Analysis of distribution risk in Arabica coffee supply chain during pandemic in Aceh Tengah District

R Aprilia, M Y Wardhana*, A Baihaqi, A Nugroho
Agribusiness Department, Universitas Syiah Kuala, Jalan Tgk. Hasan Krueng Kalee 3, Darussalam-Banda Aceh 23111, Indonesia

*Email: yuzan@unsyiah.ac.id

Abstract. Coffee is a plantation commodity that has the opportunity to be developed so as to increase state income. This study aims to determine how the risk of distribution in the Arabica coffee supply chain during the COVID-19 pandemic and to determine the most influential risk in the distribution of the Arabica coffee supply chain during the COVID-19 pandemic in Aceh Tengah District. The data used in this study are primary data and secondary data. This study uses descriptive analysis and ordinal logistic regression analysis. The results of this study indicate that the distribution risk of the Arabica coffee supply chain at the farm level is classified as high risk with a percentage of 87.2%, the distribution risk of the Arabica coffee supply chain at the collector level is in the medium category risk with a percentage of 45.5% and distribution risk Cooperatives began to occur due to the COVID-19 pandemic. From the interpretation results, it is stated that the risk of distribution risk in the Arabica coffee supply chain is the riskiest risk of loss of 0.069 times, then the variable risk of goods being exchanged is 0.036 times and the variable risk of delay is 0.004 times.

1. Introduction
Coffee is one of the plantation commodities that has the opportunity to be developed, in an effort to increase state income and increase the income of entrepreneurs and farmers [1]. Aceh Tengah is one of the main coffee-producing districts in Aceh Province. The majority of the population in Aceh Tengah work in the agricultural and plantation sectors. The number of coffee farmers in Aceh Tengah District reached 38,685 families. Aceh Tengah District is an area that has the largest coffee plantation in Aceh Province. The coffee plantation area in this area reaches 50,408.3 Ha. There are two types of coffee in Aceh Tengah District, namely Robusta coffee with a land area of 1,042 Ha and Arabica coffee with a land area of 49,366.3 Ha [2].

In 2017 coffee exports in Aceh Tengah were able to reach 6,539 tons [3]. In this activity, Arabica coffee dominates exports to foreign countries because this coffee is very popular with foreign consumers, where Arabica coffee has a distinctive aroma. Arabica coffee also has the highest selling price in the world [4]. This factor is one of the reasons it is important to maintain the sustainability of the coffee supply chain in Aceh Tengah. The supply chain has an important role in trading activities, starting from the activity of supplying raw materials to sending products to consumers. The supply chain is a complex system that has elements that are interrelated, orderly, dynamic, have opportunities and have certain goals [5].
The sustainability of the coffee supply chain in Aceh Tengah is in a difficult situation due to an imbalance between distribution and the risks borne by each supply chain actor [6]. In supply chain activities, various risks can be encountered that affect the supply chain flow so that it cannot run smoothly. One of the risks that often occurs in the supply chain process is distribution risk. The risks that occur in this supply chain can cause disruption of the flow of information and resources in the supply chain network due to termination and uncertain variations. Distribution risk is the risk that occurs in economic activities when distributing products from producers to consumers. Distribution activity is one of the factors causing the emergence of risk in agricultural products [7]. The risks that occur in the distribution of the coffee supply chain include risks that occur starting from the production process carried out by farmers until the coffee reaches consumers [8]. So that it can affect the activities of farmers. One of the unexpected events that is happening right now is the COVID-19 pandemic. The current COVID-19 pandemic has disrupted the distribution flow of the Arabica coffee supply chain, both in terms of price declines and buyers also delaying coffee purchases even though they have signed a contract.

Another problem that can be seen is the difficulty of farmers in meeting market demand for Arabica coffee supplies. This occurs due to the high-risk effect of the effect of uncertainty on the amount of coffee production, damaged goods, as well as uncertainty regarding prices [9,10]. Not only that, from the side of traders and cooperatives, there are also many risks, such as coffee being exchanged, coffee received from farmers being damaged, as well as delays in sending coffee to cooperatives, making it difficult for cooperatives to meet market demand. The impact of risk and uncertainty in the coffee supply chain is very large and affects decision making, so this research is needed to be able to determine the risks that can affect the distribution flow of the Arabica coffee supply chain in Aceh Tengah.

2. Research Methods

2.1. Place and time of research

This research was conducted in Kebayakan, Pegasing, and Atu Lintang Sub districts Aceh Tengah District in February 2021. The location of this research was determined purposively with the consideration that Aceh Tengah District is one of the areas with the largest Arabica coffee production in Aceh Province.

