Analysis of Farmer Behaviour to the Risk of Corn Farming System in Banyumas Regency

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Abstract. Agriculture is an activity burdened with multiple risk factors, some of which are related to yields and price fluctuations. The uncertainty of the yields and also the price on agricultural commodities often leads farmer to loss. Therefore, farmers tend to resist from the possibility of risk and uncertainty of agribusiness. As a decision marker, farmers become reluctant to increase investment to develop and expand their business in agriculture. The research aims to: 1) analyse the risk of cost, production and price; 2) identify farmer behaviour to the risk of corn farming system; 3) determine the factors that affecting farmers’ behaviour toward risk of corn farming system. The research was conducted at Karanggintung Village, Sumbang District, Banyumas Region which is one of corn producing villages in Banyumas Region. Variation coefficient, quadratic utility function model, and regression analysis were used in this study. Results show that farmers face high risk on cost, while it is low on the risk of production and price. From thirty seven respondents, 70.27% farmers are risk averter, 10.81% farmers are risk lover, and the remaining is neutral. Farmers’ behaviour was influence by harvest area, years of education, and experience.

1. Introduction
Corn is one of the main agricultural food commodities after rice in Indonesia. In some regions, corn is a mainstay commodity because of its benefit, that are for food and as well as animal feed. According to Ministry of Agriculture, demand on corn in Indonesia reached 19 million tons in 2017 [1] Banyumas Regency is one of the corns producing area in Central Java. Although it is not as much as other regional productions, it is still able to contribute to meet the demand for corn. One sub-district in Banyumas Regency which contributes a lot to the corn is Sumbang Sub-district, this can be seen in Table 1.

Sumbang Sub-district has the largest of harvest area as well as corn production in Banyumas Region. Karanggintung village is one of corn producing village beside Silado Village, Susukan Village and Datar Village. In 2015, Karanggintung produced 6,213 tons of corn, while Silado Village was 6,133 tons, Susukan Village was 5,674 tons, and Datar Village was 5,158 tons [3].

According to Ningsih [4], when people running a business in agriculture they will face an uncertainty situation, in consequently will never has a definite outcome. The most significant factors of the uncertainty situation are yields or production fluctuation and price fluctuation. The risks that will be faced by farmers, cause them tend to avoid the possibility to face the risk and uncertainty. Farmers as a decision maker are reluctant to increase investment to develop and expand business, so that farming that is being run is still simple and inefficient [5].
Table 1. Harvest Area and Corn Production as Per Districts in Banyumas Regency in 2017

| Districts  | Harvest Area (Ha) | Production (Ton) |
|------------|-------------------|-----------------|
| Cilongok   | 184.60            | 915.00          |
| Gumelar    | 140.50            | 800.85          |
| Ajibarang  | 165.80            | 810.00          |
| Banyumas   | 20.70             | 84.87           |
| Sumbang    | 1,558.20          | 9,628.10        |
| Kembaran   | 1,220.10          | 8,565.10        |
| Purwojati  | 131.00            | 759.80          |

Source: Banyumas Regency in Figures, 2018 [2]

Farmers who run corn farming in Karanggintung Village are facing some problems that are price fluctuation in production facilities, the availability of labor, and erratic of weather changes. These will certainly affect the yield of corn production and will also affect farmers’ income. Farmer’s decision to run the next term of farming is also affected by production’s yield and income. Based on these problems, it is interesting to study the behavior of farmers to the risk of corn farming in Karanggintung Village, Sumbang Subdistrict, Banyumas Regency. The objectives of the research are: 1) to analyse the risk of cost, risk of production, and risk of price received by farmers; (2) to determine the behavior of farmers to the risk of corn farming; and (3) to determine the factors that influence farmers’ behaviour towards the risk of corn farming in Karanggintung Village, Sumbang District, Banyumas Regency.

2. Materials and Methods

The study was carried out in Karanggintung Village, Sumbang District, Banyumas Regency because it is the most corn-producing villages in Sumbang District. and this research was carried out 9 months, from Desember to August 2018. Data collection activities are carried out for 3 months, from February to April 2018. Survey method was used in this research with 37 farmers as respondent who still become the member of farmer group that is the Luhur Ngudi Rahayu Gapoktan. Sample was taken by using purposive sampling method. Data was collected by using three types of techniques that were observation, interviews, and documentation. The data included primary and secondary data.

