Business Review and Case Studies, Vol. 6 No. 2, August 2025
Permalink/DOI: http://dx.doi.org/10.17358/brcs.6.2.304
Available online at http://journal.ipb.ac.id/index.php/brcs
EISSN: 2721-6926

STRATEGIC APPROACHES TO SUSTAIN VANNAMEI SHRIMP CULTIVATION IN LINDUK, BANTEN

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Article history:

Received
16 January 2025

Revised
22 January 2025

Accepted
24 July 2025

Available online
28 August 2025

ABSTRACT

Background: With the development of various techniques, aquaculture has played an important role in Indonesia's economic growth. Cultivation of vannamei shrimp is one of the most popular aquaculture practices. Vannamei shrimp is an export commodity, with significant results. The Linduk Aquaculture Pond in Banten Province is an example of this industry's contribution by providing economic benefits to the local community. Linduk was chosen as the research site because it is known as one of the aquaculture centers in Banten, supported by geographical and ecological conditions such as the availability of extensive pond land, water quality suitable for shrimp cultivation, and local community support for the fisheries sector. Furthermore, it is located close to the domestic market, facilitating distribution access to export markets through ports in Banten. Furthermore, several challenges, including limited capital, climate variability, seed quality, high operational costs, and management inefficiencies hamper optimal business performance.
Purpose: This study aimed to identify and analyze business strategies for maintaining and increasing the productivity and growth of Linduk Aquaculture Ponds in Banten Province.
Design/Methodology/Approach: This study involved two key internal stakeholders (the business owner and field coordinator), three customers, and three competitors as informants to provide comprehensive insights into the operational, market, and competitive dynamics of the Linduk shrimp aquaculture business.This study uses a qualitative approach, which integrates strategic management tools. The internal and external environments were analyzed using IFE, EFE, IE, SWOT, and QSPM matrices to produce actionable strategies.
Findings/Results: The IE matrix shows that the business is in a "hold and maintain" position. The “hold and maintain” position in the IE matrix indicates that the business is currently stable and performing adequately, requiring strategies focused on sustaining existing market share and operational efficiency. Five alternative strategies were derived from the SWOT analysis, with QSPM identifying priority strategies to optimize shrimp growth and production.
Conclusion: Strategic recommendations focus on maintaining business productivity by addressing the identified challenges and ensuring long-term growth and sustainability in the aquaculture sector.
Originality/value (State of the art): Previous studies have largely examined the common challenges in aquaculture, such as climate variability, seed quality, and operational costs. They have not specifically focused on formulating actionable strategies utilizing robust analytical frameworks such as the IFE, EFE, IE, SWOT, and QSPM matrices. This study addresses this gap by systematically identifying crucial internal and external factors, prioritizing context-specific strategies for local aquaculture enterprises, and offering a comprehensive roadmap for improving productivity, competitiveness, and sustainability in the Indonesian aquaculture industry.

Keywords: aquaculture business, business strategy, competitiveness, sustainability, SWOT Analysis

How to Cite:
Prabawanti, B. E., & Natarina, A. (2025). Strategic approaches to sustain vannamei shrimp cultivation in Linduk, Banten. Business Review and Case Studies, 6(2), 304. https://doi.org/10.17358/brcs.6.2.304

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INTRODUCTION

Fisheries are a crucial sector for Indonesia's economic development, supported by its status as the world's largest archipelagic nation, with a marine area of 3.25 million km². The Ministry of Maritime Affairs and Fisheries (MMAF) reported that Indonesia's fisheries sector exports reached approximately USD 2.8 billion between January and June 2023, with aquaculture being the main contributor. Among aquaculture commodities, shrimp is a dominant commodity, contributing USD 567 million (IDR8.47 trillion) to exports from January to April 2023 (MMAF, 2023). This study aims to develop strategic recommendations to improve the sustainability and competitiveness of shrimp aquaculture businesses using analytical frameworks such as the SWOT matrix, IE matrix, and QSPM. The research hypothesizes that product innovation, digital marketing, and operational efficiency significantly impact business performance and competitive advantage, and their optimization is expected to strengthen the long-term sustainability of the sector. Figure 1 shows a graph of the growth in shrimp exports in Indonesia.

