Analysis of probability value of risk and its influence on agribusiness of citrus cultivators (case: Parbuluan IV Village, Parbuluan Subdistrict, Dairi District)

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Abstract. The production and price of citruses in the Parbuluan IV Village were very fluctuating. The citrus production has dropped dramatically from 2014 until 2016. From the productions and price, it is known that there is a probability of risk in this area. The purpose of this study was to analyse the types of risks faced by citrus agribusiness actors and analyse the value of risk probability and its effect on citrus agribusiness actors in Parbuluan IV Village. The method to determine the research area used was the purposive sampling method so that the research was conducted in Parbuluan Village IV. Parbuluan Village IV was chosen because the productivity of citrus was decreasing in recent years and the price selling of citruses at the farmers level had not comparable with the price selling of citrus at the consumers level. The results showed that the risks faced by agribusiness actors consist of internal risks and external risks. The probability value of production risk of 57.14% means that the chance of risk to occur is high and the probability value of price risk of 46.02% means that the chance of risk to occur is low.

1. Introduction
Citrus production centres are almost spread throughout Indonesia mainly in the provinces of North Sumatra, West Kalimantan, South Kalimantan, East Java, and South Sulawesi. North Sumatra occupies the second largest contributor of citrus production after East Java of 26.92%. In 2015, Dairi District was one of the highest citrus production centres after Karo District and Simalungun District with production reaching 52,405 tons [1].

The development of citrus producer prices in North Sumatra tends to increase with an average growth of 9.30% per year. In 1983 the price of citrus producers was IDR 460 per kg then increase to IDR 7,293 per kg by 2015, but in 2016 the price of citruses drops to IDR 6400 - IDR 5000 per kg [1]. The fluctuations in the price of citruses of both producers and consumers side can be seen in Figure 1 and Figure 2.
Figure 1. Fluctuation of citrus production in Dairi District

Figure 2. Fluctuation of producer and consumer price of citruses from 1983 until 2015 in North Sumatera Province

From both figures, it is known that fluctuating production allows the internal risks to be faced by farmers so that the production will fluctuate and tends to decrease. Then the price fluctuations at the producer level allow an external risk to be faced by farmers. Figure 2 shows that there is a gap between producer price and consumer price at 2007-2015. The existence of probability and the possibility of internal risk and external risk affect citrus agribusiness actors in making a decision.

2. Materials and methods

2.1. Determination method of research areas and sampling
This research was conducted in Parbuluan Village IV, Parbuluan District, Dairi District, North Sumatra Province. Site determination was based on the decline of citrus production and productivity in the research area and fluctuations in the high selling price of citrus in the study area [2]. The study population is citrus farmers on agribusiness farm in Parbuluan Village IV. The sample size of 54 citrus farmers was counted using Slovin method from the population size of 122 farmers. Sampling was taken by using the Simple Random Sampling method.
2.2. Data analysis method
The descriptive method is the scientific procedures that was used to describe the types of internal risk (production risk) and the types of external risk (price risk) faced by the citrus agribusiness actors as well as a state or phenomenon that occurs [3] based on data from direct interviews to the sample farmers with questionnaires.

Analyse the risk probability: Probability is often translated as an opportunity or possibility, and an event defined as the probability of an event [3]. The method used to determine the possibility of risk is the standard value (z-score) method. The z-score method is a method that uses a number that indicates how far a value deviates from its average on a normal distribution. By knowing the amount of z-score then it is also known the possibility of production risk and price risk to occur.

\[ Z = \frac{X_{\text{bond}} - X}{S} \]  

Description of equation (1); \( Z = \) Z-score; \( S = \) Average value of production and price; \( X_{\text{bond}} = \) Risk limits which considered beneficial (variance value). Decision-making criteria; \( H_0: \) If \( Z \) table < 50%, then the risk probability to occur is low, and if \( H_1: \) \( Z \) table \( \geq 50\% \), then the risk probability to occur is high. The probability of production risk and price risk is derived from the value of the z-distribution table [4].

3. Results and discussion

3.1. Types of risks faced by citrus agribusiness actors
The internal risks are directly caused by the farmer's negligence in controlling, forecasting, and identifying the causes of those risks. The internal risks of citrus agribusiness are any kind of risk that can still be controlled, foreseen, identified and prevented by the farmers themselves.