2.1. Analysis Data

2.1.1. Risk Analysis. The risk of cost, production, and price are analyzed by using the coefficient of variation (CV).

a. Risk of Cost. Risk of cost is calculated as the following formula [6]

\[
CV_c = \frac{\sigma_c}{Q_c}
\]

Where:
\(CV_c\) = coefficient variation of cost
\(\sigma_c\) = standard deviation of cost
\(Q_c\) = average farm corn production costs (Rp)

b. Risk of Production. The following formula use to determine the risk of production [7]:

\[
CV_y = \frac{\sigma_y}{Q_y}
\]

Where:
\(CV_y\) = coefficient variation of production
σ_y = standard deviation of production
Q_y = average corn production (kg)

c. Risk of Price. The risk of price is determined by using the following formula[8]:

\[ CV_p = \frac{\sigma}{Q_p} \]

Where:
CV_p = coefficient variation of price
\( \sigma \) = standard deviation of price of corn
Q_p = average price of corn (Rp)

d. Standard Deviation. To calculate the standard deviation (\( \sigma \)), it uses the following formula:

\[ V = \sqrt{\frac{\sum_{i=1}^{n}(E_i - E)^2}{n - 1}} \]

Where:
V = standard deviation
E = average cost, production and price of corn
E_i = cost, production, and price of corn received by farmers
n = number of respondents/sample

According to Saragih [9], if the CV value is greater than 0.5 means that farmers will bear high risk or loss, and vice versa.

2.1.2. Quadratic Utility Function

Quadratic Utility Function Model and Neumman-Morgenstern technique that is enhanced with neutral probability were used to analyse farmers' behaviour towards risk [10]. The following is the formula:

\[ U = \gamma_1 + \gamma_2M + \gamma_3M^2 \]

Where:
U = utility value
M = expected income at the balance point (rupiah value from CE)
\( \gamma_1 \) = intercept
\( \gamma_2 \) = indifference income coefficient (certainty equivalent)
\( \gamma_3 \) = farmer's risk coefficient

Where:
\( \gamma_3 = 0 \) : risk neutral
\( \gamma_3 < 0 \) : risk averter
\( \gamma_3 > 0 \) : risk lover

2.1.3. Analysis Multiple Regression

To determine the factors that influence farmer behaviour on the risk of corn farming, multiple linear regression analysis was used with the following formula [11]:

\[ \gamma_3 = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5D_1 + E \]

Where:
\( \gamma_3 \) = risk coefficient of corn farmers
\( \beta_0 \) = intercept
\( \beta_1 \) = regression coefficient
\( X_1 \) = age of farmer (year old)
\( X_2 \) = harvest area (ha)
\( X_3 \) = years of formal education (year)
\( X_4 \) = experience of farming (year)
\( D_1 = \) dummy variable (member of farmer group)
0 ; inactive member
1 ; active member

3. Results and Discussions

3.1. Characteristic of Farmer

3.1.1. Farmer’s Age

Table 2. Characteristic of Farmer Based on Age in Karanggintung Village, Sumbang Subdistrict, Banyumas District

| Number | Age’s Category (Years) | Number of Respondent (Person) | Percentage (%) |
|--------|------------------------|-------------------------------|----------------|
| 1      | 40-49                  | 6                             | 16.22          |
| 2      | 50-59                  | 14                            | 37.84          |
| 3      | 60-69                  | 12                            | 32.43          |
| 4      | 70-79                  | 3                             | 8.11           |
| 5      | 80-89                  | 2                             | 5.41           |
| Total  |                        | 37                            | 100            |

Source: Primary Data Processed, 2018

From Table 2, it is shown that age of respondents is mostly around 50 to 69 years old. It means that they are in unproductive age.

3.1.2. Education

Table 3. Characteristic of Farmer Based on Years of Formal Education in Karanggintung Village,

| Number | Education              | Number of Respondent (Person) | Percentage (%) |
|--------|------------------------|-------------------------------|----------------|
| 1      | Elementary School      | 20                            | 54.05          |
| 2      | Junior High School     | 1                             | 2.70           |
| 3      | Senior High School     | 16                            | 43.24          |
| Total  |                        | 37                            | 100.00         |

Source: Primary Data Processed, 2018

Farmers’ education is mostly in elementary schools level as many as 20 respondents. Low level of education makes it difficult for farmers to accept and adopt new innovations and information that provided by relevant officials and agencies.

