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Financial Feasibility Analysis of Vannamei Shrimp (*Litopenaeus vannamei*) Farming in Mesjid Raya District, Aceh Besar Regency

Nova Lianda Tambunan[1*], Makwiyah A. Chaliluddin[2], Ichsan Setiawan[3]
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***Abstract*—** Vannamei shrimp (*Litopenaeus vannamei*) is one of Indonesia's leading aquaculture commodities, with high economic value and significant export potential are held. This study aimed to analyzed the financial feasibility of vannamei shrimp farming in Mesjid Raya District, Aceh Besar Regency. The research was conducted from December 2025 to May 2026 using observation and structured interviews with 37 shrimp farmers who were selected through purposive sampling and surveyed using a census approach. Primary data were collected through questionnaires and field observations, whereas secondary data were obtained from relevant literature and institutional reports. Financial feasibility was analyzed using short-term indicators, including investment, production costs, revenue, profit, and the Revenue Cost Ratio (R/C), as well as long-term indicators that are consisted of Net Present Value (NPV), Net Benefit Cost Ratio (Net B/C), Internal Rate of Return (IRR), and Payback Period (PP). It was shown by the results that the average R/C values ranged from 1.46 to 2.81, by which it is indicated that revenues exceeding production costs were generated by all farming enterprises. Positive NPV values ranging from IDR 30,790,484.79 to IDR 2,889,612,837.71, Net B/C values between 2.07 and 3.12, IRR values ranging from 39% to 68%, and Payback Periods between 1.5 and 2.6 years were revealed by the long-term financial analysis. It is indicated by these findings that vannamei shrimp farming in all study villages is financially feasible and profitable, with the highest investment, revenue, profit, and long-term financial performance being shown by Lamreh Village.

Keywords—financial feasibility, IRR, Mesjid Raya, NPV, R/C ratio, vannamei shrimp

**Corresponding Author : novalianda95@gmail.com*

I. INTRODUCTION

Vannamei shrimp (*Litopenaeus vannamei*) is one of the leading aquaculture commodities, with high economic value and a significant contribution to national foreign exchange. In recent years, vannamei shrimp production in Indonesia has continued to be increased in response to growing international market demand. In Indonesia, the production of *L. vannamei* showed a significant increase in 2020, reaching 722,000 tonnes far exceeding that of *Penaeus monodon* [1]. Through this strong market demand, vannamei shrimp farming has been positioned as one of the priority sectors in the development of Indonesia's aquaculture industry. The successful expansion of vannamei shrimp farming is also supported by the species' biological characteristics, particularly its ability to adapt to a wide range of salinity conditions (euryhaline). It was reported [2] that vannamei shrimp can be grown well under low-salinity conditions of approximately 3–5 ppt, while stable physiological performance at salinity levels of around 25 ppt is maintained. This euryhaline characteristic also enables *L. vannamei* to be cultured under various environmental conditions, as reported by [3]. Through this adaptability, vannamei shrimp are enabled to be cultured in various aquatic environments, so that substantial potential for Indonesia's national shrimp production to be further enhanced is offered.

Aceh Province is one of the regions with considerable potential for the development of vannamei shrimp farming is held, the availability of brackish-water ponds, and favorable coastal environmental conditions for aquaculture activities. To enhance pond productivity, a cluster-based aquaculture development program has been introduced by which the revitalization of traditional ponds into more productive farming areas through integrated management practices is aimed at. In addition, the adoption of advanced aquaculture technologies, such as the biofloc system, has continued to be expanded. It was reported by [4] that feed utilization efficiency was improved by the application of biofloc technology in Alue Naga, Banda Aceh, while stable water quality throughout the culture period was maintained. Advancements in cultivation technology are also closely linked to the economic aspects of the operation. [5], it was shown that differences in technology, stocking density, energy use, and production inputs can affect the costs and economic performance of P. vannamei cultivation businesses.