2.2. Population and sample

The population used in this study were coffee farmers in the Sub districts of Kebayakan, Pegasing, and Atu Lintang, Aceh Tengah Districts who are members of the Baitul Qirad Cooperative (KBQ) Baburrayyan. The sampling technique was done by simple random sampling. Sampling was done by simple random sampling because the members of the population in this study were considered homogeneous. So, for the number of samples taken from 10% of the existing population. The total population and sample in each sub-district can be seen in the following table:

| No | Sub district          | Population | Sample  |
|----|-----------------------|------------|---------|
| 1  | Kebayakan Sub district| 191 Farmers| 19 Farmers |
| 2  | Pegasing Sub district | 666 Farmers| 66 Farmers |
| 3  | Atu Lintang Sub district | 623 Farmers| 62 Farmers |
|    | Total                 | 1,480 Farmers| 147 Farmers |

Determination of the sample collector using snowball sampling. Snowball sampling is a sampling technique that initially has a small sample size, then enlarges [11]. The number of collector samples for each sub-district can be seen in the Table 2.
2.3. Types and methods of data collection

The types of data used in this study are primary data and secondary data. The method of data collection in this research is to use questionnaires that are distributed directly to the population that is the sample in this study.

2.4. Data analysis method

2.4.1. Descriptive statistical analysis. Descriptive analysis aims to describe or describe a research subject based on the collected sample or population data [12]. Descriptive statistical test will be carried out by processing the data from the questionnaire by tabulating and grouping which is then explained. The data that has been obtained can be seen from the average value (mean), median, mode, standard deviation as well as from the maximum and minimum values [13]. Then the results of the statistical descriptive analysis are presented in tabular form. Rusydi and Fadhli [14] stated that in categorizing data, they were arranged based on the mean ideal (Mi) and standard deviation ideal (SDi), with the following calculation steps:

a. Mi  = \frac{1}{2} (The highest score + Lowest value) \hspace{1cm} (1)
b. SDi = \frac{1}{6} (The highest score – Lowest value) \hspace{1cm} (2)

The distribution risk variables are grouped into 3 categories based on the categorization formula proposed by Azwar [15], as follows:

a. High group  \hspace{1cm} = X \geq Mi + Sdi \hspace{1cm} (3)
b. Medium group  \hspace{1cm} = Mi – Sdi \leq X < Mi + Sdi \hspace{1cm} (4)
c. Low group  \hspace{1cm} = X < Mi-Sdi \hspace{1cm} (5)

2.4.2. Ordinal logistic regression analysis. Regression analysis is a statistical analysis method used to be able to see the effect between the dependent variable (dependent) and one or more independent (independent) variables [16]. Ordinal logistic regression is a statistical model that describes the relationship between a dependent variable (Y) and more than one independent variable (X), where the dependent variable (Y) has an ordinal measurement scale [17]. In the ordinal logistic regression test, there is no need for a data normality test because according to Ghozali, ordinal logistic regression does not require an assumption of normality in the independent variables and also ignores heteroscedasticity [18]. The ordinal logistics model formed is as follows:

\text{Logit} (Y_{1,j}) = \ln \left(\frac{Y_j-1}{1-Y_j-1}\right) = \theta_{j-1} + \beta_1X_{1} + \beta_2X_2 + \ldots + \beta_kX_k \hspace{1cm} (6)

Description:

Y  = Arabica Coffee Farmers Distribution Risk (score)
\ j  = Dependent variable category 1-3 (1 = Low, 2 = Medium and 3 = High)
X_{1,2,k}  = The value of each independent variable
\beta  = A set of parameters to be estimated
\ k  = The independent variable (1-4)

Furthermore, statistical tests were carried out with simultaneous tests and part tests, namely:

1) Full Likelihood Ratio Test

| Table 2. Number of sample collectors for each sub district. |
|-----------------|-----------------|
| No | District                  | Sample      |
|---|-----------------|-----------------|
| 1 | Kebayakan Sub district | 2 Collector   |
| 2 | Pegasing Sub district | 5 Collector   |
| 3 | Atu Lintang Sub district | 4 Collector |
|---|-----------------|-----------------|
| Total |                         | 11 Collector   |
Likelihood ratio test sed to see the effect of all independent variables used simultaneously (simultaneously) on the dependent variable [19]. The hypotheses used are as follows:

$H_0$: All independent variables have no effect on the dependent variable

$H_1$: There is at least one independent variable that affects the dependent variable

If the $p$ value $> \alpha$ then $H_0$ accepted, and the decision taken is that all variables have no effect on the dependent variable. Conversely, if the $p$ value $< \alpha$, then $H_0$ is rejected so that the decision taken is that there is at least one independent variable that affects the dependent variable.

2) Goodness of Fit Test

Goodness of Fit test used to see how well the model generated by the data [20]. The hypothesis is as follows:

$H_0$: The logit model fits the data

$H_1$: Logit model does not match the data

Testing the fit of the model can be seen from the Pearson and Deviance values. $H_0$ will be rejected if the significant value obtained in the Pearson test and deviance is less than $\alpha$ ($p$-value $< \alpha$), which means that the resulting logit model does not match the data [21].

