JURNAL PERIKANAN DAN KELAUTAN
Volume 30 No. 2, June 2025: 261-267

e-issn : 2721-8902
p-issn : 0853-7607

Risk and Income Analysis of Vaname Shrimp Cultivation Business (*Litopenaeus vannamei*) in Bantan District, Bengkalis Regency

Analisis Resiko dan Pendapatan Usaha Budidaya Udang Vaname (Litopenaeus vannamei) di Kecamatan Bantan Kabupaten Bengkalis

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Received
25 April 2025

Accepted
26 May 2025

Abstract

This research was conducted in April 2025 in Bantan District, Bengkalis Regency. This study aimed to calculate the income of vaname shrimp farming and analyze the production and income risk of vaname shrimp farming. The survey method was used in this study. The risk measures used include variance, standard deviation, coefficient of variation, and lower limit, while business income is analyzed using income analysis. The number of samples was 26 respondents, with the selection of census technique samples. The results showed that the respondents' average production of vaname shrimp was 660,558.85 kg/Ha, and the average income was IDR614,516,253 / ha. The coefficient of variation of the results of production risk analysis is 0.0887, with a lower limit of 20,896 kg/Ha. The coefficient of variation from the results of the income risk analysis is 0.1139 with a lower limit of IDR474,445,189/Ha. From the study results, the risk to the production and income of Vaname shrimp farming is relatively low.

Keywords: Vaname Shrimp, Income, Production, Risk.

Abstrak

Penelitian ini dilakukan pada bulan April 2025 di Kecamatan Bantan, Kabupaten Bengkalis. Tujuan dari penelitian ini adalah untuk menghitung besar pendapatan usaha budidaya udang vaname, serta menganalisis risiko produksi dan risiko pedapatan usaha budidaya udang vaname. Metode yang digunakan yaitu survei dimana ukuran risiko yang digunakan meliputi *variance, standart deviation, coefficient variation* dan batas bawah, sementara pendataan usaha dianalisis menggunakan analisis pendapatan. Jumlah sampel sebanyak 26 responden, dengan pemilihan sampel teknik sensus. Hasil penelitian menunjukkan rata-rata produksi udang vaname yang dihasilkan responden adalah 660.558,85 kg/Ha dan rata-rata pendapatan yaitu sebesar Rp. 614.516.253/Ha. Nilai koefisien variasi dari hasil analisis risiko produksi adalah 0.0887 dengan batas bawah sebesar 20.896 Kg/Ha. Nilai koefisien variasi dari hasil analisis risiko pendapatan adalah 0.1139 dengan batas bawah Rp. 474.445.189/Ha. Dari hasil analisis tersebut, risiko terhadap produksi dan pendapatan usaha budidaya udang Vaname relative rendah

Kata kunci: Udang Vaname, Pendapatan, Produksi, Risiko

1. Introduction

One of the aquaculture subsectors that shows rapid development is shrimp farming, especially the vaname shrimp species (*Litopenaeus vannamei*). This commodity is a mainstay of Indonesian exports due to high international market demand and its significant contribution to the country's foreign exchange value. About 40% of the total export value of Indonesian fishery products comes from shrimp, most of which are cultured (BPS, 2023). Vaname shrimp are widely chosen because of their fast growth advantages, high disease resistance, and efficiency in a densely stocked culture system (FAO, 2020).

This potential is also evident at the regional level, one of which is in Bengkalis Regency, Riau Province. This district is located on the east coast of Sumatra Island and has a large coastal area with ecosystems that support aquaculture activities. Based on data from the DKP (2021), Bengkalis Regency has the potential for about 1,300 vaname shrimp ponds, but only about 100 hectares are actively utilized. Bantan sub-district is one of the areas with the most significant growth in vaname shrimp farming, with the number of farms reaching 35 units in 2023 and total production reaching 1,059.7 tons, making it the sub-district with the highest output in the district (Dinas Perikanan Kabupaten Bengkalis, 2023).

