of corn farming production costs selling wet and dry seeds per hectare is the farmer who sells wet corn seeds Rp.8,375,515.17 / ha / mt and the production costs of farmers who sell dried seeds Rp. 9,074,887.65 / ha / mt. The process of generating added value is a complex process that runs continuously and can only be said to be successful if the application of machinery, human skills, and raw materials can be fully integrated by technology to produce high value products rather than the original raw material value. Revenues are total revenues minus all costs incurred. In order for the income calculation to be carried out correctly, it is necessary to know what is meant by revenue and costs. The added value obtained from the processing of a product can use the Hayami method. The advantages of value added analysis using the Hayami method are first; can know the value added, output value, and productivity. Second, it can be known the amount of remuneration for the owners of production factors, and third, the value added principle according to Hayami can be applied to other subsystems outside of processing, for example for marketing activities [14-15].

2. Research Methods
This research was conducted in Sarimatondang Village, Sidamanik District, Simalungun Regency, North Sumatra. Sampling was done by simple random sampling, where the total population of corn farmers located in the village of Sarimatondang many as 267 KK (Head of Family), and for the samples taken 30 families of 15 families corn growers who sell grain wet and 15 households corn growers who sell dry beans. The data collected in this study consisted of primary data and secondary data. The hypothesis (1) was analyzed descriptively by knowing several factors that explain the reason farmers sell wet and dry corn seeds. For hypothesis (2) it is analyzed using the Hayami Method. Analysis using the Hayami Method can be seen in the following Table 1.

| No. | Output, input, price | Formulation |
|-----|----------------------|-------------|
| 1   | Output (kg)          | A           |
| 2   | Input (kg)           | B           |
| 3   | Labor (day of the work) | C          |
| 4   | Conversion Factor    | A/B = M     |
| 5   | Labor coefficient (day of the work) | C/B = N |
| 6   | Output price (Rp/kg) | D           |
| 7   | Labor wages (Rp/day of the work) | E         |

Income

| No. | Raw material prices (Rp/kg) | Other input contribution (Rp/kg) | Output value (Rp/kg) | a. Value-added (Rp/kg) | b. Add value ratio (%) | a. Direct labor income (Rp/labor) | b. Share of labor (%) | a. Advantages (Rp/Kg) | b. Profit rate (%) |
|-----|------------------------------|---------------------------------|----------------------|-----------------------|------------------------|-------------------------------|-----------------------|---------------------|-------------------|
| 8   | F                            | G                               | K = M x D            | L = K – F - G         | H = (L/K)              | P = N x E                     | Q = (P/L)             | R = L – P           | I = (R/L)          |
| 9   |                              |                                 |                      |                       |                        |                               |                       |                     |                   |
| 10  |                              |                                 |                      |                       |                        |                               |                       |                     |                   |
| 11  | a. Value-added (Rp/kg)       | b. Add value ratio (%)          | a. Direct labor income (Rp/labor) | b. Share of labor (%) | a. Advantages (Rp/Kg) | b. Profit rate (%) |
| 12  |                              |                                 | P = N x E             | Q = (P/L)             | R = L – P              | I = (R/L)         |
| 13  |                              |                                 |                      |                       |                        |                               |                       |                     |                   |
| 14  | Margin (Rp/kg)               |                                 | S = K - F             | T = P/S                | U = G/S                | V = R/S               |
|     | a. Direct employment income (12a/14) (%) | b. Additional materials (9/14) (%) | c. Company profits (13a/14) (%) |                             |                        |                               |                       |                     |                   |

Table 1. Calculation of added value by using hayami method
For hypothesis (3) is analyzed using the average difference test method (t-count) or independent test is used to compare two variables. Mathematically formulated as follows:

\[ t = \frac{\bar{x}_1 - \bar{x}_2}{s_{\bar{x}_1 - \bar{x}_2}} \]  