3.1.3. Harvest Area and The Status of Land

Table 4. Characteristic of Farmer Based on Land Area and the Status of Land Ownership in Karanggintung

| No  | Harvest Area (Ha) | Status of Land (Person) | Percentage (%) |
|-----|-------------------|-------------------------|----------------|
|     |                   | Self-ownership | Rent | Self-ownership | Rent |
| 1   | 0.5-1             | 22              | 12   | 59.46         | 52.17 |
| 2   | 1.1-2             | 14              | 10   | 37.84         | 43.48 |
| 3   | >2                | 1               | 1    | 2.7           | 4.35  |
| Total|                   | 37              | 23   | 100           | 100   |

Source: Primary Data Processed, 2018
The majority of harvest area owned by farmers is between 0.5–1 ha, the status of land owned by the respondents is self-ownership or “bengkong” land (gifted land by local government).

### 3.1.4. The number of Family Members

Table 5. Characteristic of Farmer Based on The Number of Family Members in Karanggintung Village, Sumbang Subdistrict, Banyumas District

| Number | Family Members (Person) | Number of Respondent (Person) | Percentage (%) |
|--------|-------------------------|-------------------------------|----------------|
| 1      | 1-2                     | 11                            | 29.73          |
| 2      | 3-4                     | 19                            | 51.35          |
| 3      | 5-6                     | 6                             | 16.22          |
| 4      | 7-8                     | 1                             | 2.70           |
| Total  |                         | 37                            | 100            |

Source: Primary Data Processed, 2018

Majority, the number of farmer family members is 3 people. This is possible for farmers to use other labor to carry out their farming activities.

### 3.1.5. Experience of Farming

Table 6. Characteristic of Farmer Based on Experience of Farming in Karanggintung Village, Sumbang Subdistrict, Banyumas District

| No   | Experience of Farming (Years) | Number of Respondent (Person) | Percentage (%) |
|------|-------------------------------|-------------------------------|----------------|
| 1    | 2-8                           | 6                             | 16.22          |
| 2    | 9-15                          | 8                             | 21.62          |
| 3    | 16-22                         | 8                             | 21.62          |
| 4    | 23-29                         | 4                             | 10.81          |
| 5    | 30-36                         | 6                             | 16.22          |
| 6    | 37-43                         | 1                             | 2.70           |
| 7    | 44-50                         | 4                             | 10.81          |
| Total|                               | 37                            | 100.00         |

Source: Primary Data Processed, 2018

Farmers who have long experience in farming will be able to increase productivity and able to read situations and conditions. The average experience of farming farmers is 22 years. Most farmers carry out corn farming for generations from their parents.

### 3.1.7. Main Occupation

Table 7. Characteristic of Farmer Based on Main Occupation in Karanggintung Village, Sumbang Subdistrict, Banyumas District

| Number | Main Occupation            | Number of Respondent | Percentage (%) |
|--------|----------------------------|-----------------------|----------------|
| 1      | Farmer                     | 26                    | 70.27          |
| 2      | Village Apparatus          | 7                     | 18.92          |
| 3      | Construction Laborers      | 1                     | 2.70           |
| 4      | Merchant                   | 2                     | 5.41           |
| 5      | Driver                     | 1                     | 2.70           |
| Total  |                           | 37                    | 100            |

Source: Primary Data Processed, 2018
Agriculture is still a reliable occupation for respondent. It is showed in table that as many as 26 people working as farmers.

3.1.8. Active Member of Farmer Group

Table 8. Characteristic of Farmer Based on Active Member of Farmer Group in Karanggintung Vilage, Sumbang Subdistrict, Banyumas District

| No. | Source        | Number of Respondent (Person) | Percentage (%) |
|-----|---------------|------------------------------|----------------|
| 1.  | Active        | 16                           | 43.24          |
| 2.  | Inactive      | 21                           | 56.76          |
| Total|               | 37                           | 100            |

Source: Primary Data Processed, 2018

All respondents are the member of farmer groups in the Karanggintung village. There are Ngudi Rejeki, Sri Rahayu, and Tani Luhur farmer groups. Out of 37 respondents, 16 farmers are still active in the group.

