Risk analysis of catfish cultivation (*Pangasius hypophthalmus*) business in Gondosuli Village, Gondang, Tulungagung

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**Abstract.** The catfish farming business is an activity that offers the opportunity to earn large profits, but it also has the potential for business risks. The aims of this research is to ascertain the characteristics of catfish business farmers and to analyze the level of production risk. This research was carried out in Pokdakan Mina Jaya and Mina Baru Gondosuli Village, Gondang, Tulungagung. The research location was chosen purposively and the sample method used was snowball sampling. The data analysis method used analysis of income and analysis of risk. The results showed that the profit of the catfish farming on each planting season was IDR 81,631,322. The production risk and income risk analysis showed that the coefficient of variance was CV < 0.5. The lower limit of production risk and income risk was L > 0. Then, based on the value of coefficient variance’s production and income showed that there was a little of risk catfish cultivation production faced by farmers. The relation between the coefficient of variance (CV) and the lower limit (L) of production risk and income risk represent that the catfish cultivation do not suffer from production risk due to small production risks.

1. Introduction
The fisheries sector is all activities related to the management and utilization of fish resources and their environment ranging from preproduction, production, processing to marketing carried out in a fisheries business system. The fisheries sector is divided into two parts, there is the capture fisheries and aquaculture.

Tulungagung Regency is one of the districts in East Java with a high potential for fish cultivation and freshwater consumption. Data on the development of freshwater fish production in Tulungagung Regency from 2018 to 2019 are provided in Table 1.
Table 1. Fish cultivation production of freshwater consumption in Tulungagung Regency 2018-2019

| No. | Types of Fish                  | Production (Ton)          | Average Production (Ton) |
|-----|--------------------------------|---------------------------|--------------------------|
| 1   | Carp                           | 11.079,74, 18.593,32      | 14.836,53                |
| 2   | Catfish (Clarias sp)           | 9.508,28, 10.006,88       | 9.757,58                 |
| 3   | Nile Tilapia                   | 137,39, 24,13             | 80,76                    |
| 4   | Catfish (Pangasius hypophtalmus)| 11.251,71, 10.449,45      | 10.850,58                |

Source: [1]

Table 1 shows the main freshwater fish commodities cultivated in Tulungagung Regency, which include carp, nile tilapia, and catfish (Clarias sp and Pangasius hypophtalmus). Carp and catfish (Pangasius hypophtalmus) are the most common types of fish cultivated in Tulungagung Regency, with average production in 2018-2019 reaching 14,836.53 tons and 10,850.58 tons. According to [1], the average production of catfish in Tulungagung Regency in 2018-2019 contributed 60.16 percent to East Java's catfish production.

The catfish farming business offers the opportunity for large profits, but there is also the possibility of facing business risks. Production and productivity are the problems that are often faced by farmers in the process of cultivating catfish in Tulungagung Regency. The amount of production and productivity is usually determined by internal and external factors in the cultivation process. Internal factors include the area of cultivation land, the method of breeding fish, the quality of fish seedlings and feed also the intensity of fish vitamin administration, while external factors include weather and environmental conditions. Unpredictable weather patterns are often the cause of decreased production from cultivated freshwater fish. According to [2] production risks include a high percentage of mortality, low productivity, limited accessible capital, low profits made by farmers, and a higher utilization of production costs in cultivation business activities.

In addition to production risks, fish farmers also face price risks. Price fluctuations are caused by fluctuations in the production of these commodities. If the selling price is too low, the cultivator will be unable to cover the necessary production costs, such as fish seedlings, fish feed, and medicines, causing fish farmers to lose money. [3] study showed that drugs are significant to the risk of freshwater fish hatchery production. The presence of production and price risks will affect the amount of receipts obtained, causing income risk. This needs to be anticipated because if allowed to continue, it will pose even greater risks affecting the income of fish farmers. In order to explore the mentioned problems, this study aims to determine the characteristics of catfish business farmers and analyze the level of production risk in the catfish farming business.

2. Research Methodology

2.1. Research Area

This research was carried out in Gondosuli Village, Gondang Subdistrict, Tulungagung Regency, East Java. Gondang subdistrict is one of the centers of catfish production in Tulungagung Regency. The data gathering time is carried out for 3 months from July to October 2020.

2.2. Types and Data Source

This research uses primary and secondary data, the types are qualitative and quantitative. Data is obtained directly from business farmers ranging from the process of catfish cultivation, business performance, and the level of business risk. Secondary data is gathered in the form of statistical data, books, journals, and other library materials relevant to this research.