One effort to increase exports and domestic consumption is to increase shrimp production in the fisheries sector. Several policies demonstrate government support for promoting sustainable fishery cultivation programs, particularly for shrimp, including the Operational Standards for CBIB and Area-Based Shrimp Cultivation (BUBK). One of the most promising shrimp species for cultivation is whiteleg shrimp. Whiteleg shrimp has economic value and is an alternative shrimp species that can be cultivated in Indonesia, along with tiger shrimp (Penaeus monodon) and whiteleg shrimp (Penaeus merguiensis). Whiteleg shrimp is relatively easy to cultivate. According to data from the Indonesian Ministry of Maritime Affairs and Fisheries (KKP, 2020), whiteleg shrimp cultivation is currently the mainstay of the fishery cultivation sector and a priority for aquaculture development in Indonesia within the national economy. Whiteleg shrimp is a popular cultivation option because of several advantages. These shrimp are known for their high adaptability, strong survival, and low mortality rates. Another advantage of the whiteleg shrimp is its broad and flexible market share. From small to large, whiteleg shrimp always have a place in the market and are in constant demand by companies and the public. Whiteleg shrimp contributed to more than 36% of Indonesia's fisheries export value (Hanif, 2023). This indicates that whiteleg shrimp plays a significant role in Indonesia's fishery export performance.

One of the areas named shrimp production centers in Indonesia is located in Banten Province. Banten Province is recorded as having aquaculture production reaching 111,599.30 tonnes with a production value of 2.49 trillion rupiahs, higher than capture fisheries production, which reached 67,759.28 tonnes with a production value of 2.24 trillion rupiahs (DKP Banten, 2023). White shrimp production in Banten reaches 4 tons per hectare, with harvests occurring twice yearly (DKP Banten, 2023). Linduk Village in Pontang District, Serang Regency, is a rapidly developing shrimp cultivation area, with cultivation ponds being the primary source of income for residents and immigrants. Vannamei shrimp cultivation businesses provide many economic benefits to business actors and the environment in which the business is established. Apart from providing economic benefits, the Panama shrimp cultivation business also faces several challenges, including capital issues, fry quality, operational costs, management, and extreme weather and disease, which can often become obstacles in this industry.

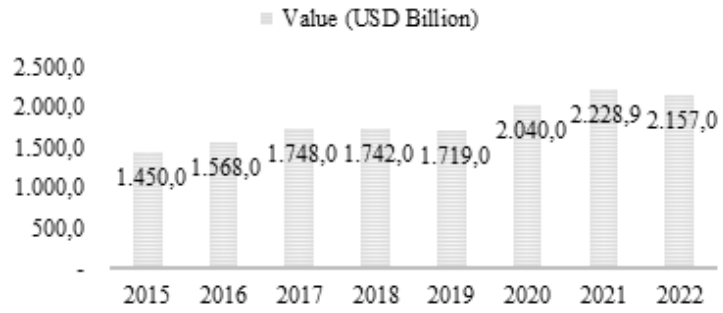

Figure 1. Indonesia Shrimp Export 2015-2022 (Grahadyarini, 2023)

Previous studies have identified several recurring problems experienced by shrimp farmers. Clapano et al. (2022), Mohamed et al. (2022), and Tien et al. (2024) found that Vannamei farmers often face problems with fluctuations in water quality parameters, such as decreased dissolved oxygen, changes in pH, and increased ammonia, which trigger stress in shrimp and increase the risk of disease outbreaks such as White Spot Syndrome Virus (WSSV) and vibriosis. Additional challenges include the rapid spread of disease outbreaks, dependence on imported feed, high operational costs, and ineffective pond waste management, which causes accumulation of organic matter and eutrophication, impacting water quality and pond productivity decline.

While existing studies have extensively documented these operational and environmental challenges, there remains a significant gap in comprehensive strategic management approaches that integrate multiple analytical frameworks to address the complex interplay between internal capabilities and external market dynamics in shrimp aquaculture businesses. Most previous research has focused on technical and environmental aspects, with limited attention paid to holistic business strategy development that considers both competitive positioning and sustainability requirements.

Today's fishery business models can transcend traditional trade by integrating economic viability, resource sustainability, and socio-environmental responsibility. Fisheries economics, as a discipline, examines resource allocation, market dynamics, policy impacts, and sustainability in aquaculture and capture fisheries with the goal of balancing economic efficiency and ecological conservation. Globally, aquaculture has surpassed capture fisheries in terms of seafood supply while also offering significant socio-economic contributions, such as increased food security and employment, while still prioritizing environmental issues. In the Indonesian context, aquaculture, including shrimp farming, is a crucial economic sector; Indonesia currently ranks fourth in global aquaculture production, with over 14 million tons in 2014, and projections indicate continued growth, potentially surpassing capture fisheries by 2026.

This rapid expansion presents both opportunities and challenges. While increasing export value and rural livelihoods, it also demands better business strategies to manage environmental impacts, market volatility, and governance issues. Therefore, the integration of strategic management frameworks, such as SWOT, IE, and QSPM, is crucial for fisheries companies seeking to optimize their performance while ensuring long-term ecological and economic sustainability.