Vaname shrimp excel at rapid reproduction and disease resistance, making them suitable for dense cultivation. However, production risks such as disease, environmental conditions, and yield fluctuations are still threatened, potentially reducing yields by up to 65% or leading to crop failure (Afandi et al., 2024). Despite its promising prospects, vaname shrimp farming in Bantan Sub-district is not free from challenges, especially concerning production and income risks. Production risks can be caused by disease attacks such as the White Spot Syndrome Virus (WSSV) and Early Mortality Syndrome (EMS), water temperature and quality fluctuations, and non-optimal farming techniques. These risks can potentially cause a reduction in yield of more than 65%, even total failure (Lightner, 2011).

In addition to production risks, farmers face income risks that are no less important. This risk is triggered by fluctuations in the selling price of vaname shrimp due to market dynamics, harvest seasons, and global competition. On the other hand, input costs such as feed and seeds continue to increase. Feed accounts for more than 60% of total production costs, so spikes in feed prices directly reduce farmers' profit margins (Subandiyono & Hidayat, 2021). This income risk directly affects aquaculture businesses' sustainability and farmers' welfare (Jamilah, 2024) vaname shrimp farmers face revenue risks due to price fluctuations and rising input costs, which impact profits and business sustainability. Risk analysis is needed to formulate management strategies to reduce losses and increase profitability.

Good risk management is key to maintaining the stability and sustainability of shrimp farming. Systematic risk identification and analysis can help farmers understand the level of risk faced and determine appropriate control strategies (Purnomo et al., 2022). As stated by Saragih et al. in Putri (2019), every form of business has potential risks that can cause losses, so risk management becomes an integral part of business planning and implementation.

2. Material and Method

2.1. Time and Place

This research was conducted in April 2024, located in Bantan District, Bengkalis Regency, Riau Province. Determining the research location was carried out purposively, considering that this method is based on the ease of access to information and business opportunities for vaname shrimp farming in the long term at the research location.

2.2. Methods

The survey method was used in this research. According to Sugiyono (2019), the survey method was used to obtain facts from symptoms and seek actual information about a fishing business group's fisheries and social and economic fields. The survey method is used to get data from a specific natural place, but research conducts treatment in data collection, for example, by circulating questionnaires, text, and structured interviews as treatment, unlike in experiments.

The types of data used are primary data and secondary data. Primary data was obtained directly from research subjects through interviews using questionnaires and observations. Secondary data was collected to get types of data sourced from archives or documents relevant to the problems and objectives of the study.

2.3. Data Analysis

2.3.1. Income

According to Suratiyah (2009), income is the difference between total revenue (TR) and all costs (TC). So, the income formula can be written as follows:

$$\pi = TR - TC$$

Description:

π = Income (IDR)
TR = Total revenue (IDR)
TC = Total cost (IDR)

2.3.2. Gross income

To calculate gross income can be calculated using the following formula: TR = P . Q

Description:
TR = Total revenue (IDR)
Q = Total production (tons/kg)
P = Selling price (IDR)

2.3.3. Total cost

To calculate the Total Cost can be calculated using the following formula: TC = FC + VC

Description:
TC = Total cost (IDR)
FC = Fixed cost (IDR)
VC = Non-fixed cost (IDR).

2.3.4. RCR

To find out whether the vaname shrimp farming business is profitable or not economically, it can be analyzed with the following formula:

RCR = TR TC

Description:
RCR = Ratio of revenue and cost
TR = Total revenue
TC = Total cost

The decision-making criteria are: a. If R/C > 1, the farm is profitable because the revenue exceeds the cost. b. If R/C < 1, the farm is making a loss because the revenue is less than the cost. c. If R/C = 1, the farm breaks even because revenue equals costs.