2.3. Sample Selection and Data Collection

Data collection techniques are carried out through observations, interviews, and discussions directly with respondents who are in the research area. Sampling is done by purposive method in finding
respondents. Sampling method using census method, which means all populations are made respondents in the study [4]. This research took 30 respondents who are the member of Pokdakan Mina Jaya and Mina Baru. The sample size of this research (n ≥ 30), that means in the general rules statistically it is distributed normally.

2.4. Data Analysis Method
Data analysis used qualitative and quantitative methods. Qualitative data analysis is intended to describe the characteristics of catfish growers in the research area. Quantitative data analysis in this research includes analysis of the performance of catfish farming business, and the level of business risk.

2.4.1. Analysis of Performance.
[5], [6] stated, business income is the difference between receipts and all production costs. Analysis of business income can be formulated mathematically as follows:

\[ \pi = TR - TC = (Y \cdot Py) - (FC + VC) \]  
(1)

Where:
- \( \pi \) = Profit (IDR)
- \( TR \) = Total Revenue (IDR)
- \( TC \) = Total Cost (IDR)
- \( Y \) = Total Production (kg)
- \( Py \) = Price per unit (IDR)
- \( FC \) = Fixed cost (IDR)
- \( VC \) = Variable cost (IDR)

The Revenue Cost ratio (R/C) indicator is used to determine whether a business is profitable or not. The R/C ratio is a comparison of total receipts and total costs during the manufacturing process. According to [5] the R/C ratio is formulated as follows:

\[ R/C = \frac{TR}{TC} \]  
(2)

Where:
- \( R/C \) = Total Revenue/Total Cost
- \( TR \) = Total Revenue (IDR)
- \( TC \) = Total Cost (IDR)

Criteria:
1) If R/C > 1, that means the farm is profitable
2) If R/C < 1, that means the farm is not profitable
3) If R/C = 1, that means the farm is has reached break event

2.4.2. Risk Analysis
[7] stated, risk is associated with an activity or decision as an opportunity for negative outcomes. Three statistical analyses can be used to determine risk levels: variance value analysis, standard deviation, and variation coefficient. The three sizes are interconnected, and the variance value determines the other size. According to [8], the level of agricultural risk is measured by determining the density of probability distributions, and risk assessment can be done by measuring the value of deviations that occur; several measures that can be used to measure storage include variance, standard deviation, variation coefficient, and lower limit value (L). According to the research [9], the measure of variance, standard deviation, and coefficient variation are used as a risk analysis method. Production risk and income can thus be quantified using variance values, standard deviations, variance coefficients, and lower limit values (L).

- [2] stated measures of variance and standard deviation can be used to measure the spread of risk from observations with expected average results using probability parameters from investment and the measure of variance and standard deviation as indicators of risk, variance is systematically formulated as follows:
\[ V_{\alpha}^2 = \frac{\sum (Q - Q_1)^2}{n-1} \]  

(3)

Where:
- \( V_{\alpha}^2 \) = Variance
- \( Q \) = Quantity value (unit)/Income (IDR)
- \( Q_1 \) = Average results (unit)/Income mean (IDR)
- \( n \) = Sample size

According to [10] standard deviation and variance as a measure of variations in a very related data set. Standard deviation is the second power of variance and variance is the square of the standard deviation. [11] adds that raw inequality is the root of variance values. Variance is in contrast the square of the standard deviation value. Standard deviation can be mathematically written with the formula:

\[ V_{\alpha} = \sqrt{V_{\alpha}^2} \]  

(4)

Where:
- \( V_{\alpha} \) = Standard deviation
- \( \sqrt{V_{\alpha}^2} \) = Variance

Variance and standard deviation as a measure to determine the level of production and income risk. According to [12] the higher the value of variety \((V_{\alpha}^2)\) and the standard deviation \((V_{\alpha})\), the higher the level of risk.