3) Wald Test

Wald test used to test the effect of each independent variable, so that it can be seen which independent variables have a real influence on the dependent variable [22]. The hypotheses used are as follows:

$H_0$: The $i$ independent variable does not affect the dependent variable

$H_1$: The $i$ independent variable affects the independent variable

The $H_0$ hypothesis will be rejected if the significant value is less than ($p$-value $< \alpha$), which means that the $i$ independent variable affects the dependent variable.

4) Parallel Lines Assumption Test

Parallel lines assumption is an important assumption that must be met in the proportional odds model. Parallel lines test is used to test the assumption that each category has the same relationship between the independent variables and the logit for all logit equations. The hypotheses used are:

$H_0$: The model produces the same regression coefficient (slope)

$H_1$: The model does not produce the same regression coefficient (slope)

Hypothesis $H_0$ is rejected if the $p$-value $< \alpha$. Then if the $H_0$ hypothesis fails to be rejected, it means that the slope of the independent variable category has the same value, and the assumption of parallel lines is met.

2.5. Variable limit

Variable limitations in this study are as follows:

1) Distribution risk is the risk that occurs during the production process carried out by farmers to marketing activities starting from the process of delivering coffee from producers to consumers. Measured by score.

2) The risk of loss is the risk that occurs when the coffee cannot reach the consumer due to loss during distribution. Measured by score. (X1)

3) The risk of goods being exchanged is the risk that occurs when the coffee sent by farmers to collectors, from collectors to cooperatives or from cooperatives to exporting countries is exchanged, both in terms of coffee quality and type of coffee at the time of distribution. Measured by score. (X2)

4) The risk of delay is the risk that arises when the coffee sent from farmers to collectors, from collectors to cooperatives, or from cooperatives to export countries does not match the specified time. Measured by score. (X3)

5) The risk of damaged goods is the risk that occurs when the coffee harvesting process carried out by farmers is not good, so that the quality of the coffee harvested is not suitable. The risk of damaged goods also occurs when the coffee sent by the farmer does not meet the specified quality, causing the coffee to be damaged during coffee processing. Measured by score. (X4)
3. Results and discussion

3.1. Distribution risk of farmers in arabica coffee supply chain in Aceh Tengah District

Based on data that has been processed using SPSS version 16, the highest score (Max) is 20, the lowest score (Min) is 12, the average score (Mean) is 18, the median score is 18, the mode (Mode) is 18 and standard deviation of 1.54. Distribution risk at the farmer level in this study is categorized into 3 categories, namely low, medium and high based on the tendency of frequency. The next step is to determine the level of frequency trend, then calculate the value of Mean ideal (Mi) and Standard Deviation ideal (SDi). Mean Ideal by using the formula \( (Mi) = \frac{1}{2} (\text{The highest score} + \text{Lowest value}) \), then standard deviation ideal by using the formula \( (SDi) = \frac{1}{6} (\text{The highest score} - \text{Lowest value}) \).

After obtaining the Mean ideal (Mi) value of 16 and the Standard Deviation ideal of 1.3, then further identification of high, medium and low distribution risk trends at the farm level using the (Mi) and (SDi) values. To find the category is as follows:

- **High Group**: \( X \geq Mi + Sdi \)
  - \( X \geq 16 + 1.3 \)
  - \( X \geq 17.3 \)
- **Medium Group**: \( Mi - Sdi \leq X < Mi + Sdi \)
  - \( 16 - 1.3 \leq x < 16 + 1.3 \)
  - \( 14.7 \leq X < 17.3 \)
- **Low Group**: \( X < Mi - Sdi \)
  - \( X < 16 - 1.3 \)
  - \( X < 14.7 \)

Based on the results of the calculation of the trend of distribution risk variables at the farmer level, the following results are obtained:

**Table 3.** Risk category distribution of arabica coffee farmers in Aceh Tengah District.

| No. | Interval Score | Total | Percentage | Category |
|-----|----------------|-------|------------|----------|
| 1.  | \( X < 14.7 \) | 4     | 2.7%       | Low      |
| 2.  | \( 14.7 \leq X < 17.3 \) | 15 | 10.2% | Medium |
| 3.  | \( X \geq 17.3 \) | 128 | 87.2% | High    |
|     | **Total**     | **147** | **100%**  |          |

Based on the Table 3, we can see that the distribution risk of Arabica coffee supply chain at the farmer level is in the high category with a percentage of 87.2% with a total of 128 respondents, the distribution risk is in the medium category with a percentage of 10.2% with a total of 15 respondents and distribution risk is in the low category with a percentage of 2.7% with a total of 4 respondents. From the explanation above, it can be concluded that the risk of Arabica coffee supply chain distribution at the farmer level in Aceh Tengah District is classified as a high-risk category.

The data for this distribution risk variable was obtained from the results of a questionnaire distributed to 147 respondents. Distribution risk at the farm level in this study was measured by 4 statements. The following is the average score for each statement on the farmer-level distribution risk.