(1)

where:

\[ \bar{x}_1 = \text{variable average 1} \]
\[ \bar{x}_2 = \text{variable average 2} \]
\[ s_{\bar{x}_1 - \bar{x}_2} = \text{average variable standard deviation or standard error} \]

if \( N_1 \neq N_2 \), then to calculate \( s_{\bar{x}_1 - \bar{x}_2} \) the following formula is used:

\[ s_{\bar{x}_1 - \bar{x}_2} = \sqrt{\left( \frac{\sum x_1^2 - (\frac{\sum x_1}{N_1})^2 + \sum x_2^2 - (\frac{\sum x_2}{N_2})^2}{N_1 + N_2 - 2} \right) \left( \frac{1}{N_1} + \frac{1}{N_2} \right)} \]  

(2)

if \( N_1 = N_2 \), then to calculate \( s_{\bar{x}_1 - \bar{x}_2} \) the following formula is used:

\[ s_{\bar{x}_1 - \bar{x}_2} = \sqrt{\frac{\sum x_1^2 - (\frac{\sum x_1}{N})^2 + \sum x_2^2 - (\frac{\sum x_2}{N})^2}{N(N-1)}} \]  

(2)

if: \( s_{\bar{x}_1 - \bar{x}_2} = \text{average variable standard deviation or standard error, } X_1 = \text{variable } X_1 = \text{variable 2, } N = \text{number of samples, } N_1 = \text{number of samples for variables 1, } N_2 = \text{number of samples for variables 2.} \)

Test criteria with independent samples \( t \text{ test} = \text{if } \text{sig} > \alpha \\text{ then both groups have the same variant and if } \text{sig} < \alpha \text{ then both groups have unequal variants.} \)

3. Results and discussion

3.1. The different stages of post-harvest management of corn farming between wet and dry seeds

Wet corn seeds mean that the corn kernels that are just ready to be harvested are sold directly by the farmers along with the cobs in bulk. Dry corn seeds mean harvesting and then the corn kernels and the cob are dried in the sun in 3-4 days until the corn cobs are 10-17% moisture content. After drying the corn with cobs, the shelling is done, which is to remove the corn seeds from the cob, then the corn seeds that have been piped are dried in the drying area provided, then the corn seeds are packaged and marketed [16-18]. Flowchart of the research as shown in Figure 1. below:

Figure 1. Chart of stages of wet seed and dry seed farming research

3.2 Value added of dry seed processing business

According to Hayami, value added is the value added of a commodity due to the process of processing, transporting, or storing in a production. The analytical method used to determine the added value obtained from processing corn seeds in the wet form to dry corn seeds is the Hayami Method. Calculation of added value carried out in wet seed processing in the study area with the aim of
measuring the value added that occurs due to the wet seed processing to dry seeds that are ready to be marketed.

In the business of processing wet corn kernels into dried corn kernels the average wet seed input is as much as 7.372.33 Kg which can produce as much as 3.096.33 Kg of dry beans. Where the average labor used in the process of shelling, drying and packaging for 6.4 hours resulting in a conversion factor of 0.434 dry seeds. The processing process requires labor. So that the labor coefficient used to produce 1 kg of dry seeds is 0.0009 HOK. The raw material for processing dried beans in the study area is wet corn seeds with an average price of Rp1.173.3 /Kg. The dry seed processing process does not use other input contributions because the process of wet beans after being ready for harvest is immediately sold in bulk. While dry corn seeds that are sold are only dried in the sun without any additional ingredients in the study area. Margin obtained from the value of the product is reduced by the price of the raw material. Service fees for other input contributions are obtained from the comparison of other input contributions with a margin multiplied by 100%. In the process of processing wet beans into dry seeds, it does not use other additives, so the contribution of other inputs obtained from this research is zero. The profits of entrepreneurs are obtained from the comparison between profits and margins multiplied by 100% [19]. Can be seen in Table 2. as below:

**Table 2. Added value of dry corn seeds**

| variable | value     |
|----------|-----------|
| I. output, input, and price | production of dry maize: 3.096.33 |
| 1. output (kg) | production of wet corn: 7.372.33 |
| 2. input (kg) | labor: 6.4 |
| 3. labor (hour) | separation: 12 hour, drying: 5.2 hour, packaging: 2 hour, total: 19.2/3 |
| 4. conversion factor | 3.096.33/7.372.33: 0.429934 |
| 5. labor coefficient (day of the work) | 6.4/7.372.33: 0.0008681 |
| 6. output price (Rp/kg) | prices of dry maize: 3.046.7 |
| 7. labor wages (Rp/day of the work) | average wages of labor / day: 70.000 |
| II. acceptance and profit | prices of wet corn: 1.173.33 |
| 8. raw material prices (Rp/kg) | 0.429934 x 3.046.7 |
| 9. other input contribution (Rp/kg) | 1.309.8799–1.173.33 - 0: 1.309.8799 |
| 10. output value (Rp/kg) | 0.0008681 x 70.000: 10.42461 |
| 11. a. value-added (Rp/kg) | 60.76/136.5499 x 100%: 60.76 |
| b. add value ratio (%) | 136.5499/1.309.8799 x 100%: 136.5499 |
| 12.a. direct labor income (Rp/labor) | 0.0008681 x 70.000: 10.42461 |
| b. share of labor (%) | 60.76/136.5499 x 100%: 60.76 |
| 13. a. advantages (Rp/kg) | 136.5499-60.76: 44.49655 |
| b. profit rate (%) | 55.50345/136.5499 x 100%: 55.50345 |
| III. reply to production factor owner services | 136.5499 |
| 14. margin (Rp/kg) | 1.309.8799 – 1.173.33: 136.5499 |
| a. revenue of labor (%) | 60.76 / 136.5499 x 100%: 44.49655 |
| b. other input contribution (%) | 0/136.5499 x 100%: 0 |
| c. entrepreneur profits (%) | 75.7899 / 136.5499 x 100%: 55.50345 |

3.3 The difference in the production costs of corn farming that is sold by wet seeds with dried seeds is sold
Production costs are all costs incurred by farmers in corn farming for one planting season [20]. Total average production costs incurred by corn farmers k who sell wet seeds or sell dry seeds per Ha can be seen in the following Table 3.

**Table 3.** The average difference in production of corn farmers sells wet beans by selling dried beans per ha in one growing season.

| No | Cost type (wet seed process) | Corn farming | Corn farming |
|----|----------------------------|--------------|--------------|
|    |                            | Wet sale (Rp) | Percentage (%) | Selling dry (Rp) | Percentage (%) |
| 1  | labor                      | 1.471.666.7  | 24.17         | 603.666.63       | 15.95          |
| 2  | saprodi                    | 2.180.366.7  | 35.82         | 1.246.318.7      | 32.94          |
| 3  | depreciation               | 423.588.89   | 6.96          | 390.023.36       | 10.31          |
| 4  | wholesale                  | 682.400      | 11.21         | 451.533.33       | 11.93          |
| 5  | sack                       | 132.633.33   | 2.18          | 74.306.67        | 1.96           |
| 6  | tax and land lease         | 1.196.666.7  | 19.66         | 510.000          | 13.48          |
|    | total                      | 6.087.322.3  | 100           |                |                |

3.4 *The difference in the acceptance of corn farmers who sell wet seeds with dry seeds*

Acceptance is the result that farmers receive for the sale of their farming results. Receipt is obtained from the multiplication of output produced at the output price per kilogram unit. From the table it can be seen that the average income of corn farmers who sell wet seeds is Rp. 7,834,000 per farmer and Rp. 10,789,922 per Ha in one growing season. While the average income of corn farmers who sell dry beans is Rp. 9,570,866.7 per farmer and Rp. 20,303,851 per Ha in one growing season. Differences in the average acceptance of corn farming farmers selling wet seeds with farmers selling dry seeds per farmer and per ha in one season of planting as shown in *Tabel* 4 as below:

**Table 4.** Differences in the average acceptance of corn farming farmers selling wet seeds with farmers selling dry seeds per farmer and per ha in one season of planting.

| No | Farmer acceptance | Average acceptance of each farmer every planting season (Rp) | Average reception per ha every planting season (Rp) |
|----|-------------------|-------------------------------------------------------------|---------------------------------------------------|
| 1  | selling wet seeds | 8.734.000                                                  | 10.789.922                                        |
| 2  | sell dry seeds    | 9.570.866.7                                                | 20.303.851                                        |

3.5 *The difference in farming income of corn farmers who sell wet seeds with dry seeds*

Net income is the result obtained by farmers from corn farming either selling wet seeds or selling dry seeds which is stated in rupiah obtained from the difference between total revenue and total production costs. The income earned by corn farmers who sell dry beans is higher than the income of corn farmers who sell wet seeds. The income of farmers who sell wet beans in the form of cobs is less than that of farmers who sell dry seeds because the average land tenure is higher than that of farmers who sell dry seeds [21-23]. The average farm income of corn farmers who sell wet seeds with farmers who sell dried seeds is as follows in *Tabel* 5.