2.3.5. Coefficient Variation

To calculate the relative risk measure, divide the standard deviation by the average value (coefficient variation), which is mathematically written as the following formula:

$$CV = \frac{V}{E}$$

Description:
CV = coefficient of variation
V = Standard deviation
E = Average value of results (mean)

2.3.6. Lower Limit

The lower limit of profit shows the lowest nominal value of profit that may be received by farmers with the following formula:

$$L = E - 2V$$

Description:
L = Lower limit of profit
E = Standard deviation
2V = Average value of results (mean)

Criteria: a. L > 0, then shrimp farmers will not experience losses; L < 0, then shrimp farmers will experience losses in every process production; The relationship between the lower limit of the highest yield (L) and the coefficient of variation (CV) is as follows: If CV > 0.5, then L < 0 means there is a chance of losses that the company will suffer; If CV < 0.5 then L > 0 means the company will always avoid losses.

3. Result and Discussion

3.1. Analysis of Business Income

Gross income is the total revenue earned before deducting all production costs (Alwi & Arief, 2021). Gross income, referred to as revenue, is the result of selling vaname shrimp as input at the current shrimp price that has not been reduced by the costs incurred during production.

Table 1. Revenue of vaname shrimp farms in Bantan District

Description	Size	Price (IDR)	Biomass	Biomass/Ha	Revenue
Average	52,6	60.620,42	53.000	25.406	3.216.133.355
Total	-	-	1.378.000	660.559	83.619.467.227

Fixed costs are a type of cost that remains constant regardless of fluctuations in production quantities (Srimaryani et al., 2022).

Table 2. Fixed costs of vaname shrimp farms in Bantan District

No	Fixed Cost	Amount (IDR)
1	Labory Salary	423.000.000
2	Depreciation Expenses	
	Pump Machine	220.000.000
	Pinwheel	3.260.000.000
	Tarpaulin	798.333.333
	Jala	49.500.000
	Pipes	172.500.000
	Scales	29.333.333
	Carts	16.000.000
Total		4.510.750.006
Grand Total		4.933.750.000

Fixed costs incurred for vaname shrimp production in Bantan District amounted to IDR4,933,750,000, and fixed labor salaries of IDR423,000,000. The number of permanent labourers of vaname shrimp ponds in the Bantan District is 141 people with an average wage of IDR3,000,000. Then, the cost of equipment depreciation amounts to IDR4,510,750,006. This depreciation cost is a consequence of the use of fixed capital that will experience a decrease in function during use. The equipment used for production consists of pumping machines, mills, tarpaulins, nets, pipes, scales and carts.

Variable costs are defined as the total expenditure necessary to obtain factors of production, the amount of which can be adjusted (Kariawu et al., 2021). The variable costs on vannamei shrimp farms are directly proportional to the number of shrimps raised or ponds in production.

Table 3. Variable costs of vaname shrimp farms in Bantan District

No.	Description	Amount (IDR)
1.	Fry	3.854.430.000
2.	Feed	18.791.800.000
3.	Drugs	17.650.000.000
4.	Solar	2.215.000.000
5.	Diesel Fuel	80.800.000
Total		42.632.025.000

Table 3 shows that the production costs include buying fry, feed, medicines, diesel fuel and harvest wages. The most variable costs are spent on vaname shrimp feed, amounting to IDR 18,791,800,000, and the least on the purchase of diesel fuel. The total variable cost of shrimp farming in Bantan District is IDR42,632,025,000. Ups and downs in input and output prices can impact farmers' income and revenue. Price fluctuations do not only apply to the selling price of products; production inputs such as fry, feed, and so on always experience increases. Changes in input prices impact farmers' incomes because farmers' incomes depend on the amount of revenue and production costs (Hastuti, 2016).

The total cost is the aggregate expenditure incurred by vaname shrimp farmers during the production process within a specified period (Hamdani, 2015).

Table 4. Total cost of vaname shrimp farms in Bantan District

No	Description	Amount (IDR)
1	Fixed Cost	4.933.750.000
2	Variable Cost	42.632.025.000
Total		47.565.775.000

Table 4 shows that the total fixed and variable costs used in producing Vaname shrimp in Bantan District for 1 year (2 cycles) are IDR47,565,775,000. The largest costs incurred are in variable expenses. Revenue is calculated by subtracting total production costs from the income generated during one harvest period.

