Red Chili Agribusiness and the Risks Faced by the Farmers

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Abstract. Red chili is a commodity with high economic value, yet it has high risks. It can be observed from the price fluctuation as a result of the unstable supply, while it has a high demand from the consumers. In red chili agribusiness, farmers are one of the actors who play a role in the on-farm sub-systems, but their performance is affected by other sub-systems. Therefore, it is important to study the level of the risks, the sources of the risks, and the weakest sub-system in the red chili agribusiness. This research was conducted in Sukalaksana Village, Banyuresmi District, Garut Regency, which is one of the red chili production centers in Indonesia. The research was performed using a survey method with a descriptive analysis technique and a risk analysis. The results showed that the red chili farming possesses high risks, shown by the coefficient of variation (CV) of production risk (CV = 0.69), cost risk (CV = 1.25), and income risk (CV = 2.11). The main source of risks in the red chili farming is weather changes, which make the chilies very prone to pests and diseases. Meanwhile, the weakest sub-system in the red chili agribusiness is marketing sub-system because the farmers have to face a monopsonistic market, namely a middleman, which creates an income risk. Therefore, the farmers need assistance to perform risk mitigation, and there have to be institutional supports to increase their bargaining position.

1. Introduction
Indonesian people are very fond of chilies because they use its spicy taste as a complementary ingredient in their dishes. Therefore, chilies are an important commodity to meet the household needs. Besides, chilies are also used as the raw materials in the chili processing industry, and in the medicine or herbal medicine industry. In general, chilies contain many nutrition and vitamins, including calories, protein, fat, carbohydrate, calcium, vitamin A, vitamin B1, and vitamin C [1], [2]. According to Swastika, et al. [3], red chilies also contain L-asparaginase and capsaicin, which act as anti-cancer substances [3]. Red chilies are also classified as a commodity with high economic value, but their unstable availability causes price fluctuation. The price of red chilies fluctuates almost every year, particularly at the beginning of the rainy season. It happens because the red chili stock in the market decreases due to the less optimal production, while the consumer demand remains the same or even increases in some special occasions [4].

This condition brings about a high production risk and income risk to the farmers. The presence of the production risk is perceptible from the trend of the national chili productivity over the past five years, which had fluctuated and tended to decline. Based on Figure 1, throughout 2013 to 2015, the...
productivity of large chilies continued to increase with a growth of 6%. The highest productivity was achieved in 2015 at 8.65 tons/ha. After that, the productivity decreased until 2017 [5].

![Productivity of red chilies in 2013-2017](image)

**Figure 1.** Productivity of red chilies in 2013-2017

One of the areas with a high chili production in Garut Regency is Banyuresmi District. The development of production and harvested area shows a trend that tends to increase. The highest production, harvested area, and productivity of large chilies occurred in 2017 with a production of 9,163 tons, a harvested area of 613 ha, and a productivity of 15 tons/ha. However, Sukalaksana Village as one of the villages in Banyuresmi has the lowest chili productivity, which was only 12.8 tons/ha [6]. This was due to various farming risks, such as production, cost, and income risks faced by the farmers. According to Ekaria, et al. [7], production risks have an impact on crop failures or a decrease in the number of harvests of the expected yield. Meanwhile, cost risks involve the amount of production costs incurred in farming, while income risks implicate the fluctuation in selling prices and an increase in production facility prices. Accordingly, the production risk of red chilies is certainly not a stand-alone result of the farming sub-systems (on farm), but there are other agribusiness sub-system links. Therefore, it is important to systematically study the red chilies in terms of all sub-systems in the red chili agribusiness systems.

2. Literature Review

Agribusiness system is a set of business activities that involve one or all of the production chains, processing and marketing, related to agriculture in a broad sense, including business activities that support agricultural activities and are supported by agricultural activities [8]. As a system, agribusiness consists of several subsystems, such as: 1) procurement and production facility distribution subsystem, 2) agricultural or farming production subsystem, 3) agricultural product processing or agro-industry subsystem, 4) agricultural product marketing subsystem, and 5) supporting subsystem. The five subsystems must run in an integrated manner so that the agricultural system runs efficiently. If one of the subsystems does not work well, the agricultural system will be paralyzed or there will be a waste in the use of production resources that will increase production costs, marketing costs and prices of agricultural products at the end consumer level.