Results of independent sample test analysis t test corn farmers who sell wet seeds with farmers who sell dry seeds. The test will test the basic assumption of t test that the variants of both groups are
the same or not, with the hypothesis: If H0 is accepted or sig> α then both groups have the same variant. If H1 is accepted or sig <α then both groups have unequal variants. In table 5 it can be seen that the value of sig (0.044) <α (0.05), then H0 is rejected. So both groups do not have the same variant.

Table 5. Average revenue difference farm farming income that sell wet seeds with corn farmers selling dry seeds per farmer and per ha in one planting season.

| No | Farmers' income | Average income of each farmer each planting season (Rp) | Average revenue per ha every planting season (Rp) |
|----|-----------------|--------------------------------------------------------|--------------------------------------------------|
| 1  | selling wet seeds | 2.654.177,8                                           | 2.986.363,7                                      |
| 2  | sell dry seeds   | 4.871.719,6                                           | 9.908.806,9                                      |

The next test uses equal variant not as assumed with the hypothesis: If H0 is accepted or t Sig (2-tailed) > α, it means that there is no significant income difference between wet seed farmers and dry seed farmers, and if H1 is accepted or t Sig (2-tailed) <α, that means there is a difference in income real between wet seed farmers and dry seed farmers. The sig (0.014) <(0.025) value means that there is a difference in the income of wet seed farmers with dry seed farmers. Results of average differences analysis of farmers' farming income corn selling wet seeds with maize farmers selling dry seeds per ha in one planting season group as shown in Table 6 as below

Table 6. Results of average differences analysis of farmers' farming income corn selling wet seeds with maize farmers selling dry seeds per ha in one planting season group

| Corn seeds                  | N | Mean     | Std. deviation | Std. error mean |
|-----------------------------|---|----------|----------------|-----------------|
| Wet corn kernel income      | 15| 2.986.363.8 | 1.635.690.52  | 422.333.51      |
| Revenue of dried corn kernels | 15| 9.908.807.12 | 10.099.162.91 | 2.607.592.65   |

Independent samples test

| Income | F    | Sig. | t   | Df | Sig. (2-tailed) | Mean Difference | Std. error difference | 95% confidence interval of the difference |
|--------|------|------|-----|----|-----------------|-----------------|----------------------|-----------------------------------------|
|        |      |      |     |    |                 |                 |                      | Lower                    | Upper                    |
| Equal variances assumed     | 4.452 | .044 | -2.621 | 28 | .014 | -6.922.443.12 | 2.641.572.45 | -12.333.459.12 | -1.511.427.33 |
| Equal variances not assumed |      |      | 14.734 | .020 | -6.922.443.12 | 2.641.572.45 | -12.561.688.10 | -1.511.427.33 |

4. Conclusion
The conclusions obtained from the results of this study that the factors that influence corn farmers that produce wet and dry corn kernels are the need for fast refunds, weather, labor wages, high selling prices and availability of storage. There is an added value of Rp136.55/Kg obtained by dry corn seed farmers from processing wet corn seeds. The results of the analysis of the independent test sample t test of corn farmers who sell wet seeds with farmers who sell dry seeds that the value of sig (0.014) <(0.025), meaning that there is a significant difference in the income of wet seed farmers with dry seed farmers. With the level of profit the farmer sells dry seeds by 55.50345%. The broader the average area cultivated for corn farming, the greater the level of wet seed sales in the form of cob.
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Acknowledgement
We are grateful to the Universitas Katolik SantoThomas, who support in writing our paper. We also want to show our gratitude to the Rector and our Lecturers who have guided us and taught us in writing this paper. So also to Mr. Arjon Turnip as who helped us at the time of writing this paper.