Strategic positioning is the foundation for achieving sustainable competitive advantage in the digital era and global market dynamics. By adopting the Resource-Based View (RBV) approach, companies are expected to identify and utilize valuable, rare, inimitable, and non-substitutable internal resources as a basis for differentiation. In a rapidly changing and diverse business environment, strategic positioning must consider three key aspects: entrepreneurial ecological orientation, digital capabilities, and organizational dynamics. Recent studies show that the combination of ecological orientation, digital transformation, and dynamic capabilities creates a strategic configuration that supports a sustainable competitive advantage (Abdurrahman et al. 2024). Furthermore, strong digital capabilities, including digital leadership and absorptive capacity, support innovative ambidexterity and strategic flexibility, which in turn strengthens a company's competitive position (Shao & Tzeng, 2025). Strategic business positioning involves positioning an organization for the future, considering environmental changes and their strengths and weaknesses (Lumumba, 2021). Strategic positioning can also be defined as determining how a company differentiates itself from its competitors and provides benefits to customers. This process involves identifying and evaluating a company's internal strengths and weaknesses as well as external opportunities and threats to formulate a plan aligned with growth objectives and critical success factors (Berrachedi et al. 2023). Therefore, it can be concluded that strategic business positioning involves properly positioning an organization for the future, considering environmental changes and the company's strengths and weaknesses. This process involves differentiating a business from competitors while providing benefits to customers by identifying and evaluating internal strengths, weaknesses, external opportunities, and threats in order to formulate a successful growth plan (Berrachedi et al. 2023; Lumumba, 2021).

The novelty of this research lies in its integrated approach to strategic analysis, combining the SWOT matrix, internal–external (IE) matrix, and Quantitative Strategic Planning Matrix (QSPM) frameworks specifically tailored for small-scale shrimp aquaculture businesses in Indonesia. This multidimensional analytical approach provides a more comprehensive understanding of strategic positioning and enables the development of evidence-based recommendations that address both immediate operational challenges and long-term sustainability goals.

Furthermore, this study contributes to the limited literature on strategic management applications in Indonesian aquaculture by focusing on a specific geographic context (Linduk Village, Banten) while providing insights that can be generalized to similar small-scale shrimp farming operations across the archipelago.

This research adopts a strategic management approach using three primary analytical tools: SWOT analysis to identify internal and external factors, IE matrix to determine business strategic positioning, and Quantitative Strategic Planning Matrix (QSPM) to quantitatively evaluate and prioritize alternative strategies.

Using this approach, this study describes the actual conditions of the whiteleg shrimp farming business in Linduk Village; analyzes its strengths, weaknesses, opportunities, and threats; and formulates the most appropriate strategic steps to increase business competitiveness and sustainability.

Based on initial interviews conducted by the author, it was discovered that the owner still managed the Linduk shrimp pond business very simply, using manual record-keeping for various operational activities. Furthermore, extreme weather conditions in Indonesia and diseases that can attack shrimp often hamper the operation of shrimp ponds. Therefore, Linduk Aquaculture Pond aims to address these issues by finding an appropriate business strategy to maintain business sustainability amidst industry competition and existing challenges. Therefore, the objectives of this study were as follows:

1. To identify internal and external factors influencing the performance of the whiteleg shrimp farming business in Linduk Village**.**
2. To determine the strategic position of the business based on the results of the SWOT analysis and the IE matrix**.**
3. To develop and prioritize alternative strategies using the QSPM.
4. To provide appropriate strategic recommendations to improve operational efficiency, competitiveness, and sustainability of the shrimp farming business amidst dynamic market and environmental challenges.

METHODS

This study used a qualitative approach with descriptive statistics. The data used in this study consist of primary data obtained directly from interviews with business actors (pond owners), field coordinators, pond workers, as well as consumers and competitors in the Pontang area, Serang Regency, and Secondary data obtained through a literature review of previous research reports, government policy documents, scientific articles, and other relevant sources that support the strategic analysis and validate the field findings.

Data collection techniques were carried out through in-depth interviews with respondents selected through purposive sampling, based on their active involvement in operations and strategic decision-making. The respondents consisted of two key employees: the business owner and field coordinator, and three customers (consumers) who had made a purchase. Three shrimp farming competitors in the Pontang area had 1–3 years of experience. This technique was selected to obtain comprehensive information on business operations, market perceptions, and competitive dynamics.

Data analysis is conducted using a strategic management approach in three main stages:

- Input stage: Internal factor evaluation (IFE) and External Factor Evaluation (EFE) to assess strengths, weaknesses, opportunities, and threats. Each factor was weighted and scored to determine an organization's strategic position.
- Matching Stage: A SWOT matrix is used to formulate alternative strategies based on a combination of internal and external factors. An internal–external (IE) matrix is used to map the business's position within nine strategy cells, reflecting the combined conditions of the IFE and EFE scores.
- Decision stage: The quantitative strategic planning matrix (QSPM) is used to evaluate and prioritize

the most feasible strategies. Each strategy was assigned an Attractiveness Score (AS) on a scale of 1–4 by experts, and then a Total Attractiveness Score (TAS) was calculated as the basis for determining the main strategy.