- Coefficient of Variance (CV), according to [8], the coefficient of variation (CV) is a measure of relative risk in which the value of the coefficient of variance is obtained from dividing standard deviation by the expected value. The high coefficient value of the resulting variation indicates that cultivation efforts also have a high relative risk and so on. [13] opined that the level of cultivation risk based on coefficient of variance value is formulated below:

\[ KV = \frac{V_{\alpha}}{Q_i} \]  

(5)

Where:
- \( CV \) = Coefficient of variance
- \( V_{\alpha} \) = Standard deviation
- \( Q_i \) = Average results (unit)/Income mean (IDR)

Criteria

Coefficient of variance value \((KV) < 1\), then the farm has a little risk

Coefficient of variance value \((KV) > 1\), then the farm has a big risk

- Lower Limit (L), represent a lowest face value possible received by a catfish farmer. Mathematically, the lower limit value \((L)\) is formulated as follows:

\[ L = Q_i - 2V_{\alpha} \]  

(6)

Where:
- \( L \) = Lower limit value
- \( V_{\alpha} \) = Standard deviation
- \( Q_i \) = Average results (unit)/Income mean (IDR)

The lower limit of the highest yield \((L)\) and the coefficient of variation \((KV)\) are related as follows:

If \( CV > 0,5 \) then \( L < 0 \), that means there is an opportunity to lose on the farm;

If \( CV \leq 0,5 \) then \( L > 0 \), that means the farm will always avoid losses;

If \( CV = 0 \) then \( L = 0 \), that means the farm is at break even.

3. Results and Discussion

3.1. Characteristics

The average catfish farmer is between the ages of 32 and 56. This reveals that the number of adult catfish farmers is more active in the business of catfish cultivation. According to [14], the population between the ages of 32 and 56 is productive, whereas the population under the age of 15 is
unproductive. [15] adds the productive age ranges from 15 to 64 years, whereas the unproductive age extends from 0 to 14 years and 65 and more. The population of productive age (32-56 years) has such a good work ethic and spirit, as well as physical resiliency, which helps to enhance business productivity.

According to the degree of education, as many as 53% or 16 farmers studied up to the high school level. According to study data, respondents with a junior high school education level count for as many as 12 individuals or 40% of all respondents, followed by respondents with an elementary education level accounting for just 7 percent or 2 people. This demonstrates that the majority of cultivator respondents' educational attainment is sufficient to enable business success, both technically and non-technically. A high degree of education will also influence cultivators' mindsets toward adopting information, with catfish farmers predicted to readily absorb knowledge from television media, newspapers, radio, or other forms of information to support business output.

Pool ownership in Pokdakan Mina Jaya is as high as 5 people or 13.04 percent, 6-10 ponds as high as 13 people or 56.52 percent, >10 pools as high as 7 people or 30.43 percent, and Pokdakan Mina Baru is as high as 6-10 ponds as high as 4 people or 57.14 percent, and >10 ponds as high as 3 people or 42.86 percent. According to research, the more ponds that are held, the more seedlings that can be stocked, allowing farmers to produce a large enough harvest of catfish. The ownership of ponds in catfish production also illustrates the farm's magnitude.

Cultivators in Pokdakan Mina Jaya almost all have business experience 5 years, which is as many as 23 individuals, whereas cultivators in Mina Baru Pokdakan have business experience 5 years on average, which is as many as 7 people. The duration of experience possessed by cultivators will gain the farming business that is being run, because experience in cultivation business is one of the factors that support cultivators in carrying out cultivation business better, and wise in responding to any changes that occur, whether in the form of profits or losses as a result of these activities.

3.2. Performance of Catfish Farming Business

According to [16], business performance is the output or result of a process. Therefore, financial analysis is required to determine how well the performance of the catfish cultivation business in Pokdakan Mina Jaya and Mina Baru in Gondosuli Village, Gondang District, Tulungagung Regency. Financial aspects employed in the study of aquaculture business performance can be short-term investments to evaluate the expenses, income, profits, R / C ratio, and Payback Period of catfish farming operational processes. Business analysis is often used to evaluate the advantages of an investment to a business.

The business of farming catfish necessitates expenses in production, income, and profits earned, including fixed cost and variable cost.

The early money incurred for catfish farming business operations is referred to as investment costs. The following table shows the investment data or starting capital required for catfish farming activities.