3.2. Analysis of Risk

3.2.1. Risk of Cost

Table 9. Risk of Costs of Corn Farming in Karanggintung Village, Sumbang Subdistrict, Banyumas District, 2017

| No. | Source               | Total               |
|-----|----------------------|---------------------|
| 1.  | Average cost         | 18,843,168          |
| 2.  | Standard Deviation   | 10,096,891.05       |
| 3.  | Coefficient Variation| 0.534               |
| 4.  | CV (%)               | 53.4                |

Source: primary data processed, 2018

Table 9 shows that the coefficient of variation is greater than 0.5. It means that the level of risk of corn farming costs borne by farmers is high or there is a chance of loss. This is due to variations of variable cost that is cost input production such as seeds, fertilizer and labor from outside of family member.

The price of chemical fertilizers often to increase that affected the amount of fertilizers to purchase even though the use of chemical fertilizers is the most important input in supporting their farming activities. In addition, the difficulty of getting fertilizers is also one of the obstacles that faced by farmers. Farmers often find out of stock of fertilizer in nearest stores in the village so farmers usually have to wait until the fertilizer is available. Farmers are not allowed to buy fertilizer outside of the village. Due to waiting time, farmers have to delay their farming activities or have to do farming activities without using the type of fertilizer needed so that it can affect production.

Seeds price is expensive and always fluctuated. Farmers will have to keep buying it even though they have to pay more for the continuity of their farming. However, the high price of seeds is not followed by the quality of the seeds themselves. This is again will affect production.

The difficulty of getting the labour is also an obstacle for farmers because the labours who work in agriculture are not in the productive age anymore, and least regenerate of young people who want to do work in agriculture. To get the labour, farmers usually have to be willing to spend more money to hire them.

3.2.2. Risk of Production

The risk of production of corn farming system in Karanggintung Village, Sumbang District, Banyumas Regency, with the coefficient of variation (CV) analysis can be seen in Table 10.
Table 10. Risk of Production of Corn Farming in Karanggintung Village, Sumbang Subdistrict, Banyumas District, 2017

| No. | Source                  | Total  |
|-----|-------------------------|--------|
| 1.  | Average Production      | 9,465  |
| 2.  | Standard Deviation      | 4277.08|
| 3.  | Coefficient Variation   | 0.452  |
| 4.  | CV (%)                  | 45.2   |

Source: Primary Data Processed, 2018.

Result shows that the risk of corn production is low because it is less than 0.5. It means that farmers can avoid losses. Farmers have anticipated several problems or obstacles that will be faced, including the use of seeds that are appropriate to the season. Before cultivating the farm, farmers will predict the weather during the planting season. It can be done by noticing at the weather in a certain period of time. If the weather is hot, farmers will use seeds that are resistant in dry or hot conditions, but if the weather is often rainy, farmers will usually use seeds that are resistant to rain.

3.2.3. Risk of Price

The risk of price corn farming system in Karanggintung Village, Sumbang Subdistrict, Banyumas District, can be seen in Table 11.

Table 11. Risk of Price of Corn Farming System in Karanggintung Village, Sumbang Subdistrict, Banyumas District, 2017

| No. | Source                  | Total |
|-----|-------------------------|-------|
| 1.  | Average Price           | 3,665 |
| 2.  | Standard Deviation      | 462.01|
| 3.  | Coefficient Variation   | 0.126 |
| 4.  | CV (%)                  | 12.6  |

Source: Primary Data Processed, 2018.

The risk level of price is low or farmers avoid losses. Usually, the farmers sell their crops in the form of dry shells. Farmers dried the corn so that they could sell corn at a higher price.

3.3. Farmer Behavior Towards The Risk of Corn Farming System

The behaviour of farmers towards the risk of corn can be identified after CE value and utility value are calculated.

Table 12. Farmer Behavior towards the Risk of Corn Farming System in Karanggintung Village, Sumbang Subdistrict, Banyumas Regency

| No  | Type of Risk  | Number of Farmer | %    |
|-----|---------------|------------------|------|
| 1   | Risk Averter  | 26               | 70.27|
| 2   | Risk Neutral  | 7                | 18.92|
| 3   | Risk Lover    | 4                | 10.81|
|     | Total         | 37               | 100  |

Source: Primary Data Processed, 2018.