The systematic steps in calculating the QSPM include: Identifying alternative strategies; Determining key success factors; Assigning attractiveness scores by experts; Calculating the QSPM; Strategy prioritization and validation.

This study did not use a formal quantitative hypothesis because its approach is both qualitative and descriptive. However, the underlying premise of this study is that internal strengths (such as operational efficiency and product innovation) and responses to external opportunities (such as export markets and policy support) can be strategically combined to increase the competitiveness and sustainability of the shrimp farming businesses in Linduk. This implicit hypothesis is based on Resource-Based View theory and a strategic analysis framework, which states that differentiation and mastery of strategic resources are determinants of competitive advantage in a dynamic industry. The following is a framework of thought in the form of a conceptual model in Figure 2.

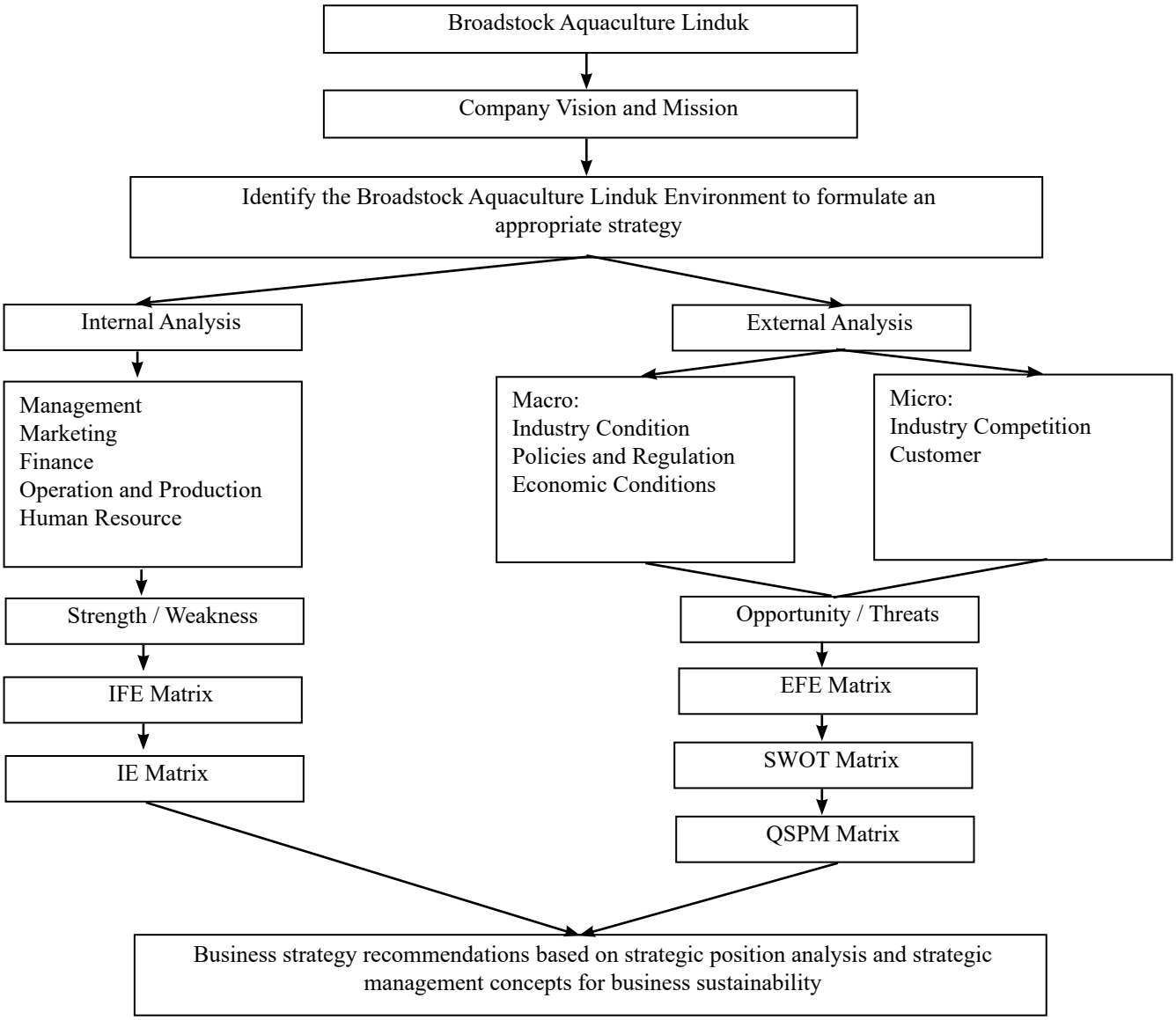

Figure 2. Conceptual model

This conceptual model illustrates the stages of management strategy, starting from identifying internal and external factors (through IFE and EFE), mapping the business position (IE Matrix), formulating alternative strategies (SWOT Matrix), and prioritizing the best strategy through QSPM. This model aims to develop appropriate strategic steps to improve the performance and sustainability of the whiteleg shrimp cultivation business in Linduk Village.