Based on the Table 4, it can be seen that the statement of transportation delays (damaged vehicles, accidents, natural disasters and others) is in the high category with an average score of 4.44, meaning that the distribution of coffee from farmers is still experiencing obstacles to vehicles and disasters that occur when the coffee is distributed. Then for the statement that there are obstacles on farming roads (damaged roads, muddy and others) are also classified as high category with an average score of 4.63, it can be interpreted that there are still obstacles on farming roads such as inadequate roads to the
garden. Furthermore, for the statement that there is a current COVID-19 pandemic event that causes delays in purchasing coffee so that coffee accumulates in warehouses is classified as high category with an average score of 4.37, it means that the COVID-19 pandemic has greatly impacted farmers, causing delays in purchasing coffee which can harm farmers. For the statement of a decline in prices that causes farmers to prefer to store coffee, it is also still in the high category with an average score of 4.48, which means that the current decline in coffee prices makes farmers have to process coffee so that the coffee can be stored. This causes the risk of coffee distribution to be disrupted.

| Distribution Risk                                                                 | N  | S  | ST | O  | A  | Category |
|-----------------------------------------------------------------------------------|----|----|----|----|----|-----------|
| Transportation delays (damaged vehicles, accidents, natural disasters, etc.)     | 0% | 5% | 5% | 33%| 58%| High      |
| There are obstacles on the farm road (broken, muddy roads, etc.)                 | 0% | 0% | 0% | 37%| 63%| High      |
| The current COVID-19 pandemic has caused delays in purchasing                      | 0% | 0% | 18%| 26%| 56%| High      |
| coffee so that coffee has piled up in warehouses                                   |    |    |    |    |    |           |
| A decline in prices has caused farmers to prefer to store coffee                   | 0% | 0% | 8% | 36%| 56%| High      |

Description: N = Never, S = Seldom, ST = Sometimes, O = Often, A = Always

3.2. Collector distribution risk in arabica coffee supply chain in Aceh Tengah District

The distribution risk variable was measured by 4 statements distributed to 147 respondents. Based on the data that has been processed, the highest score (Max) is 19, the lowest score (Min) is 11, the average score (Mean) is 14.54, the median score is 14, the mode (Mode) is 12 and the standard deviation is 2.87. The distribution risk at the collector level in this study is categorized into 3 categories, namely low, medium and high based on the tendency of frequency. The next step is to determine the level of frequency tendency, then the value of is calculated Mean ideal (Mi) and Standard Deviation ideal (SDi). Mean Ideal by using the formula \( Mi = \frac{1}{2} (\text{The highest score} + \text{Lowest value}) \), then standard deviation ideal by using formula \( SDi = \frac{1}{6} (\text{The highest score} - \text{Lowest value}) \).

After obtaining the Mean ideal (Mi) value of 15 and the Standard Deviation ideal of 1.3, then further identification of high, medium and low distribution risk trends at the collector level by using the values (Mi) and (SDi). To find the category is as follows:

**High Group**

\[ X \geq Mi + Sdi \]
\[ X \geq 15 + 1,3 \]
\[ X \geq 16,3 \]

**Medium Group**

\[ Mi – Sdi \leq X < Mi + Sdi \]
\[ 15 – 1,3 \leq x < 15 + 1,3 \]
\[ 13,7 \leq X < 16,3 \]

**Low Group**

\[ X < Mi - Sdi \]
\[ X < 15 - 1,3 \]
\[ X < 13,7 \]

Based on the results of the calculation of the tendency of the distribution risk variable at the collector level, the following results are obtained (see Table 5).
**Table 5.** Distribution risk category for arabica coffee collectors in Aceh Tengah District.

| No. | Interval Score | Total | Percentage | Category |
|-----|----------------|-------|------------|----------|
| 1.  | X < 13.7       | 3     | 27.3%      | Low      |
| 2.  | 13.7 ≤ X < 16.3| 5     | 45.5%      | Medium   |
| 3.  | X ≥ 16.3       | 3     | 27.3%      | High     |
|     | Total          | 11    | 100%       |          |

Based on the Table 5, we can see that the distribution risk of the Arabica coffee supply chain at the collector level is in the high category, which is 27.3% with a total of 3 respondents, the distribution risk in the medium category is 45.5% with a total of 5 respondents and the distribution risk is in the medium category with the low category is also 27.3% with a total of 3 respondents. From the explanation above, it can be concluded that the risk of Arabica coffee supply chain distribution at the collector level in Aceh Tengah District is categorized as moderate risk.

The data for this distribution risk variable was obtained from the results of a questionnaire distributed to 11 respondents. Distribution risk at the collector level in this study was measured by 3 statements. The following is the average score for each statement on the collector-level risk distribution.