In agribusiness activities, there are several risks faced by the farmers. Risk is generally defined as an opportunity for an undesired outcome that results in a loss or disadvantages [9], [10], [11]. Furthermore, Debertin [12] stated that risk is an event that is likely to arise and cause fluctuations in the results, whereby the likelihood or probability of the obtained results can be estimated. Risk originates from upstream to downstream and emerges from each of different agribusiness subsystems. Seed and fertilizer inputs are risk-enhancing factors. This is because the use of seeds and fertilizers must follow a certain dosage, so when their use does not comply with the recommended dosage, it can...
increase the production risk [13]. The perishable nature of agricultural products has a major impact on the loss of agricultural products. Furthermore, Steven J and co-workers [14] pointed out that the main risks in the agricultural sector, especially those in the supply chain, consist of climate and weather risk, natural disaster risk, biological and environmental risk, market risk, logistical and infrastructure risk, as well as managerial and operational risk. In addition, risks are dynamic and have interdependencies between one another.

3. Materials and Method

This research was conducted in Sukalaksana Village, Banyuresmi District, Garut Regency, since this location was one of the villages that develops a red chili production centre. The method used in this study was survey method. The survey method was used to obtain data from a particular place that is natural (not artificial) by distributing questionnaires and structured interviews [15].

Determination of the samples was performed using a simple random sampling, while the number of sample farmers was determined by using the Slovin formula, resulting in 40 samples. The analysis technique used to explain the red chili agribusiness system was descriptive analysis, and the magnitude of risks was measured based on the following parameters:

a) Expected value (\(\bar{x}\))

The expected value was calculated as the average production (kg/ha), cost (IDR/ha) and income (IDR) formulated as in Equation 1:

\[
\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}
\]

\[\text{Equation 1}\]

where:
- \(x_i\) = production (kg/ha), cost (IDR/ha), or income (IDR)
- \(i\) = respondents
- \(n\) = the number of respondents

b) Variance (\(S^2\))

\[
S^2 = \frac{\sum_{i=1}^{n} (X_i - \bar{x})^2}{n-1}
\]

\[\text{Equation 2}\]

c) Standard deviation (S)

\[
S = \sqrt{S^2}
\]

\[\text{Equation 3}\]

d) Coefficient of variation (CV)

\[
CV = \frac{S}{\bar{x}}
\]

\[\text{Equation 4}\]

e) Lowest limit (L)

\[
L = \bar{x} - 2S
\]

\[\text{Equation 5}\]

To estimate the risks, we calculated variance, coefficient of variation (CV), and highest lower limit (L). If the CV \(\leq 0.5\), then \(L \geq 0\). On the other hand, if CV \(> 0.5\), then \(L < 0\). It implies the following:

a) CV \(\leq 0.5\) means that the farmers could avoid the risks in large red chili farming practices.

b) CV \(> 0.5\) means that the farmers will probably face risks in implementing large red chili farming.
4. Results and Discussion

4.1 Chili Agribusiness in Sukalaksana Village

The production facilities needed for the farming of red chilies in Sukalaksana Village consist of seeds, fertilizers, pesticides, mulch, and agricultural equipment and machineries. The production facilities are obtained from agricultural shops in the village, but the agricultural equipment such as hoes and sprayers are purchased from agricultural equipment stores in Garut City. The seeds used are victor and pertiwi varieties. The type of manure used is quite uniform, which is the chicken manure. The chemical fertilizers used are NPK, TSP, ZA, KNO₃, KCl, and urea fertilizers in various combinations for each farmer. The pesticides used by the farmers also vary, consisting of curacron, demolish, amistar, and abacel. The farmers also use antracants to overcome fruit flies.