The research was conducted from January to April 2024 at Linduk Cultivation Pond, Linduk Village, Pontang District, Serang Regency, Banten. The research population included five employees, five customers, and competitors in the Pontang District, with sources selected through purposive sampling based on specific criteria to obtain relevant and in-depth information (Sugiyono in Santina et al. 2021; Palinkas et al. 2015). The population of this study consisted of three groups: (1) five employees, namely the business owner, field coordinator (representative of the business owner), pool workers, field workers, and pool guards; (2) five customers or consumers (collectors); and (3) business competitors located in the Pontang District. From this population, two employees (business owner and field coordinator) were selected as sources because of their active role in operations and strategic decision-making, three customers who had made at least one purchase, and three competitors with one to three years of similar business experience in an area close to the business location.

This sample selection aimed to obtain comprehensive and relevant information regarding business operations, consumer perceptions, and competitive conditions to support the analysis in this study. In this study, data processing and analysis techniques adopt the concept of strategic management with limitations at the strategy formulation stage.

The primary data and secondary data that have been collected are processed using an analytical tool, namely, the IFE Matrix (Internal Factor Evaluation), Matriks EFE (External Factor Evaluation), Matrix IE (Internal-External), SWOT Matrix, and QSPM (Quantitative Strategic Planning Matrix). The processing process includes three stages: input, matching, and decision-making.

RESULTS

Based on the results of identifying the internal environment of the Linduk Cultivation Pond, five strengths and six weaknesses were obtained, which became strategic business factors. Then, the relevant sources give strategic factor weights and rankings to produce a weighted score. The final result of this weighting and ranking process produces an IFE matrix, as presented in the following Table 1.

The IFE Matrix analysis showed that a total score of 2.598 from internal factors indicated that the Linduk Aquaculture Pond had a competitive advantage, which was driven by the competence of the owner or coordinator (0.431), technical planning (0.350), and process efficiency (0.399). The results of this study are in line with Purwanto et al. (2023), who found that the implementation of good cultivation SOPs is a major strength in vannamei cultivation businesses in Tegal Regency, which helps maintain their position in Cell V according to the IE Matrix, namely the "hold and maintain" strategy. This study also found significant weaknesses, namely, factors indicating limited business capital (score 0.098) and a suboptimal human resource management system (0.096). Capital problems have been confirmed in the study by Ratnasari et al. (2023), which showed that limited financing is one of the main obstacles to the sustainability of small-scale vannamei farmers.

In addition, Hermawan et al. (2019) in the context of grouper cultivation noted that weak human resource management has a direct impact on the implementation of operational standards, causing decreased productivity. This comparison emphasizes that, while technical competence and understanding of SOPs are fundamental strengths, increasing access to capital and strengthening human resource management are strategic interventions that must be prioritized. By focusing on building human resource capacity for example, through ongoing training and expanding access to microfinance or partnerships with financial institutions, Linduk Aquaculture Ponds can improve operational efficiency and business resilience. This strategy aligns with the recommendations of Purwanto et al. (2023), who advocated optimizing product quality and quantity through technology and sustainable SOPs to strengthen competitiveness. From the results of identifying the external environment of Linduk Cultivation Pond, five opportunities and four

threats were obtained, which became strategic business factors. The results of the ranking and weighting of the last resource person produced the EFE matrix shown in the Table 2.

The results of the EFE Matrix analysis show that the total weight score of external strategic factors from the Linduk Cultivation Pond was 2.967. While the most significant threats that need to be anticipated by businesses are climate change, temperature, and the risk of pests and diseases with a score based on the results of this EFE matrix analysis, the most significant opportunity that Linduk Cultivation Ponds can currently take advantage of is the potential to increase domestic market share and customer loyalty with a score of 0.313. The biggest threats that businesses need to anticipate are climate change, temperature, and the risk of pests and diseases, with a score of 0.365.

Identifying the business's position is crucial for formulating the right business strategy for the Linduk Cultivation Ponds. The IE matrix (Internal – External) is the analytical tool used to identify a business's strategic position. Based on the IE matrix, three strategic implications can be formulated to suit the current strategic position of a business. Figure 3 shows the strategic implications and positions of the Linduk Cultivation Pond presented in the IE matrix.

Based on the IFE matrix score weight results on the horizontal axis (x) of 2.59 and the EFE matrix score weight results of 2.96 on the vertical axis (y), the strategic position of the Linduk Cultivation Pond business is quadrant V. The strategic position of the Linduk Cultivation Pond business in this quadrant shows that the right strategy for business is maintenance and conservation (Hold and Maintain) by penetrating the market. Market penetration strategies can be implemented by expanding operational shrimp cultivation ponds, increasing operational efficiency, and using more optimal cultivation technology to increase production capacity. Linduk Cultivation Ponds can also expand the market penetration to collectors in new areas with more significant market potential.