**Table 6.** Average score statement risk distribution collector level.

| Distribution Risk | N  | S  | ST | O  | A  | Category |
|-------------------|----|----|----|----|----|----------|
| Transportation delays (damaged vehicles, accidents, natural disasters, etc.) | 0% | 55% | 18% | 27% | 0% | Medium   |
| The current COVID-19 pandemic has caused delays in purchasing coffee so that coffee has piled up in warehouses | 0% | 0% | 37% | 27% | 36% | High     |
| A decline in prices has caused farmers to prefer to store coffee | 0% | 27% | 37% | 0% | 36% | Medium   |

Description: N = Never, S = Seldom, ST = Sometimes, O = Often, A = Always

Based on the data that has been collected, it can be seen in table 9 which shows that the statement of transportation delays (damaged vehicles, accidents, natural disasters, etc.) is in the moderate category with an average score of 2.73 meaning that at the collector level it is decreasing. The occurrence of vehicle damage because the collector has ensured the vehicle used to transport all the coffee purchased from the farmers. Furthermore, for the statement that there is a current COVID-19 pandemic event that causes delays in purchasing coffee so that coffee accumulates in warehouses is classified as high category with an average score of 4.00, it means that the COVID-19 pandemic has also greatly impacted collectors so that the coffee that has been processed by the collector piled up in the warehouse due to delays in purchasing coffee. Then for the statement of a decrease in prices, causing farmers to prefer to store coffee belonging to the medium category with an average score of 3.45, it means that at the collector level there is also a decrease in prices, only those collectors have processed coffee purchased from farmers so that the selling price of coffee is higher than farmer level. This is in accordance with the statement in the value-added research on processed coffee at the collector level [23].
3.3. Risk of cooperative distribution in arabica coffee supply chain in Aceh Tengah District

Based on the results of the questionnaire, it can be seen that the distribution risk at the cooperative level began to occur due to the COVID-19 pandemic. Before the COVID-19 pandemic, the distribution from cooperatives to export countries had no problems or obstacles, because before sending coffee to export countries, all coffee export requirements were met. The demand for coffee supply is very high, even cooperatives are a little overwhelmed to meet market demand. The following is the number of requests for coffee in 2019 before the COVID-19 pandemic.

| No | Month | Country of Destination                        | Total Kg |
|----|-------|----------------------------------------------|----------|
| 1. | January | Helsinki Finlandia, Melbourne                | 57.600   |
| 2. | February | Vancouver, Baltimore                         | 134.400  |
| 3. | March | Baltimore                                     | 19.200   |
| 4. | May | Vancouver, Baltimore, Tacoma dan Oakland      | 192.000  |
| 5. | June | Baltimore, Charleston dan Kobe Japan         | 211.200  |
| 6. | Juli | Oakand dan Hamburg Germany                   | 76.800   |
| 7. | August | Oakland dan Tacoma                           | 76.800   |
| 8. | November | Charleston                                  | 19.200   |
| 9. | December | Oakland dan Seattle                          | 172.000  |
| Total | |                                      | 960.000  |

From the table above, it can be seen that the demand for Arabica coffee in 2019 was very high, the total number of Arabica coffee exports at the Baitul Qiradh Baburrayyan Cooperative reached 960,000 Kg. This cooperative distributes coffee to various countries, one of which is Melbourne. The highest number of exports in 2019 was in June of 211,200 Kg. This Arabica coffee is exported to various countries, namely Baltimore, Charleston and Kobe Japan. However, when compared to the demand for Arabica coffee in 2020, it is highly inversely related, this is due to the COVID-19 pandemic so that the demand for Arabica coffee has decreased. The following table shows the number of requests for Arabica coffee in 2020.

| No | Month | Country of Destination                        | Total Kg |
|----|-------|----------------------------------------------|----------|
| 1. | January | Seattle                                      | 19.200   |
| 2. | February | Melbourne                                   | 19.200   |
| 3. | March | Vancouver                                    | 19.200   |
| 4. | April | Seattle, Vancouver dan Baltimore             | 57.600   |
| 5. | May | Vancouver                                    | 38.400   |
| 6. | June | Vancouver                                    | 38.400   |
| 7. | Juli | Vancouver, New York dan Savannah             | 172.800  |
| 8. | August | Oakand dan Baltimore                          | 96.000   |
| 9. | November | Melbourne                                   | 19.200   |
| Total | |                                      | 480.000  |

From the table above, it can be concluded that the demand for Arabica coffee supply in 2020 decreased, the total number of Arabica coffee exports in 2020 was 480,000 Kg. The highest number of Arabica coffee exports in 2020 was in July as many as 172,800 Kg with various export destinations, including Vancouver, New York and Savannah. This is one of the problems in the distribution of coffee in the Baitul Qiradh Baburrayyan Cooperative. This declining demand for coffee has a huge impact on the Baitul Qiradh Baburrayyan Cooperative because coffee that has been purchased from farmers and has been processed into coffee ready for export must accumulate in warehouses.
At this time, the demand for coffee is very low. This happened because the buyers chose to postpone the purchase of coffee, because the buyers also had difficulty selling coffee. Many coffee shops are closed or operating hours are enforced. There is another impact from the COVID-19 pandemic that causes distribution risks to cooperatives, namely the imposition of restrictions on coffee exports, so that coffee distribution is delayed. As well as a reduction in the number of ships and a reduction in the coffee export schedule.