One of the areas by which strong potential for vannamei shrimp farming in Aceh Besar Regency is held is Mesjid Raya District. Extensive pond areas are possessed by this coastal district, and aquaculture has long been relied on by local communities as an important source of livelihood. Through its strategic location adjacent to the Malacca Strait, combined with access to

Nova Lianda Tambunan, Master's Program in Integrated Coastal Resources Management, Universitas Syiah Kuala, Banda Aceh, Indonesia. E-mail: novalianda95@gmail.com
Makwiyah A. Chaliluddin, Departement of Utilization of Fisheries Resources, Faculty of Fisheries and Marine Sciences, Universitas Syiah Kuala, Banda Aceh, Indonesia, Email : chaliluddin@usk.ac.id
Ichsan Setiawan, Department of Marine Sciences, Faculty of Marine and Fisheries, Universitas Syiah Kuala, Banda Aceh, Indonesia, Email : ichsansetiawan@usk.ac.id

aquaculture production inputs and supporting infrastructure, significant opportunities for the development of Mesjid Raya as a major center for vannamei shrimp production are provided. Nevertheless, this potential has not yet been fully realized, due to several constraints by which both production performance and farm profitability are affected. Business scale can also influence the economic performance of *L. vannamei* cultivation, especially through efficiency and returns to scale [1]

Challenges such as high feed costs, fluctuating market prices, limited investment capital, and disease outbreaks, particularly those that are caused by *Vibrio* bacteria and viral pathogens by which mass shrimp mortality can be resulted in, are commonly faced by vannamei shrimp farmers in Aceh, including those in Mesjid Raya District. Through these constraints, production costs are increased, operational efficiency is reduced, and pond productivity is ultimately lowered. Consequently, the success of vannamei shrimp farming depends not only on the achievement of high production levels but also on the maintenance of economic profitability and financial sustainability. Therefore, a comprehensive business feasibility analysis is required, so that the financial prospects of vannamei shrimp farming in the study area are evaluated.

Business feasibility analysis is a widely used approach by which it is assessed whether an enterprise is financially viable. Financial performance is commonly evaluated using economic indicators such as the Revenue–Cost (R/C) Ratio, Net Present Value (NPV), and Internal Rate of Return (IRR), by which profitability and investment feasibility are measured. Financial feasibility analysis is also widely used to assess the profitability and investment risk of *L. vannamei* farming [6, 7]. It has been demonstrated by previous studies that intensive vannamei shrimp farming is economically feasible, as is indicated by R/C Ratio values greater than one, positive NPV values, and IRR values exceeding prevailing interest rates [8, 9, 10]. However, the level of financial feasibility is strongly influenced by farm management efficiency, pond productivity, feed costs, post-larvae quality, shrimp survival rate, and local farming conditions. Consequently, findings that are obtained in one region cannot necessarily be generalized to other areas.

To date, information regarding the financial feasibility of vannamei shrimp farming in Mesjid Raya District, Aceh Besar Regency, remains limited. As a result, the profitability and business prospects of shrimp farming in this area have not been comprehensively evaluated. Such information is essential, so that investment decisions, business development strategies, and the long-term sustainability of shrimp aquaculture in the region are supported. Therefore, a financial feasibility study specific to the Mesjid Raya area is required, utilizing both short-term and long-term feasibility indicators. Accordingly, this study aimed to analyze the financial feasibility of vannamei shrimp (*Litopenaeus vannamei*) farming in Mesjid Raya District, Aceh Besar Regency.

II. METHOD

Study Area

This study was conducted from December 2025 to May 2026 in Lamnga, Kampong Baro, Ladong, Ruyung, Paya Kameng, and Lamreh Villages, which are located in Mesjid Raya District, Aceh Besar Regency, Aceh Province, Indonesia. These villages were selected because the major vannamei shrimp (*Litopenaeus vannamei*) farming areas within the district are represented by them. The geographical distribution of the study sites is presented in Figure 1.

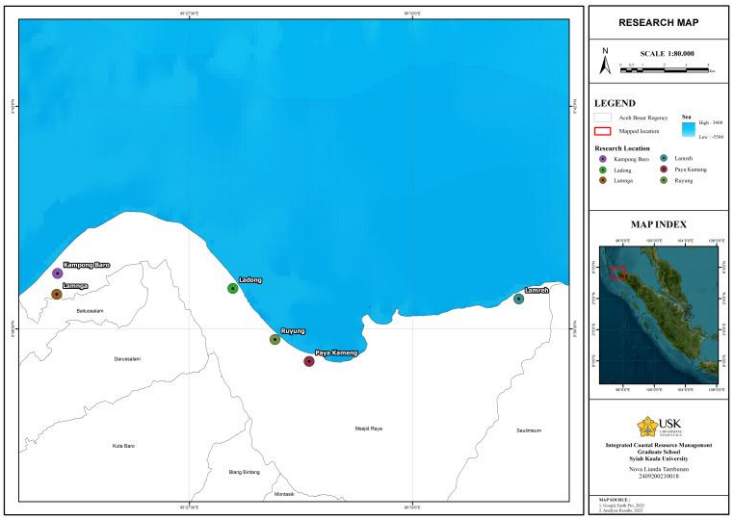


Figure 1. Study map area

Data Collection Methods

Observation and structured interviews were employed by this study as the primary data collection methods. Field observations were conducted directly at both traditional and intensive vannamei shrimp (*Litopenaeus vannamei*) farms, so that an overview of farming practices and operational conditions was obtained. Face-to-face interviews were conducted with