Table 1. Results of IFE Matrix analysis of linduk cultivation ponds

Internal Strategic Factors	Weight	Range	Score (Weight x Range)
Strengths			
Measurable and standardized technical planning process.	0.100	3.5	0.350
Efficiency of production and cultivation processes with intensive cultivation technology.	0.114	3.5	0.399
Planned and systematic business operational management.	0.111	3	0.333
High knowledge, experience, and competence of the owner and field coordinator.	0.123	3.5	0.431
Area size and strategic business location.	0.107	3	0.321
Total Strength			1.834
Weakness			
Limited business capital.	0.098	1	0.098
The HR and workforce management system is not yet optimal.	0.064	1.5	0.096
Financial recording is still manual and straightforward.	0.064	2	0.128
There is no particular marketing strategy to market the product.	0.055	2	0.110
Market access is still limited.	0.091	2	0.182
Facilities and infrastructure supporting intensive cultivation technology are still limited.	0.075	2	0.150
Total Weakness			0.764
Total			2.598

Table 2. Results of EFE Matrix Analysis of Linduk Cultivation Pool

External Strategic Factors	Weight	Range	Score (Weight x Range)
Opportunity			
Export and global market potential.	0.097	1.5	0.146
Support for government policies and regulations.	0.104	2	0.208
Modernization of the fisheries sector with a revitalization program.	0.104	3.5	0.364
Positive economic growth accompanied by increased domestic consumption.	0.090	2.5	0.225
Potential to increase domestic market share and customer loyalty.	0.125	4	0.500
Total Opportunity			1.443
Threat			
Fluctuations in shrimp commodity prices in global and national markets.	0.128	4	0.512
Changes in climate, temperature, and risk of pests and diseases.	0.146	3	0.438
High level of competition.	0.076	2.5	0.19
Realization of foreign and domestic investment is still low.	0.128	3	0.384
Total Threat			1.524
Total			2.967

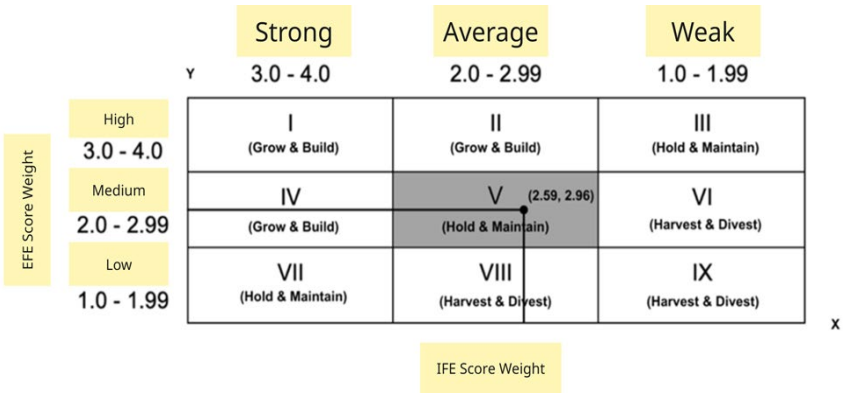

Figure 3. Strategic position of protected fish farming linduk business

The analytical tool used in this research is the SWOT matrix to formulate appropriate strategic alternatives to maintain business sustainability. The results of formulating alternative Linduk Cultivation Pond strategies based on SWOT matrix analysis are shown in the Table 3.

From the SWOT matrix analysis results, five alternative strategies were identified to maintain the sustainability of the Linduk Cultivation Pond business-based analysis. Alternative strategies from the resulting SWOT matrix are as follows:

1. Strategy I: Market penetration by increasing production capacity.
2. Strategy II: Strengthening operational management.
3. Strategy III: Adding a professional workforce.
4. Strategy IV: Increase business productivity by maximizing shrimp growth and production
5. Strategy V: Development of infrastructure and supporting facilities

After obtaining the results of formulating alternative strategies for the Linduk cultivation pond business, the next stage is to determine strategic priorities using the QSP matrix (Quantitative Strategic Planning). The results from the QSP matrix are strategic priorities that Linduk Cultivation Ponds can use to maintain business sustainability. The higher the STAS QSPM value, the more attractive is the value of the alternative strategy. Table 4 shows the results of the Linduk Cultivation Pond strategy priorities, based on an analysis of the QSP matrix.