### Table 2. Average investment costs and depreciation of Catfish farming business per cycle

| Number | Description               | Amount     | Investment (IDR) | Depreciation rates | Annual Depreciation (IDR) | Depreciation per cycle (IDR) |
|--------|---------------------------|------------|------------------|--------------------|--------------------------|------------------------------|
| 1      | Pond                      | 151.2 m²   | 11,760,000       | 5%                 | 588,000                  | 392,000                      |
| 2      | Feed storage              | 1 unit     | 7,500,000        | 5%                 | 375,000                  | 250,000                      |
| 3      | Water pump                | 2 units    | 2,500,000        | 25%                | 625,000                  | 416,667                      |
| 4      | Net                       | 2 units    | 1,200,000        | 25%                | 300,000                  | 200,000                      |
| 5      | Foldable fishing net      | 2 units    | 108,333          | 25%                | 27,083                   | 18,056                       |
|        | Mechanical Cooking scale  |            |                  |                    |                          |                              |
| 6      | Watangan                  | 1 unit     | 140,000          | 25%                | 35,000                   | 23,333                       |
| 7      | Watangan                  | 1 unit     | 650,000          | 25%                | 162,500                  | 108,333                      |
According to Table 2, the average investment required for a catfish farming business every cycle was IDR28,564,667.00, and the average depreciation was IDR2,151,111.00. According to the data in table 2, the investment value for the pond is larger than other investment requirements, and the depreciation value per cycle for water pumps is greater than other depreciation.

In every business activity, aquaculture requires costs to run the production process, as well as catfish farming activities also have costs. The cost is separated into two categories, there are fixed cost and variable costs.

| Number | Description | Amount | Unit Price (IDR) | Value (IDR) |
|--------|-------------|--------|-----------------|-------------|
| I      | Operational Costs |        |                 |             |
| 1      | Fish seedlings | 35,400 fish seedlings | 400 | 14,160,000 |
| 2      | Fish feed-1   | 103 sacks | 311,000 | 32,033,000 |
| 3      | Fish feed-2   | 62 sacks | 295,000 | 18,290,000 |
| 4      | Fish feed-3   | 41 sacks | 279,000 | 11,327,400 |
| 5      | Probiotic (EM4) | 21 bottles | 32,000 | 661,333 |
| 6      | Pesticide (Fastac) | 10 bottles | 20,000 | 207,333 |
| 7      | Labour        |         |                 | 5,069,167  |
|        | **Sum I**     |        |                 | 81,748,233 |
| II     | Fixed Costs   |        |                 |             |
| 1      | Depreciation  |         |                 | 2,151,111   |
| 2      | Land rent     |         |                 | 32,954,667  |
| 3      | Electricity   | 9 months | 325,000 | 3,600,000  |
| 4      | Communication | 9 months | 100,000 | 900,000    |
| 5      | Pool treatment | 10 ponds | 500,000 | 5,166,667  |
|        | **Sum II**    |        |                 | 44,772,445  |
|        | **Total Costs** |      |                 | 126,520,678 |

Seedlings, feed, EM4, fastac, and labor are the production costs in the catfish farming business. In one cycle of patin fish culture, the average number of seedlings stocked was 35,400, with a unit price of IDR 400.00 per seedling. Feed used in catfish production is priced differently for each kind, ranging from IDR 279,000.00 to IDR 311,000.00 per bag. Em4 type probiotics are required in the production of catfish to preserve the quality of pond water, it requires up to 21 bottles with a unit price of IDR 32,000.00 each bottle. Fastac is a kind of pesticide used to prevent disease pests in fish. The usage of fastac in catfish production requires up to ten bottles at a cost of IDR 20,000.00 each bottle. Wages for workers used in catfish farming business operations are IDR 5,069,167.00. Wages for workers used in catfish farming business operations are IDR 5,069,167.00. The average overall cost of catfish cultivation each cycle was IDR 126,520,678.00, with specifics of the average fixed costs incurred being IDR 44,772,445.00 and the operation costs totaling IDR 81,748,233.00. Table 3 shows that the usage of feed costs more than the other prices.
The harvest period of catfish cultivation business is about 8 (eight) months. The selling price of each kilogram is influenced by the weight of each catfish. The average selling price of catfish is IDR 14,000.00 per kg. The average production in catfish farming is 14,868 kg. The revenue is calculated from the production value multiplied by the selling price of catfish per kg. The average income of patin fish farming business per cycle amounted to IDR 208,152,000.00. Profits are calculated from the difference in value between income and total cost spent. The average profit earned by patin fish farming business per cycle amounted to IDR 81,631,322.00. The R/C ratio is derived from the calculation of total revenue compared to the total cost of production [17]. The average value of R/C of catfish farming business per cycle amounted 1.65. That means the business of cultivating catfish is profitable or feasible to run. The payback period of return on investment from the gondosuli village catfish farming business, Gondang Subdistrict, Tulungagung Regency is 0.3 years. If 0.3 is calculated in months, then 0.3 x 12 months = 3.6 months. So, the period of return on investment from the catfish farming business is 3.6 months or three months and six days.