respondents using a structured questionnaire as the primary research instrument. Respondents were selected using a purposive sampling technique on the basis of predetermined criteria that are relevant to the objectives of the study. All shrimp farmers by whom the selection criteria were met were included as respondents; therefore, a total of 37 farmers were participated in the study through a census approach. Both primary and secondary data were utilized by the study. Primary data were collected through direct field observations and structured interviews using the questionnaire. Secondary data were obtained from various sources, including scientific journals, books, government reports, and other relevant literature that is related to the study.

Data Analysis
Short Term Business Feasibility Analysis
Investment Capital
Investment capital refers to the financial resources that are allocated by a business or entrepreneur, so that an enterprise is established and operated. The funds that are invested in the acquisition of fixed assets and other long-term resources by which business operations are supported and future economic returns are generated are represented by [11].

Total Production Cost
Production cost refers to the total expenditure that is incurred in the production of a product [12]. Total production cost was calculated using the following equation:

$$TC = TFC + TVC \quad (1)$$

where:
TC = Total production cost
TFC = Total fixed cost
TVC = Total variable cost

Total Revenue
Total revenue was calculated using the formula that was proposed by [12]:

$$TR = Q \times P \quad (2)$$

where:
TR = Total revenue (IDR)
Q = Production output (kg)
P = Selling price (IDR per kg)

Revenue Cost Ratio **(R/C)**
The Revenue Cost (R/C) Ratio was calculated on the basis of the equation that was proposed [13]:

$$R/C = \frac{TR}{TC} \quad (3)$$

Where:
R/C = Revenue–Cost Ratio (the ratio of total revenue to total production cost)
TR = Total revenue generated from product sales (IDR)
TC = Total production cost incurred during the production process (IDR).

Net Profit Analysis
Net profit was calculated using the equation that was proposed by [14]:

$$\Pi = TR - TC \quad (4)$$

Where:
Π = Net profit (IDR)
TR = Total revenue (IDR)
TC = Total production cost (IDR)

Long-Term Business Feasibility Analysis
Net Present Value **(NPV)**
The Net Present Value (NPV) was calculated using the equation that was proposed by [13]:

$$NPV = \sum_{t=1}^{n} \left(0 \frac{Bt-Ct}{1+i}\right) \quad (5)$$

Where:
NPV = Net Present Value (IDR).
t = Time period (year).
n = Project life (years).
Bt = Benefits (cash inflows) in year *t* (IDR).
Ct = Costs (cash outflows) in year *t* (IDR).
i = Discount rate (%).

Net Benefit Cost Ratio **(Net B/C)**
The Net Benefit–Cost Ratio (Net B/C) was calculated as the ratio of the positive Net Present Value (NPV) to the negative Net Present Value (NPV), following the method that was proposed by [13]:

$$Net \frac{B}{C} = 0 \frac{\sum_{t=1}^{n} \left(0 \frac{Bt-Ct}{1+i} (Bt-Ct)>0\right)}{\sum_{t=1}^{n} \left(0 \frac{Bt-Ct}{1+i} (Bt-Ct<0\right)} \quad (6)$$

Interpretation of the Net B/C Ratio:
Net B/C > 1 = The business/investment is financially feasible, as the costs are exceeded by the benefits.
Net B/C = 1 = The business is at the break-even point, at which the benefits are equal to the costs.
Net B/C < 1 = The business/investment is not financially feasible, as the benefits are exceeded by the costs.

Internal Rate of Return **(IRR)**
The Internal Rate of Return (IRR) was calculated using the formula that was proposed by [13]:

$$IRR = = i' + \frac{NPV^1}{NPV^1 - NPV^2} (i'' - i') \quad (7)$$

Where:
IRR = Internal Rate of Return (%)
i' = First discount rate resulting in a positive NPV.

i'' = Second discount rate resulting in a negative NPV.