Table 3. Results of alternative formulation of pond cultivation strategies

	STRENGTH (S) 1. Measurable and standardized technical planning process. 2. Efficiency of production and cultivation processes with intensive cultivation technology. 3. Planned and systematic business operational management. 4. High knowledge, experience, and competence of the owner and field coordinator. 5. Area size and strategic business location.	WEAKNESS (W) 1. Limited business capital. 2. The HR and workforce management system is not yet optimal. 3. Financial recording is still manual and straightforward. 4. There is no specific marketing strategy to market the product. 5. Market access is still limited. 6. Facilities and infrastructure supporting intensive cultivation technology are still limited.
OPPORTUNITIES (O) 1. Export potential and global market. 2. Support for government policies and regulations. 3. Modernization of the fisheries sector with a revitalization program. 4. Positive economic growth is accompanied by increased domestic consumption. 5. Potential to increase domestic market share and customer loyalty.	STRATEGI S-O Market penetration by increasing production capacity. (S2, S3, S4, S5, O2, O3, O4, O5) Strengthening operational management. (S1, S3, S4, O2, O3)	STRATEGI W-O Adding professional workforce (W2, W3, W4, O2, O4, O5)
THREAT (T) 1. Fluctuations in shrimp commodity prices in global and national markets. 2. Changes in climate, temperature, and the risk of pests and disease. 3. High level of competition. 4. Realization of foreign and domestic investment is still low.	STRATEGI S-T Increase business productivity by maximizing shrimp growth and production (S1, S2, S3, S4, T1, T2, T3)	STRATEGI W-T Development of infrastructure and supporting facilities. (W6, T2, T3, T4)

Table 4. Priority strategy for linduk cultivation ponds

Strategy Alternatives	STAS	Priority
Market penetration by increasing production capacity.	6.281	2
Strengthening operational management.	5.397	4
Increase professional workforce.	5.354	5
Increase business productivity by maximizing shrimp growth and production.	6.413	1
Development of infrastructure and supporting facilities	5.452	3

Based on the results of the QSPM analysis, the primary priority strategy with the highest TAS value (6.413) was to increase business productivity by maximizing shrimp growth and production. To adopt this strategy, the Linduk Cultivation Ponds can take several steps. First, they can optimize the use of technology with efficient aeration systems, adoption of the Internet of Things (IoT), and the use of Fuzzy Logic. These technologies help to increase aeration efficiency, reduce energy consumption, and improve wastewater management.

Furthermore, Linduk Cultivation Ponds can utilize an on-demand (AQ1) feeding system to improve the shrimp growth performance. This system has been proven to efficiently increase shrimp cultivation yields, reduce feed waste, and improve feed management for economic efficiency on an industrial scale. In

addition to health management, an effective stocking strategy is crucial for yield optimization. FAO (2004) recommends acclimatizing pathogen-free fry during morning or evening stocking to minimize shock and ensure survival. Optimal stocking densities vary by culture type; in intensive systems, a density of 50–300 fry/m² can maximize yields, provided the carrying capacity is maintained.

Makmur et al. (2021) demonstrated a high-density tank nursery technique (5,000–20,000 fry/m³) that achieved a survival rate of 97.6% and FCR of 0.52, highlighting the advantages of controlled acclimatization and juvenile rearing. Water quality monitoring and biosecurity are crucial for the prevention of disease outbreaks. Lightner (2007) highlighted that rigorous pond preparation, such as desludge removal, liming, disinfection, and controlled plankton blooms, combined with the use of Specific Pathogen Free (SPF) fish seeds, significantly reduced disease incidence. Simultaneously, market diversification and supplier partnerships improve supply resilience and stability. A 2024 working paper comparing Indonesia and Thailand noted that effective value chain integration, particularly with feed, seed, and offtake partners, increased farmer profit margins and reduced reliance on intermediaries. Ipsos (2024) reported that establishing relationships with local processors and exporters enabled small-scale shrimp farms to access premium markets and withstand price fluctuations.

Finally, ongoing performance monitoring is supported by a novel decision support system. Dabrowski et al. (2022) developed a deep learning model and smart headset for real-time water quality monitoring, enabling proactive responses to anomalies and supporting operational efficiency.By strengthening aquaculture approaches that include optimal stocking practices, biosecurity, market diversification, and digitalized monitoring, Linduk Aquaculture Ponds can increase their productivity and adaptability to environmental and market changes.

Managerial Implication

SWOT analysis provides a strategic foundation for formulating managerial social implications that integrate internal capacity and external social dynamics for the sustainability of shrimp aquaculture businesses.

SO Strategy (Strengths–Opportunities)

By leveraging the technical expertise and knowledge of farm managers (strengths), businesses can collaborate with local communities to transfer knowledge about sustainable aquaculture practices (opportunities). Implementing community-based training and extension programs not only increases local capacity, but also fosters positive social relations and community involvement in environmental management.

ST Strategy (Strengths–Threats)

A company's efficiency in operational planning (strengths) can be leveraged to address external threats, such as market price fluctuations and environmental regulations (threats). Managers should develop inclusive decision-making mechanisms that involve local stakeholders to minimize social resistance and foster a shared understanding of sustainable aquaculture practices, thereby reducing the risk of conflicts related to resource use.