### 3.3. Risk Analysis of Catfish Farming Business

Risk analysis of patin fish cultivation in Pokdakan Mina Jaya and Mina Baru in Gondosuli Village, Gondang Subdistrict, Tulungagung Regency is done statistically by calculating the average value, standard deviation (V), coefficient of variation (CV), and lower limit (L). The coefficient of variation (CV) values indicate the level of risk faced by cultivators. The results of the calculation against risk are presented in Table 5.

| Description                  | Production Risk (unit) | Income Risk (IDR) |
|------------------------------|------------------------|-------------------|
| Average                      | 14.868                 | 81,631,322        |
| Standard deviation           | 491                    | 4,134,229         |
| Coefficient of variation (CV)| 0.03                   | 0.05              |
| Lower limit (L)              | 13.887                 | 73,362,865        |

Based on the results of calculations in Table 5 shows that the value of the standard deviation of production risk in the cultivation of catfish farming is 491. The value of standard deviation is interpreted as the level of production risk faced by farmers of catfish. The value shows that the level of production risks faced by catfish farmers at each cycle in the future. The coefficient of variation value of production risk in catfish farming business is 0.03. This means that for every 1 kg obtained by cultivators will produce a risk of 0.01 kg. The coefficient value of variation resulting from the calculation of production risk shows the value (CV) < 1, it can be interpreted that the cultivation of catfish per cycle has a small risk. The smaller the coefficient of variation value obtained, the smaller the risk faced. The lower limit value obtained from the calculation is 13,887 kg. The figures show that the minimum production limit that cultivators must produce per cycle in the future. Based on the results of the table, the coefficient of variation value (CV) < 0.5 and the lower limit value (L) > 0, it represents that the business of farming catfish per cycle will avoid losses in production risks. According to the research of [18] on the risk of production and revenue of shrimp farming, the coefficient of variation (CV) is 0.04 and the lower limit value (L) is 142.6 kg/Ha. The CV value less than 0.5 indicates the possibility of a little loss from a fire extinguisher. The lower limit value of production of 142.6 kg/Ha can be interpreted as the lowest possible shrimp production of 142.6

| Number | Description         | Value          |
|--------|---------------------|----------------|
| 1      | Production (kg)     | 14.868         |
| 2      | Income (IDR)        | 208,152,000    |
| 3      | Profit              | 81,631,322     |
| 4      | R/C ratio           | 1.65           |
| 5      | Payback period      | 0.3            |
The results of the calculations show that the shrimp farm business avoids losses due to production risks in each period based on the criteria of the relationship between the value of the coefficient of variation (CV) and the lower limit value (L). [19] also stated that the value of the coefficient of variation (CV) obtained from the production of giant tiger shrimps (Penaeus monodon) farming business of 0.444 (0.444 < 0.5) and L > 0 (32,225 > 0), it can be interpreted that the business carried out has a small level of risk and will always avoid losses. The results [20] and [21] stated that the coefficient of variation (CV) value < 0.05 and the lower limit value (L) of the > 0 business has a small level of risk and always avoid losses.

Income risk can be measured from the amount of expected income from catfish farming activities. Table 5 showed that the value of the standard deviation of income risk in the cultivation of catfish is obtained results of IDR 4,134,229. The coefficient value of variation in income risk in the catfish farming business is 0.05. This means that for every IDR 1 received by cultivators, will produce a risk of 0.05. Because the value of the coefficient of variation (KV) < 1, the cultivation of catfish per cycle has a small risk. The lower the determined coefficient value of variation, the lower the risk. The minimum amount of money earned was IDR 73,362,865. The figures indicate the bare minimum of income that cultivators must produce per cycle in the future. Based on the criteria of the relationship between the coefficient of variance value (CV) and the lower limit value (L), the farming of catfish each cycle will avoid or suffer a minor loss of income risk. According to Winarti’s research (2017), the value of the coefficient of variation (CV) obtained was 0.34, and the lower limit value of income (L) acquired was IDR 1,874,420 / kg. Based on the criteria of the correlation between the value of the coefficient of variation (CV) and the lower limit value (L), the milkfish (Chanos chanos) farming business is still profitable for farmers and desirable to attempt when viewed through the perspective of business risk analysis. According to [22], the coefficient value of variation and the lower limit of profit show that the CV 0.5 and L > 0, indicating that the respondent's business would not suffer losses in any production process carried out. That means, the processing efforts of skipjack tuna fish (Katsuwonus pelamis) do not have a high risk. The results of the research [23] and [24] showed the value of the coefficient of variation (CV) of income risk < 0.5 and the lower limit value (L) > 0 businesses will avoid losses in addition to income risk.