The average age of the large chili plants in Sukalaksana Village is 6 months. In the planting season of 2018/2019, the chili cultivation began in early November 2018 until April 2019. After the chili planting period is over, the farmers leave the former chili planting land until the next rainy season to be planted with chilies again. The large-chili plants can be harvested from the age of 90-100 days. The chilies are harvested in green condition because the farmers already have a fixed market to sell green chilies. The chilies can be harvested 6-12 times, depending on the maintenance and environment condition. The chilies are harvested by picking the fruits, collecting them in a gazebo for sorting, and then putting them in a sack. The chilies that have been harvested are then transported to the house of the middleman to be weighed and sold.

The chilies in Sukalaksana Village are sold in a fresh form to minimize the processing and post-harvest handling. Sacks of chilies that have been collected and weighed are sent directly to the destination market by trucks. The chilies are marketed by the middleman to several markets outside Garut. The middleman will pay for the chili harvest after the chilies are sold. The farmers act as the price taker, and the middleman as the price determinant. The large chili marketing channel in Sukalaksana Village can be described as in Figure 2.

![Figure 2. Marketing Channel of Red Chilies in Sukalaksana Village](image)

In Sukalaksana Village, there are no chili farmer groups, so counseling activities are carried out on the land or in a house of one of the farmers. The chili farmers in Sukalaksana Village are accustomed to relying on the middleman (broker) to help with the farm capital because it is easier than borrowing from a bank. The middleman will provide a set of production facilities as an initial capital for the chili business on a condition that the farmers must sell the harvest to the city. The absence of the farmer groups or cooperatives make the farmers dependent on the middleman, which is evidenced by the extensive role of the middleman in every chili agribusiness subsystem in Sukalaksana Village.

4.2 Risks in Red Chili Agribusiness

The sources of risks in the large-red-chili farming in Sukalaksana Village included weather conditions. The large-red-chili farmers in Sukalaksana Village utilize dry land to plant the chilies so that the
planting has to be done in the rainy season. They use rainwater collected in reservoirs to irrigate the plants. However, in reality, the rainy season causes large-red-chili plants to face a variety of risks, one of which is the decay of roots, stems, and leaves. This condition makes the large-red-chili plants deceed slowly. Furthermore, weeds grow very rapidly during the rainy season, which harm the large-red-chili plants. The spread of anthracnose disease is also very prolific during the rainy season because the fungus can spread through splashes of rainwater or spray equipment, affecting parts of the fruits that have not been infected. This is in line with the research by Situmeang [16] and Syamsiyah, et al. [17] which stated that natural conditions, such as weather and climate, become an uncertainty because they are part of the risks that must be faced by farmers.

The price of production inputs, especially pesticides, increase every year, creating a large amount of farming expenses. Accordingly, the income received by the farmers is reduced. This is in line with Suharyanto [18] which stated that the increasing use of pesticides without taking care of the threshold certainly has a negative impact because it will increase the production costs in addition to threatening the presence of natural enemies and even increasing pest and disease resistance.

Red chili is one of the commodities which have a quite large price fluctuation. The price fluctuation is basically due to an imbalance amount of demand and supply in the market. The price will increase if the demand exceeds the supply, and vice versa, the price will decrease if the number of supply exceeds the demand. The price fluctuation is often more detrimental to farmers than to traders because in general farmers cannot adjust the time of sale to obtain a favorable selling price.

In addition to the risks by the input prices, the price of output is also risky because often the price of chilies fluctuates. In the harvest season, when the chili production is abundant, the price of red chilies can dramatically decrease. The price of large red chilies will rise when approaching Eid holidays due to the increasing demand for red chilies from the consumers.