3.4. Result of analysis of factors affecting distribution risk in arabica coffee supply chain during the COVID-19 pandemic in Aceh Tengah District

The analytical model used in this study is ordinal logistic regression to see the effect of the independent variable on the dependent variable using the SPSS version 17 software. Before performing ordinal logistic regression analysis. The four assumptions are as follows:

1) Variable Y (dependent) is ordinal data, namely the distribution risk which is categorized into 3, namely, 1 = low, 2 = moderate and 3 = high.
2) Variable X (independent) may be nominal, ordinal and scale data. This study uses ordinal data. The variable risk of loss (X1) is categorized into 3, namely, 1 = low, 2 = moderate and 3 = high. Then the risk of goods being exchanged (X2) which is categorized into 3, namely, 1 = low, 2 = medium and 3 = high. The risk of delay (X3) is categorized into 3, namely, 1 = low, 2 = moderate and 3 = high. The risk of damaged goods (X4) is categorized into 3, namely, 1 = low, 2 = medium and 3 = high.
3) No outbreak of multicollinearity

The way to find out the presence or absence of multicollinearity symptoms is by looking at the value of Variance Inflation Factor (VIF) and Tolerance, when value Variance Inflation Factor (VIF) less than 10 (VIF < 10) and Tolerance more than 0.1 (Tolerance > 0.1) then it can be stated that there is no multicollinearity (Ghozali, 2011).

| Model                  | Collinearity Statistics |
|------------------------|-------------------------|
|                        | Tolerance | VIF    |
| Risk of Loss 1         | 0.963     | 1.039  |
| Risk of Loss 2         | 0.858     | 1.165  |
| Risk of Being Exchanged 1 | 0.938     | 1.066  |
| Risk of Delay 1        | 0.991     | 1.009  |
| Risk of Delay 2        | 0.912     | 1.097  |
| Risk of Damaged Goods 1 | 0.958     | 1.044  |
| Risk of Damaged Goods 2 | 0.917     | 1.091  |

From the output results obtained, it can be seen that the Tolerance value of all independent variables is greater than 0.10. Then the value of Variance Inflation Factor (VIF) of all independent variables is less than 10.00 so it can be concluded that there is no multicollinearity between independent variables.

1) Full likelihood ratio test

$H_0$ in this test are all independent variables that have no effect on the risk of Arabica coffee distribution.
Table 10. Full likelihood ratio test.

| Chi Square | Df | Sig. |
|------------|----|------|
| Final      | 30.980 | 7 | 0.000 |

Based on the results of the calculation of the simultaneous test (G) obtained a $p$-value of 0.000. $p$-value < $\alpha$ (0.000 < 0.05). So, the decision taken is to reject $H_0$. So, with a 95% confidence level, it can be said that there is at least one independent variable that affects the risk of Arabica coffee distribution in Aceh Tengah District.

2) Testing regression model parameters

a) Goodness of fit test

This study was conducted to determine whether the ordinal logistic regression model obtained could or was feasible to use. The following are the results of the model goodness test using SPSS version 16:

Table 11. Goodness of fit test.

| Chi Square | Df | Sig. |
|------------|----|------|
| Pearson    | 9.386 | 15 | 0.856 |
| Deviance   | 11.377 | 15 | 0.725 |

It is known that the Chi-Square Deviance method is 11,377 with a degree of freedom of 44. The test criteria is to reject $H_0$ if the significance is less than 0.05 (Sig < 0.05). The Pearson value is 9,386 with a significance of 0.856 (0.856 > 0.05) and the Deviance value is 11,377 with a significance of 0.725 (0.725 > 0.05). This means that accept $H_0$ which is the logit model that is feasible to use.

b) Nagelkerke R square test

Measurement of the closeness of the relationship between the independent variable and the dependent variable was also calculated using Cox and Snell R Square and Nagelkerke R Square. Nagelkerke's R Square is a further transformation for Cox and Snell's coefficients to determine that the value range is between 1 and 0. Generally, Nagelkerke's value is greater than Cox and Snell's value. The results of Nagelkerke's analysis can be seen in Table 12.

Table 12. Coefficient of determination.

| Cox and Snell | Nagelkerke | McFadden |
|---------------|------------|----------|
| 0.190         | 0.320      | 0.233    |

Based on the table above, it can be seen that the McFadden coefficient of determination is 0.233 while the Cox and Snell coefficient of determination is 0.190 and Nagelkerke's coefficient of determination is 0.320 or 32%. The Nagelkerke coefficient is 32%, which means that the independent variables in the form of Risk of Loss, Risk of Exchange of Goods, Risk of Delay and Risk of Damaged Goods affect Distribution Risk, while 68% is influenced by other factors not included in the model test.

c) Parallel lines test

Parallel lines test is a test to assess the assumption that all categories have the same parameters or not.
Based on Table 13, the parallel lines test results show that the Chi Square value is 21.103 and the p-value is 0.232. Then the decision taken is to accept $H_0$ because the p-value > $\alpha$. Thus, at the 95% confidence level, it can be said that the model produces the same slope regression coefficient for all response variables.