Table 5. Income of vaname shrimp farms in Bantan District

Description	Total Cost (IDR)	Revenue (IDR)	Income (IDR)	R/C
Total	47.565.775.006	83.619.467.227	36.053.692.221	1,757975503
Average	1.829.452.885	3.216.133.355	1.386.680.470	1,757975503

Table 5 shows that the total income of vaname shrimp farming in the Bantan District is IDR36,053,692,221 per year, with the average income of farmers in a year being IDR1,386,680,470. The high level of business income depends on the production results and costs incurred. This aligns with research by Hotmauli et al. (2020), which states that the high and low profits obtained are due to the amount of revenue received from sales, and the total costs incurred during the production process are different, resulting in different profits.

In addition, the table also shows the ratio of total revenue to total costs (R/C) > 1 with a value of 1.757975503, meaning that this business is profitable, where every IDR1.00 cost incurred by the cultivator will generate revenue of IDR1.76. In line with previous research conducted by Rambe (2021), the Vanname shrimp farming business is feasible to run because the R / C ratio value is greater than one, namely 1.76

3.2. Business Risk Analysis

Based on Table 6, it can be seen that the average production of vaname shrimp ponds in Bantan District is 25,406.11 kg/Ha. This value is the normal amount of production expected for vaname shrimp production in the Bantan District in the next period. The coefficient of variation is the ratio between the standard deviation value and the expected result value. The greater the coefficient of variation, the greater the risk. The smaller the coefficient of variation obtained, the smaller the risk faced. Based on the calculation results, the coefficient of variation obtained is 0.0887 or 8.87%. Every 1 kg of shrimp obtained by farmers will produce a risk of 0.0887 kg.

Table 6. Risk analysis of vaname shrimp farm production

Description	Production Risks
a. Average (E)	25.406,11
b. Variant (V2)	5084001,532
c. Standard Deviation (V)	2.254,77
d. Coefficient of Variation (CV)	0,0887
e. Lower Limit (L)	20.896,56

The lower limit value is obtained from the difference between the expected result and twice the standard deviation. From the calculation results, the L value obtained is 20,896.56 kg/Ha. These figures indicate the minimum production limit farmers must produce in the future and serve as a warning indicator. The farm faces potential losses if production is close to or below this value. The difference between the average value and the lower limit reflects the tolerance reserve for production risk of ±4,509.55 kg/ha (about 17.75%). When viewed from the criteria of the relationship between the value of CV and L, which vaname shrimp business has a CV value < 0.5 and a value of L > 0, this means that the shrimp farming business in each period will avoid the risk of production so that the business is feasible to continue and accept production risk. The following is a graph of the risk distribution of vaname shrimp production in the Bantan sub-district, Bengkalis Regency.

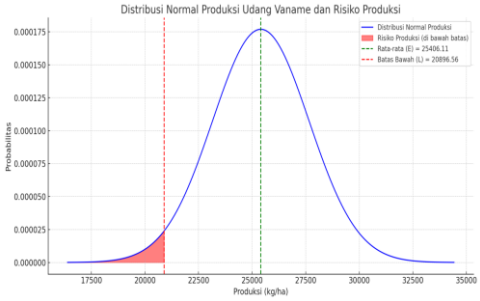

Figure 1. Normal distribution of vaname shrimp production from production risk

Table 7. Risk analysis of vaname aquaculture business income

Description	Revenue Risks
a. Average (E)	614.516.253
b. Variant (V2)	4,90498E+15
c. Standard Deviation (V)	70035531,77
d. Coefficient of Variation (CV)	0,113968559
e. Lower Limit (L)	474445189,4

Table 7 shows that the average income of vaname shrimp farming in the Bantan District is IDR614,516,253. The mean value is the amount of vaname shrimp farming income the plot expects in the next period. The greater the coefficient of variation, the greater the level of income risk faced. The coefficient of variation obtained is 0.113968559, so it can be said that every IDR1 return received by farmers will result in a risk of IDR0.113968559. The coefficient of variation of 11.4% indicates that income is quite stable. In the context of the fisheries business, this shows acceptable risk.