WO Strategy (Weaknesses–Opportunities)

Limited labor management systems (weaknesses) can be improved by building partnerships with community groups and local cooperatives (opportunities). Recruiting and empowering local people as agricultural workers not only addresses human resource gaps, but also strengthens social capital and contributes to poverty alleviation in the surrounding area.

WT Strategy (Weaknesses–Threats)

The combination of a weak capital structure and potential socio-environmental challenges (weaknesses and threats) requires managers to adopt a socially inclusive approach by forming alliances with government programmes or NGOs focused on rural development and aquaculture. These partnerships can provide access to microfinance and technical assistance, thereby reducing operational and social vulnerability.

OT Strategy (Opportunities–Threats)

Expansion into new markets (opportunities) must be balanced with attention to the potential social impacts (threats) resulting from resource competition or environmental degradation. Managers should prioritize CSR initiatives, such as mangrove rehabilitation or

public health projects, to build a positive social image and gain a social license to operate.

By integrating these strategies, shrimp farming businesses, such as Tambak Linduk, can enhance social legitimacy, improve stakeholder relationships, and ensure the sustainability of their operations in a dynamic socio-economic environment. This approach aligns with the findings of Ratnasari et al. (2022), who emphasized the role of social inclusivity and community involvement in mitigating risks and increasing the resilience of small-scale shrimp farming businesses.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The conclusions drawn from the research are that Linduk Aquaculture Ponds have advantages in measurable technical planning processes, production efficiency with intensive cultivation technology, systematic operational management, a high level of knowledge from the owners and field coordinators, and strategic locations. However, they face limited capital, suboptimal human resource management, manual financial record-keeping, a lack of specific marketing strategies, limited market access, and limited technological infrastructure.

The external environment of Linduk Cultivation Ponds offers opportunities for exports and global markets, government policy support, modernization of the fisheries sector, economic growth, and increased domestic consumption. Threats include fluctuations in shrimp commodity prices, climate change, high levels of competition, and low foreign and domestic investment.

The IE matrix analysis places the Linduk Cultivation Pond in quadrant V, with the best strategy held and maintained with market penetration strategy implications. Market penetration strategies can be implemented by expanding operations, increasing efficiency, and optimizing technology to increase production capacity and penetrate new markets.

Based on the results of the SWOT analysis tool, to maintain the sustainability of the Linduk Cultivation Pond business, an alternative strategy was obtained: market penetration by increasing production capacity, strengthening operational management, increasing business productivity by maximizing shrimp growth and production, and developing infrastructure and supporting facilities.

The strategic priority based on the QSPM is to increase business productivity by maximizing shrimp growth and production through the adoption of advanced technology, feed optimization, on-demand feeding systems (AQ1), effective stock management, market diversification, and partnerships with suppliers to increase profitability and business sustainability.

Recommendations

Based on the research findings of the analysis of vaname shrimp farming business strategies in parent aquaculture ponds for business sustainability, the following are recommendations for consideration by parent aquaculture pond owners and for future similar research.

Business actors can implement strategic priorities to increase business productivity by focusing on maximizing shrimp growth and production through the application of feeding technology and strategies, land and pond management, shrimp stock and health management, market diversification, and performance monitoring and evaluation. Implement alternative strategies in stages, including market penetration by increasing production capacity, infrastructure development, strengthening operational management, and adding a professional workforce while prioritizing and considering business environmental conditions. Increase business capital through collaboration between business partners and investors to support the implementation of recommended alternative strategies and address existing capital constraints. Provide employee training and development to improve operational efficiency, particularly in shrimp cultivation, maintenance techniques, and water quality management. Focusing on human resource development will help to create a productive and harmonious work environment and improve the quality and competence of the parent aquaculture pond workforce.

Recommendations for further research include the exploration of broader socioeconomic dynamics. Future research could investigate the broader socioeconomic impacts of shrimp farming, particularly on household livelihoods, gender inclusiveness in labor

force participation, and the contribution of aquaculture to rural poverty alleviation. Integrating Environmental and Sustainability Indicators

Given the growing importance of sustainable practices, future research should integrate environmental sustainability indicators such as water quality management, carbon footprint analysis, and the ecological impacts of intensive farming systems. Comparative studies across regions or countries can be conducted to evaluate how varying institutional support, market structures, and cultural contexts influence the success of aquaculture business strategies.

FUNDING STATEMENT: This research did not receive any specific grants from funding agencies in the public, commercial, or not-for-profit sectors.

CONFLICTS OF INTEREST: The author declares no conflict of interest

DECLARATION OF GENERATIVE AI STATEMENT: During the preparation of this work the authors used TRINKA in order to check grammar and polish text. After using this tool/service, the authors reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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