NPV^1 = Net Present Value at discount rate i' (positive value).

NPV^2 = Net Present Value at discount rate i'' (negative value).

***Payback Period* (PP)**

The Payback Period (PP) was calculated using the equation that was proposed by [13]:

$$Payback\ Period = \frac{Investment\ Value}{Profit} \text{x 1 Year} \quad (8)$$

III. Results and Discussion

Short Term Financial Feasibility of Vannamei Shrimp Farming

The financial feasibility of vannamei shrimp (*Litopenaeus vannamei*) farming was evaluated using short-term financial analysis, by which investment capital, fixed costs, variable costs, total production costs, total revenue, net profit, and the Revenue-Cost (R/C) Ratio were included. The average production cost and revenue components of vannamei shrimp farming in Mesjid Raya District, Aceh Besar Regency, are presented in Table 1.

TABLE 1.
AVERAGE PRODUCTION COSTS OF VANNAMEI SHRIMP (*LITOPENAEUS VANNAMEI*) FARMING IN MESJID RAYA DISTRICT, ACEH BESAR REGENCY

Village	n	Investment (IDR)	Fixed Cost (IDR)	Variable Cost (IDR)	Total Production Cost (IDR)	Total Revenue (IDR)	Net Profit (IDR)	R/C Ratio
Lamnga	7	46,633,571	5,216,328	36,206,000	41,422,328	67,665,000	26,242,672	1,52
Ladong	4	155,837,500	5,157,500	22,515,000	27,672,500	80,780,000	53,107,500	2,81
Ruyung	12	70,265,000	7,636,458	64,273,750	71,910,208	95,900,417	23,990,208	1,84
Paya Kameng	4	162,828,750	14,521,250	143,471,250	157,992,500	277,293,500	119,301,000	1,55
Kampong Baro	5	350,572,000	32,653,100	461,778,000	494,431,100	730,376,000	235,944,900	2,13
Lamreh	5	2,056,296,000	226,166,067	2,034,434,578	2,260,600,645	3,434,741,600	1,174,140,955	1,46

n: Number of Farmers
Source: Processed Data (2026)

Based on Table 1, a total of 37 respondents were distributed across six villages: Lamnga (7 respondents), Ladong (4 respondents), Ruyung (12 respondents), Paya Kameng (4 respondents), Kampong Baro (5 respondents), and Lamreh (5 respondents). It was shown by the results that the average investment, fixed costs, variable costs, total production costs, total revenue, net profit, and Revenue Cost (R/C) Ratio were varied among the villages. Through these differences, variations in farm scale, pond area, the use of aquaculture facilities and infrastructure, and the farm management practices that are adopted by individual shrimp farmers are indicated.

The highest average investment, amounting to IDR 2,056,296,000 per respondent, was had by Lamreh Village, whereas the lowest average investment was recorded in Lamnga Village, at IDR 46,633,571 per respondent. Through the high investment value in Lamreh, it is indicated that more comprehensive aquaculture facilities and infrastructure were employed by farmers, while intensive farming systems were implemented. Consequently, the highest fixed cost, IDR 226,166,067, and variable cost, IDR 2,034,434,578, were also recorded by Lamreh, so that a total production cost of IDR 2,260,600,645. This finding is consistent with [15], who reported that feed was the largest component of variable costs in *P. vannamei* farming, followed by electricity and other production inputs. Similarly, it was explained by [16] that investment costs represent the initial expenditure for the acquisition of fixed assets, whereas it was stated by [17] that depreciation expenses, by which a major component of fixed costs is constituted, are increased by higher investment values.

The largest cost component across all study villages was represented by variable costs. The highest variable costs were recorded by Lamreh Village, whereas the lowest variable costs, at IDR 22,515,000, were had by Ladong Village. The high variable costs in Lamreh were primarily associated with the greater demand for post-larvae, feed, probiotics, medicines, electricity, labor, and other operational inputs that are required during a single production cycle. As farming scale is increased, the demand for production inputs is also raised, so that higher variable costs are led to. It was further noted by [16] that variable costs are increased with expanding production capacity and greater utilization of aquaculture inputs.