4. Conclusions and Suggestions
The catfish farming business activities in Pokdakan Mina Jaya and Mina Baru in Gondosuli Village, Gondang Subdistrict, Tulungagung Regency has an average total income of IDR 208,152,000.00 per cycle. The average profit obtained amounted to IDR 81,631,322.00. The average R/C ratio value is 1.65, meaning that the business is profitable or desirable to run. The period of return on investment from this catfish seedling cultivation business is 0.3 years or 3 months 6 days. This catfish farming operations offer a low degree of risk in terms of output and profitability. The requirements for the connection between the coefficient of variation (CV) and the lower limit value (L) of production and income risk suggest that the catfish farming business is spared from losses or risks incurred in that cycle.

Cooperation with local government agencies and universities in the field of fisheries is required for the maximum application of risk management, the maximum application of Good Aquacultur Practice (GAP), the development of human resources, alternatives to making self-feed through counselling and training so that production and income hazards in catfish farming operations may be avoided and cultivators can obtain the amount of production expected.

5. References

[1] Dinas Perikanan Kabupaten Tulungagung 2020 Laporan tahunan statistik perikanan budidaya (Tulungagung: Dinas Perikanan).
[2] Wahyuni R D, Yulinda E dan Bathara L 2020 Analisis break even point dan risiko usaha pembesaran ikan nila (Oreochromis niloticus) dalam keramba jaring apung (KJA) di Desa Pulau Terap Kecamatan Kuok Kabupaten Kampar Provinsi Riau *JSEP* 1(1) 22-33.

[3] Sari M, Farizi W A, Supriyadi, Aisyah D dan Asshoffani D 2020 Model fungsi produksi dan risiko just and pope pada usaha pembudidaya lele dumbo (Clarias gariepinus) di Desa Joho, Wates, Kediri *JFMR* 4(3) 356-367.

[4] Arikunto S 2002 *Metodologi penelitian suatu pendekatan proposal* (Jakarta: PT Rineka Cipta).

[5] Shinta A 2011 *Ilmu usaha tani* (Malang: UB Press).

[6] Rahim A dan Hastuti D R D 2008 *Ekonomika pertanian* (pengantar, teori dan kasus) (Jakarta: Penebar Swadaya).

[7] Nto P O O, Mbanasor J A dan Nwaru J C 2011 Analysis of risk among agribusiness enterprises investment in Abia State, Nigeria *JEIF* 3(3) 187-194.

[8] Pappas J L dan Hirschy M 1995 *Ekonomi manajerial* edisi keenam jilid II (Jakarta: Binarupa Akasara).

[9] Supriadi D, Nugraha E H, Fadilatussafa’ah N dan Widayaka R 2020 Analisis finansial dan risiko usaha pengolahan ikan asin teri di Desa Gebang Mekar Kabupaten Cirebon *J. Investasi* 6(2) 77-86.

[10] Widiyanto M A 2013 *Statistika terapan* (Jakarta: PT Elex Media Komputindo).

[11] Sofyan M T 2005 Pengaruh penerapan sistem administrasi perpajakan modern terhadap kepatuhan wajib pajak pada kantor pelayanan pajak di lingkungan kantor wilayah direktorat jenderal pajak wajib pajak besar (Tangerang: Skripsi Sekolah Tinggi Akuntansi Negara).

[12] Alam H dan A S 2017 Studi risiko ekonomis pemasaran bawang merah (*Allium ascalonicum*) di tingkat pengecer pasar segiri Kota Samarinda *J. Ekonomi Pertanian dan Pembangunan* 14(1) 59-74.

[13] Hernanto F 1993 *Ilmu usaha tani* (Jakarta: Penebar Swadaya).

[14] Badan Pusat Statistik 2020 *Istilah statistik* (Jakarta: BPS).

[15] Mubyarto 1989 *Pengantar ekonomi pertanian* (Jakarta: LP3ES).

[16] Nurlaila 2010 *Manajemen sumber daya manusia* I (Ternate: LepKhair).

[17] Kasmir J 2010 *Studi kelayakan bisnis* Edisi II (Jakarta: Kencana Prenada Media Group).

[18] Saragih N S, Sukiyono K dan Cahyadinata I 2015 Analisis resiko produksi dan pendapatan budidaya tambak udang rakyat di Kelurahan Labuhan Belawan, Kecamatan Medan Belawan. *IOP publication* 1036(2022) 012025 doi:10.1088/1755-1315/1036/1/012025.
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