4.2.1 Farm Risk Analysis
The calculation results of production risk, cost risk, and revenue risk are shown in Table 1.

| Description             | Production (kg) | Cost ( IDR/ha) | Income ( IDR) |
|-------------------------|-----------------|----------------|---------------|
| Average                 | 4,225           | 12,845,800     | 9,060,450     |
| Standard Deviation      | 2,918           | 16,140,232     | 19,089,535    |
| Coefficient of Variation| 0.69            | 1.25           | 2.11          |
| Lowest Limit (L)        | -1,610          | -19,434,664    | -29,118,621   |

It shows that the average chili production is 4.23 tons/ha, with an average cost of IDR 12,845,800 per ha and net income of IDR 9,060,450. Standard deviations for production, cost and income risks are very large which shows a high level of difference. The level of risk is also high, which is indicated by the coefficient of variations of the production, cost, and income risks that are more than 0.5. If the coefficient of variations is more than 0.5, the lower limit will be negative, which indicates that the chili farming has a big risk opportunity. This condition is consistent with the research conducted by Lawalata [19] on shallots as indicated by the coefficient of variation of more than 0.5 and a negative lower limit value. The risk of cost generally occurs due to the large expenses incurred for farming, especially the costs for pesticides. The high cost of production results in an income reduction, especially as the chili farmers in Sukalaksana sell their chilies in the form of green chilies which are sold to the middleman at the village level.

In marketing the chilies, the farmers receive a fixed price based on the quantity and quality of the harvested chilies so that prices fluctuate. The middleman acts as the price maker that determines the price, and the farmers acts as the price taker. This condition is different from the results of a research by Karyani et al. [20] in Cigedug and Ciamis which showed that farmers have gathered in cooperatives to meet buyers so that they are able to have a bargaining position.
There are several reasons for the farmers in Sukalaksana Village for selling the large chilies to the middleman. First, the farmers do not want to bear the costs of transportation if the chilies are sold directly to the market. The farmers feel facilitated by the presence of the middleman coming with a vehicle so that the farmers do not need to rent one to transport their chilies. Second, the farmers would prefer to sell their large red chilies as soon as possible and acquire money right after the harvest rather than leave them withered and unsuitable for sale. Third, there is an attachment between the large-red-chili farmers and the middleman that is difficult to dissipate because it is based on a mutual need. The farmers need the middleman as a loaner and a seller of the large-red-chili yields. Accordingly, the middleman needs the farmers in order to gain benefits from the capital loans they lend and the profits from the large-red-chili sale. This condition shows that farmers’ access to formal financial institutions is still low [21, 22]. According to Sulistyowati [23], in addition to providing loans for input and capital needs, the middleman can also provide directions on the types of commodities required by the market and the technology needed. In consequence, transaction costs can be reduced. Additionally, the middleman has the role of coordinating the market value chain to better meet the consumer needs. However, all agreements between the farmers and the middlemen (traders) are not based on formal agreements or contracts on papers. This is because the transactions with smallholder farmers are mostly done in small volumes, which makes the formal arrangements too expensive.

5. Conclusions
In the large-red-chili agribusiness system of Sukalaksana Village, we found that the marketing and supporting subsystems are the weakest sub-systems. In the marketing subsystem, the chili farmers only sell their chilies to the middleman so that the farmers receive the price from the middleman as the price determinant. In the supporting subsystem, the farmers do not have an institution as a platform to jointly fight for their rights.

Furthermore, the sources of risks in the large-red-chili plants in Sukalaksana Village comprise caterpillar pests, thrips pests, anthracnose fruit rot (patek), weather conditions, and agricultural production facilities. These sources create a high production risk, cost risk, and income risk in conducting the large-red-chili farming, indicated by the value of coefficient of variations of more than 0.5. The income risk is the highest risk, suggested from the highest coefficient of variation compared to the other two risks. It occurs because of the accumulation of production risk and cost risk, the poor quality of the chili production affected by pests and diseases, a high production facility cost, and the price fluctuation.

This study advises that in marketing the chilies, institutional supports are needed to increase the farmers bargaining position. In addition, the farmers need to be convinced to market the chilies in the form of red chilies (instead of green chilies) by risk mitigation to anticipate the emerging risks.

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