Through differences in investment, fixed costs, and variable costs, considerable variation in total production costs among the villages was resulted in. The highest total production cost was recorded by Lamreh Village, whereas the lowest, at IDR 27,672,500, was had by Ladong Village. The relatively high production cost in Lamreh was attributed to the implementation of intensive farming systems, by which greater capital investment and higher production input utilization than

those in other villages are required. In contrast, the reduced use of production facilities and operational inputs was reflected by the lower production cost in Ladong. These findings are consistent with those of [17] by whom it was reported that substantially higher investment and operational expenditures than semi-intensive and traditional farming systems are required by intensive shrimp farming.

Regarding revenue and profitability, the highest average total revenue, IDR 3,434,741,600, and net profit, IDR 1,174,140,955, were achieved by Lamreh Village. Through this, it is indicated that higher production values than those in the other villages were generated by the shrimp farming operations in Lamreh, despite substantially higher production costs being incurred. In contrast, the lowest average net profit, amounting to IDR 23,990,208, was recorded by Ruyung Village. Through these results, it is suggested that profitability depends not only on production output but also on the balance between total revenue and total production costs. This finding supports [18], by whom profit was defined as the difference between total revenue and total cost. Likewise, it was reported by [19] that business profitability is reduced by increases in production costs without corresponding increases in revenue.

The Revenue-Cost (R/C) Ratio across all villages ranged from 1.46 to 2.81, with all values exceeding one (R/C > 1). The highest R/C Ratio was recorded in Ladong Village (2.81), whereas the lowest was observed in Lamreh Village (1.46). Through an R/C Ratio greater than one, it is indicated that total production costs are exceeded by total revenue, so that it is demonstrated that vannamei shrimp farming is financially feasible. This finding is comparable to [10], who reported a benefit-cost ratio of 2.01 and a net profit of USD 2.73/kg, indicating the economic viability of *P. vannamei* farming. Therefore, all vannamei shrimp farming enterprises in Mesjid Raya District can be considered financially feasible. Through the variation in R/C Ratios among villages, differences in the efficiency of production cost utilization are indicated. Greater efficiency in the conversion of production costs into revenue is reflected by higher R/C values. These findings are consistent with [19], by whom it was stated that vannamei shrimp farming is profitable when the R/C Ratio is greater than one. Similarly, it was reported by [20] that greater production efficiency is indicated by higher R/C Ratios. The present findings are also consistent with those of [21], by whom an R/C Ratio of 2.14 for intensive vannamei shrimp farming was reported, and [22], by whom an R/C Ratio of 1.71 for non-partial intensive vannamei shrimp farming was obtained. The differences in R/C Ratios among the villages indicate that higher investment and production costs do not necessarily result in higher financial efficiency. Although Lamreh Village generated the highest total revenue and net profit, it recorded the lowest R/C Ratio (1.46) because its production costs were substantially higher. In contrast, the higher R/C Ratio in Ladong Village (2.81) indicates a more efficient conversion of production costs into revenue despite its lower production scale.

Long-Term Financial Feasibility of Vannamei Shrimp Farming

The long-term financial feasibility of vannamei shrimp (*Litopenaeus vannamei*) farming was evaluated using Net Present Value (NPV), Net Benefit–Cost Ratio (Net B/C), Internal Rate of Return (IRR), and Payback Period (PP) analyses. The average values of Net Present Value (NPV), Net Benefit-Cost Ratio (Net B/C), Internal Rate of Return (IRR), and Payback Period (PP) for vannamei shrimp farming in each village of Mesjid Raya District, Aceh Besar Regency, are presented in Table 2.

TABLE 2.
AVERAGE VALUES OF NET PRESENT VALUE (NPV), NET BENEFIT COST RATIO (NET B/C), INTERNAL RATE OF RETURN (IRR), AND PAYBACK PERIOD (PP) OF VANNAMEI SHRIMP (*LITOPENAEUS VANNAMEI*) FARMING IN MESJID RAYA DISTRICT, ACEH BESAR REGENCY

Village	n	NPV (IDR)	Net B/C Ratio	IRR (%)	Payback Period (Years)	Feasibility
Lamnga	7	63,910,108.39	2,85	61	1,6	Feasible
Ladong	4	67,870,609.74	2,07	39	2,4	Feasible
Ruyung	12	30,790,484.79	2,31	45	2,3	Feasible
Paya Kameng	4	339,710,461.98	2,56	53	1,9	Feasible
Kampong Baro	5	643,313,752.15	2,11	39	2,6	Feasible
Lamreh	5	2,889,612,837.71	3,12	68	1,5	Feasible

n: Number of Farmers
Source: Processed Data (2026)

It is indicated by the results that are presented in Table 2 that positive Net Present Value (NPV), Net Benefit–Cost Ratio (Net B/C) values greater than one, Internal Rate of Return (IRR) values exceeding the 6% discount rate, and Payback Periods (PP) ranging from 1.5 to 2.6 years were recorded by all vannamei shrimp (*Litopenaeus vannamei*) farming enterprises in Mesjid Raya District, Aceh Besar Regency. On the basis of these financial indicators, vannamei shrimp farming in all six villages can be considered financially feasible.