Table 1. Types of internal risk in Parbuluan Village IV, Parbuluan District, Dairi District

| No | Type of Risk               | Indication of Influence                                                                 |
|----|---------------------------|----------------------------------------------------------------------------------------|
| 1) | Incomplete land preparation | - Plants cannot achieve maximum production  
- Plants are more susceptible to diseases  
- Improper plant spacing causes the absorption of nutrients is not the same so that the growth is not evenly distributed |
| 2) | Planting                  | - Uneven depths cause the plant is not solid  
- Fertilizers that do not fit the needs of soil and plants will cause the plants to lack or excess nutrients |
| 3) | Fertilization             | - Fertilization during high rainfall causes the fertilizer eroded by water  
- Uneven application of dose so that crop production varies |
| 4) | Pruning                   | - The wrong pruning technique can cause the plants to be less productive  
- Cost of pruning is quite expensive  
- Pesticides are ineffective, and pests are more vulnerable to come back |
| 5) | Pest and disease attacks  | - Fruits damaged/rotten  
- Plants are damaged and cannot produce  
- Production is not maximal  
- The harvested raw fruits are so low in prices and finally become unsold and damaged |
| 6) | Harvest and post-harvest  | - The harvest interval is only 1-2 days so that many fruits are not yet harvested or too ripe for harvesting |
| 7) | Ineffective use of labour | - High labour costs reduce the income of citrus farmers |
External risks lead to non-technical issues that come from outside the farm or the ability of managers to minimize risk. External risks are the result of uncontrollable external factors, predictable and identifiable matters causing the risks and their indicative impact on the sustainability of citrus crops.

Table 2. Type of external risk in Parbuluan Village IV, Parbuluan District, Dairi District

| No  | Risk Type                      | Indication of Influence                                      |
|-----|--------------------------------|--------------------------------------------------------------|
| 1.  | Climate/weather change         | – Prone to pests and diseases<br>– Maintenance costs are high |
| 2.  | The selling price of citruses  | – Prices offered by collectors is low so that the income of farmers is low.<br>– Fluctuations that occur each year varies<br>– The occurrence of natural disasters of Sinabung and landslides that often occur leads to more expensive treatment costs and crop failures |
| 3   | Natural disasters              | – Lack of knowledge of farmers in facing the risk of citrus agribusiness<br>– No sale price set |
| 4   | The role of government         |                                                              |

3.2. Value of risk probability
The probability of the risk value of citrus yield can be measured through cross-section data in the form of the low production data of farmers caused by the harvest failure. The data taken is the percentage of harvesting the present period against the normal percentage.

Table 3. Probability value of citrus production risk in Parbuluan IV Village, Parbuluan District, Dairi District

| Risk Probability | Average | Standard Deviation | Z-rate | Z-table | Risk Probability |
|------------------|---------|--------------------|--------|---------|------------------|
| 87.67%           | 68.30%  | 0.18               | 0.5714 |         | 57.14%           |

The average percentage of current production with normal production is 87.67%. A value of Z of 0.18 with a positive sign indicates that the decline in citrus yields is on the right of the average normal distribution. Risk probability of 57.14% means that H1 accepted so that the farmers chance to get high production risk is equal to 57.14%.

The probability of citrus price risk value can be measured through cross-section data in the form of price data received by farmers per production period. The data taken is a percentage of the current period price against the normal price percentage.

Table 4. Value probability of citrus price risk in Parbuluan IV Village, Parbuluan District, Dairi District

| Risk Probability | Average | Standard Deviation | Z-rate | Z-table | Risk Probability |
|------------------|---------|--------------------|--------|---------|------------------|
| 107.02%          | 70.00%  | -(0.10)            | 0.4602 |         | 46.02%           |

The average current price percentage compared to the normal price is 107.02%. A Z-count value of -0.10 with a negative sign indicates that the decline in citrus yields is on the left of the average normal distribution. Risk probability of 46.02% means the H0 accepted so that the farmers chance to get low price risk that is equal to 46.02%.

The implication of this research is the probability of farmers getting risk is higher on internal conditions compared to external conditions. In internal conditions, the production received by farmers is very volatile. It is caused by farmers who are not good at managing their farming. An extension is
needed so that internal conditions do not cause production to be too low and very volatile. In addition, external risks indicate that the price at the farm level is very volatile, so the risk from the selling price that affects the farmers’ income will threaten. There is the need for an institution to help farmers to stabilize the selling price of citrus at the farm level.

4. Conclusions
Internal risks faced by the cultivators on citrus agribusiness in Parbuluan IV Village are the risk of land mismanagement, planting mistakes, improper use of fertilizers, mismatch on citrus pruning, errors in pest management, harvesting and post-harvest errors, and the inefficient use of labour workforce. External risks faced by farmers on citrus farming in Parbuluan IV Village are climate or weather change, high fluctuation of citrus prices, natural disasters, and government involvement in handling citrus agribusiness. The high probability value of production risk of 57.14% means there is a chance of farmers to get a high-risk return, so farmers have to do proper mitigation technique; and the low probability value of price risk of 46.02% means there is a chance of farmers to get a low-risk return.

References
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