### d) Wald test

The statistical test used partially is the Wald test. This test is used to determine each significant independent variable, namely the risk of loss, the risk of goods being exchanged, the risk of delay and the risk of damaged goods.

Based on the results of the analysis using logistic regression on the ordinal logistic regression model. From the results of this analysis, it can be seen that there are several variables that are not significant, so these variables are not used in the analysis. Meanwhile, significant variables will be used in the analysis. The significant value is more than 0.05 (> 0.05), which means rejecting $H_0$.

### Table 14. Partially significant parameter test.

| Predictor | Coefficient | Wald | Sig. | Odds Ratio |
|-----------|-------------|------|------|------------|
| Constant (1) | -4.883 | 33.917 | 0.000 |            |
| Constant (2) | -2.268 | 30.899 | 0.000 |            |
| [X1=1] | -2.677 | 5.938 | 0.015 | 0.069 |
| [X1=2] | -0.087 | 0.014 | 0.904 | 0.916 |
| [X1=3] | 0 | . | . | 1 |
| [X2=1] | -2.588 | 4.393 | 0.036 | 0.075 |
| [X2=2] | 18.753 | 0.000 | 0.999 | 1.394E8 |
| [X2=3] | 0 | . | . | 1 |
| [X3=2] | -5.497 | 12.961 | 0.000 | 0.004 |
| [X3=3] | 0 | . | . | 1 |
| [X4=1] | -3.488 | 3.470 | 0.063 | 0.031 |
| [X4=2] | 1.109 | 1.638 | 0.201 | 3.031 |
| [X4=3] | 0 | . | . | 1 |

The table above shows that the independent variables that significantly affect the risk of distribution in the Arabica coffee supply chain during the COVID-19 pandemic in Aceh Tengah District with a 95% confidence level are the risk of loss (X1), the risk of goods being exchanged (X2) and the risk of delay (X3), because it has a p-value that is smaller than $\alpha = 0.05$, in this study, accept $H_1$ or reject $H_0$. Because the response variable consists of three categories, there are two logit models using all independent variables as follows:

**Logit** $[P (Y_1 ≥ 1 | Xi)] = -4.883 - 2.677X1(1) - 2.588X2(1) - 5.497X3(2)$

**Logit** $[P (Y_1 ≥ 2 | Xi)] = -2.268 - 2.677X1(1) - 2.588X2(1) - 5.497X3(2)$

The interpretation of the model formed is to use the odds ratio value obtained from the Exp (coefficient) of each variable. Based on table 17, the value of the odds ratio is seen so that interpretation can be made to determine the tendency of the influence of the independent variables. The interpretation based on the odds ratio is as follows:

1) Risk of loss variable (X1)

The results of the partial test show that the risk of losing the low category has a significant effect on the risk of distribution in the Arabica coffee supply chain during the COVID-19 pandemic in
Aceh Tengah District. The p-value is 0.015 and the odds ratio is 0.069, which means that the low-level loss risk is 0.069 times less risky than the high-level loss risk in Arabica coffee distribution. So, it can be concluded that the higher the risk of loss, the more influence on the risk of distribution of Arabica coffee.

2) Exchanged goods variable (X2)

The results of the partial test show that the risk of goods being exchanged in the low category has a significant effect on the risk of distribution in the Arabica coffee supply chain during the COVID-19 pandemic in Aceh Tengah District. The p-value is 0.036 and the odds ratio is 0.075 which means that the risk of goods being exchanged at a low level is 0.075 times less risky than the risk of goods being exchanged at a high level in the distribution of coffee. So it can be concluded that the higher the risk of goods being exchanged, the more it affects the distribution risk of Arabica coffee.

3) Variable delay risk (X3)

The results of the partial test show that the risk of delay in the medium category has a significant effect on the risk of distribution in the Arabica coffee supply chain during the COVID-19 pandemic in Aceh Tengah District. The p-value is 0.000 and the odds ratio is 0.004 which means that the risk of medium-level delay is 0.004 times less risky than the risk of high-level delay in the distribution of Arabica coffee. So, it can be concluded that the higher the risk of delay, the more it affects the risk of Arabica coffee distribution.

Based on the results of the interpretation of the ordinal logistic regression equation using the odds ratio value, the probability of distribution risk in the Arabica coffee supply chain during the COVID-19 pandemic in Aceh Tengah District is the most at risk in the first variable, namely the risk of loss of 0.069 times, then the variable risk of goods swapped by 0.036 times and the last variable risk of delay was 0.004 times.