The Net Present Value (NPV) was varied considerably among the villages, ranging from IDR 30,790,484.79 to IDR 2,889,612,837.71. The highest NPV was recorded in Lamreh Village, whereas the lowest was observed in Ruyung Village. Nevertheless,

positive NPV values were generated by all villages, by which it is indicated that positive net benefits throughout the project life were able to be generated by the investments. The high NPV that was observed in Lamreh Village was associated with the implementation of intensive farming practices, by which higher revenues and profits than those of the other villages were generated. Conversely, although the lowest NPV was recorded by Ruyung Village, the value remained positive, by which it is indicated that shrimp farming in this village was still profitable and financially viable. This finding is comparable to [23], who reported a positive NPV of IDR 3,463,203,705 for intensive *L. vannamei* farming in Aceh Tamiang, indicating financial feasibility and [24], it was demonstrated that productivity is improved by intensive shrimp farming systems and financial feasibility is consequently enhanced.

The Net Benefit–Cost Ratio (Net B/C) ranged from 2.07 to 3.12 across all villages. The highest Net B/C value was observed in Lamreh Village (3.12), whereas the lowest was recorded in Ladong Village (2.07). Net B/C values greater than one were achieved by all villages, by which it is indicated that the total costs that were incurred were exceeded by the net benefits that were generated, so that the financial feasibility of the farming enterprises is confirmed. Through the relatively high Net B/C values, it is further suggested that investment and operational expenditures were efficiently converted into economic returns. The Net B/C values that were obtained in the present study were lower than those that were reported by [24], by whom a value of 4.02 was obtained, but were comparable to the findings of [25], by whom a Net B/C value of 3.10 was reported.

The Internal Rate of Return (IRR) ranged from 39% to 68%, with all values substantially exceeding the 6% discount rate. Through this, it is indicated that the cost of capital was exceeded by the expected rate of return on investment, so that it is confirmed that vannamei shrimp farming is financially attractive for investment. The highest IRR (68%) was recorded by Lamreh Village, whereas the lowest IRR values (39% each) were exhibited by Kampong Baro and Ladong Villages. Despite these differences, all IRR values remained well above the discount rate, by which it is indicated that satisfactory financial returns were generated by investments in all villages.

Through the Payback Period (PP) analysis, it was indicated that the investment recovery period ranged from 1.5 to 2.6 years. The shortest payback period (1.5 years) was exhibited by Lamreh Village, whereas the longest investment recovery period (2.6 years) was required by Kampong Baro Village. These differences were primarily influenced by variations in initial investment, net profit, and production capacity among the villages. Despite these differences, their initial investments were able to be recovered by all shrimp farming enterprises within a relatively short period, by which it is indicated that they are financially feasible for long-term investment. These findings are supported by [26], by whom it was reported that vannamei shrimp farming remains financially viable despite relatively high initial investment being required, provided that sufficient economic returns are generated throughout the project's operational life. Addition, [27], who reported a Payback Period of four production cycles for *L. vannamei* farming, demonstrating the importance of a relatively short investment recovery period in assessing financial feasibility

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IV. CONCLUSION

On the basis of the financial analysis, vannamei shrimp (*Litopenaeus vannamei*) farming in Mesjid Raya District, Aceh Besar Regency, was found to be financially feasible for further development. It was indicated by the short-term financial analysis that a Revenue–Cost (R/C) Ratio greater than one (R/C > 1) was achieved by all farming enterprises. Furthermore, it was demonstrated by the long-term financial analysis that the investment feasibility criteria were met by all farming enterprises, as is evidenced by positive Net Present Value (NPV) values, Net Benefit–Cost Ratio (Net B/C) values greater than one (Net B/C > 1), Internal Rate of Return (IRR) values ranging from 39% to 68%, by which the 6% discount rate is exceeded, and Payback Periods ranging from 1.5 to 2.6 years.

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