The lower bound of revenue (L) generated is 474445189.4. This figure shows that the lowest income that vaname shrimp farmers must receive in the coming cycle is IDR474,445,189.4 per hectare. If revenues fall below this figure, then the vaname in shrimp farming business in Bantan District has the potential to experience problems

such as disease attacks, bad weather, or falling prices. Judging from the criteria and the relationship between the value of CV and L, if CV> 0.5, then L < 0, then the business will likely experience losses. The business will avoid losses if CV < 0.5, then L> 0. Because the three periods have a value of CV < 0.5 and a value of L > 0, the shrimp farming business in each period will avoid losses or risks suffered will be very small. The results of the calculation of the risk analysis of the income of the two cycles of the stocking season will avoid the risk or have a reasonably low risk so that the Vaname shrimp farming business can continue and accept the risk of income. This is following the research of Afandi et al. (2024), analyzing the risk of vaname shrimp farming in Panggoosi Village, Tinanggea District, South Konawe Regency and Saragih et al. (2015) analyzing the risk of production and income of smallholder shrimp farming in Labuhan Deli Village, Medan Marelan District, Medan City.

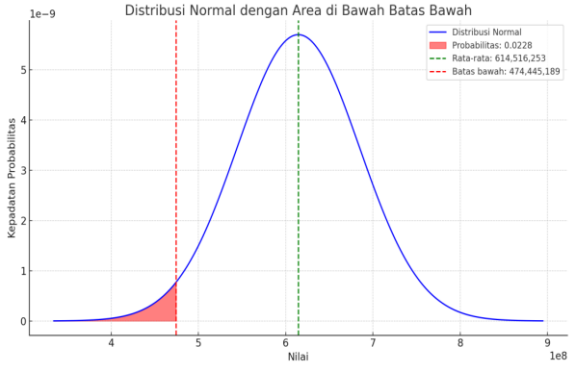

Figure 2. Normal distribution of vaname shrimp income from income risk

The graph above shows a normal distribution with the area under the lower boundary (474,445,189.4) shaded in red. This area represents the probability that a value will fall below that limit.

Table 8. Sources of Production and Income Risks

Risk Category	Risk Type	Impact	Countermeasure Strategy
Production	Unhealthy/low-quality fry	Non-uniform growth, disease-prone	Purchase from certified hatcheries, fry screening, use of SPF (Specific Pathogen Free) fry, vitamin application in feeds
Production	Poor quality feed /mismanagement	Low feed efficiency, declining water quality	Use high-quality feed, feeding management (frequency/amount), vitamin & probiotic supplements
Income	Market price fluctuations	Unstable income does not cover production costs	Market diversification, partnership contracts, optimal harvest schedule, improved yield quality (size & uniformity)
Income	High production costs (feed, electricity, labor)	Falling profit margins, operational difficulties	Input use efficiency, cooperative cooperation, government assistance/subsidies, utilization of family labor
Income	Difficulty accessing capital	Unable to buy fry/feed, cultivation halted	Loans from cooperatives, banks/microfinance institutions, government assistance programs, careful cash/budget management

4. Conclusions

From the results of the analysis conducted, it is known that the production of vaname shrimp farming in the Bantan District amounted to 1,378,000 kg/year or 660,558.85 kg/Ha with an average production of 25,406.11 kg and a total income of IDR36,053,692,221 per year IDR614,516,253 Ha/Year. The R/C value is >1 (1.75797), making the business economically profitable. Production risk has a value of KV <0.5 is 0.0887 and the lower limit value >0 is 20,896, then the risk of income has a value of KV <0.5 is 0.1139 and the lower limit value >0 is 474445189 so that Vaname shrimp farming in Bantan District has a low risk and will avoid losses so it is feasible to continue.

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