4. Conclusions

The risk of distribution in the Arabica coffee supply chain at the farmer level in Aceh Tengah District is categorized as high risk with a percentage of 87.2% with a total of 128 respondents. Meanwhile, the distribution risk of Arabica coffee supply chain at the collector level in Aceh Tengah District is categorized as moderate risk with a percentage of 45.5% with a total of 5 respondents and distribution risk at the cooperative level began to occur due to the COVID-19 pandemic. Prior to the COVID-19 pandemic, the distribution from cooperatives to export countries had no problems or obstacles. Based on the results of the analysis, the variables that have a significant effect on the risk of distribution in the Arabica coffee supply chain during the COVID-19 pandemic in Aceh Tengah District with a 95% confidence level are the risk of loss, the risk of goods being exchanged and the risk of delay with a p-value of α < 0.05. From the results of the interpretation of the ordinal logistic regression equation using the odds ratio value, the probability of the distribution risk in the Arabica coffee supply chain during the COVID-19 pandemic in Aceh Tengah District is most at risk in the first variable, namely the risk of loss of 0.069 times, then the risk variable for goods being exchanged of 0.036 times then the variable risk of delay is 0.004 times.

References
[1] U. Zainura, Ulya N K dan B 2016 Perilaku Kewirausahaan Petani Kopi Arabica Gayo di Kabupaten Bener Meriah Provinsi Aceh Penyuluhan 12 126–43
[2] BPS Aceh 2019 Aceh Tengah Dalam Angka 2019
[3] M. Mardhiah, A. Baihaqi S S 2020 Faktor-Faktor yang Mempengaruhi Ekspor Kopi di Aceh JIM 5
[4] Kurnia 2019 Pengolahan dan Diversifikasi Kopi (Bandung: Alfabeta)
[5] S. Suharjito, M. Marinin M M et al. 2016 Identifikasi dan Evaluasi Risiko Manajemen Rantai Pasok komoditas Jagung dengan Pendekatan Logika Fuzzy Manaj. dan Organ.
[6] Saputra A 2012 Desain Rantai Pasok Agroindustri Kopi Organik di Aceh Tengah untuk Optimalisasi Balancing Risk (Institut Pertanian Bogor)

[7] S. Afandi, H. Miftah W N 2019 Analisis Margin Tatanan dan Risiko Distribusi Tomat di Pasar Tradisional Kota Bogor (Pendekatan Enterprise Risk Management) Agribisains 5 39

[8] Manalu D T 2019 Analisis Manajemen Risiko pada Rantai Pasok Kopi Non Ekspor (Sumatera Utara)

[9] Yusmanizar, Setiasih I S, Nurjanah S, Muhaemmin M, Nurhadi B, Rosniawaty S and Munawar A A 2019 Fast and Non-Destructive Prediction of Moisture Content and Cholegenic Acid of Intact Coffee Beans Using Near Infrared Reflectance Spectroscopy IOP Conference Series: Materials Science and Engineering vol 506 (Institute of Physics Publishing)

[10] Agussabti, Rahmadiansyah, Satriyo P and Munawar A A 2020 Data analysis on near infrared spectroscopy as a part of technology adoption for cocoa farmer in Aceh Province, Indonesia Data Br. 29

[11] Sugiyono 2014 Memahami Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif dan R&D (Bandung: Alfabet)

[12] Sugiyono 2017 Metode Penelitian Bisnis (Pendekatan Kuantitatif, Kualitatif, Kombinasi dan R&D) (Bandung: Alfabet)

[13] Saifuddin A 2004 Metode Penelitian (Yogyakarta: Pustaka Pelajar)

[14] Rusydi, A., dan Fadli M 2018 STATISTIKA PENDIDIKAN: Teori dan Praktik dalam Pendidikan J. Vis. Lang. dan Comput. 11

[15] Azwar S 2012 Penyusunan Skala Psikologi (Yogyakarta: Pustaka Pelajar)

[16] Ghozali I 2011 Aplikasi Analisis Multivariate dengan Program SPSS 19. Edisi Kelima (Semarang: Universitas Diponegoro)

[17] Hosmer DW L S 2000 Applied Logistic Regression 2nd Edition (New York: John Wiley & Sons, Ltd)

[18] Gujarati D. 2009 Basic Econometrics (Mc)

[19] Hosmer, DW., Lemeshow S. dan S 2013 Applied Logistic Regression 3rd Edition (New York: John Wiley and Sons Inc)

[20] Kleibbaum, D.G dan Klein M 2010 Logistic Regression: A Self Learning Text 3rd Edition (New York: Springer)

[21] Agresti A 2010 Analysis of Ordinal Categorical Data 2nd Edition (New York: John Wiley and Sons Inc)

[22] Kutner, M.H, Nachtsheim, C.J, Meter, J dan Li W 2004 Applied Linear Statistical Models 5th Edition (New York: Mc Graw-Hill)

[23] Baihaqi A, Hamid A H, Susanti E, Paga P E, Wardhana M Y and Marsudi E 2020 Analysis of value added agro industry arabica export coffee processing in Aceh Tengah case study at Oro Coffee Gayo IOP Conference Series: Earth and Environmental Science