It can be concluded that farmers in Karanggintung Village, Sumbang Subdistrict, Banyumas Regency tend to be reluctant to the risk of farming. This is because the farmers owned the land or inheritance from parents. There are also farmers who rent some land to increase the production although
they owned cultivation land. The ownership status has a considerable influence on whether farmers are reluctant to face the risks or not. According to Soekartawi [10], farmers who have land are usually not fully aware of the good opportunities they have to develop their farms and also because they feel that they are not being chased by rent or production sharing agreements, so that these cause farmers to have less motivation to increase their production.

In contrary, tenant farmers tend to bear risks. It is evident that the coefficient of utility function estimation on 3 of 4 farmers who take the risk shows a positive sign. It means that farmers tend to behave willing to take risk. It shows that farmers who rent the land have a stronger encouragement to develop their farms because of high price of land rent that requires farmers to work more efficient.

3.4. Determining Factors on Farmers Behavior to the Risk of Corn Farming

Table 13. Multiple Regression Analysis of Determining Factor on Farmer Behaviour

| Variabel                  | Coefficient | T    | Sig  |
|---------------------------|-------------|------|------|
| (Constant)                | 0.852       | 19.486 | 0.000 |
| Age of Farmer             | 0.012       | 1.001 | 0.325 |
| Harvest Area              | 0.020       | 5.434 | 0.000 |
| Years of Education        | 0.032       | 6.667 | 0.000 |
| Farming Experience        | 0.007       | 2.233 | 0.033 |
| Member of Farmer Group    | 0.006       | 1.676 | 0.104 |

\[ R\text{-squared} = 0.693 \quad F\text{-statistic} = 14.020 \]

Source: Primary Data Processed, 2018.

The F calculate is obtained at 14.020 with a significance of 0.000. Therefore the value of F calculate is greater than F table: 14.020 > 2.679 (confidence level 95%) and the significance value is 0.000 is less than 0.05. This implies that the variables of farmer age, harvest area, years of education, experience in farming, and active dummy of farmer groups together have a significant effect on farmers' behaviour to risk.

From Table 13 it is also known that the t calculate value of the variable land area, years of education, and experience is greater than the value of t table (2.040) at a confidence level of 95% and a significance value of 0.000 is less than 0.05. It can be concluded that the variable of harvest area, years of education, and experience of farming have a significant effect on farmers' behaviour to risk, while the variable of age, active member of farmer group are not significant based on Table 13, the equation of multiple linear regression analysis is written as below:

\[ y_3 = 0.852 + 0.012X_1 + 0.020X_2 + 0.032X_3 + 0.007X_4 + 0.006D_1 + E \]

3.4.1. Harvest Area

The larger the land owned by farmers, the greater the opportunity for farmers to be able face the risk. This is indicated by the value of the regression coefficient of harvest area variable with a positive value. To cultivate corn is actually a risky decision because of the uncertainty factor in conducting farming. Therefore, cultivating corn on a large area is only can be done by farmers who want to bear the risk. Cultivating corn on large area means they can have opportunity to get greater profits even with a greater risk.

3.4.2. Years of Education

Years of education influences farmers' behaviour towards risk. The higher education they have, the more rational they face problems or accept failure on their cultivation. Farmers with higher education usually have a sharp minded than farmers with low education. In addition farmers with higher education absorb
more new innovations in case of applying high technology, and tend to be brave to face risk than farmers who use simple technology levels [5].

3.4.3. Farming Experience
The longer they cultivate their farm, the more experience they have, and the more ability they have to solve the problems. With the experience, farmers can predict future condition which usually used as a basis of making risky decision [10].

4. Conclusion
The risk level of corn farming costs tends to be high due to variations in the costs of using production inputs. The level of production risk and the price of small corn farming is due to the strategy or planning that has been established by farmers and farmers who usually sell their corn harvest in dry shell form so as to increase the selling price.

Farmers of corn farming in Karanggintung village tend to be reluctant to risk because farmers mostly own land ownership which causes farmers to not have the motivation to increase their production. Farmer behaviour towards the risk of corn farming in Karanggintung Village, Sumbang Subdistrict, Banyumas Regency is influenced by the size of the land, the length of formal education and the experience of farming.

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