Original Research Article

A SWOT analysis of aquaculture for sustainable management in coastal waters of Ba Ria – Vung Tau province, Vietnam

ABSTRACT

Aquaculture stands as a vital marine economic sector in Vietnam's coastal provinces, with specific significance in Ba Ria - Vung Tau. The consistent growth of this sector plays a pivotal role in the local socio-economic development. However, this growth has led to legitimate concerns about environmental sustainability and socio-economic progress. Building on the findings from sociological surveys conducted through questionnaires and in-depth interviews in 2022, this article has applied the SWOT analysis method (Strengths, Weaknesses, Opportunities, and Threats) to pinpoint the existing issues that demand attention within the aquaculture sector. Moreover, it proposes strategies and guidelines aimed at nurturing aquaculture development in a manner that ensures responsible environmental management while balancing economic growth with societal well-being. The aquaculture industry in Ba Ria - Vung Tau is presented with numerous growth opportunities, driven by the rising consumer demand for seafood, ongoing technological advancements, and the pursuit of sustainable development goals. Yet, it has to navigate challenges such as resource scarcity, market competition, regulatory constraints, and the perpetual threats of climate change and disease. The industry's advancement is contingent on the collaboration of stakeholders to leverage strengths, address weaknesses, seize opportunities, and confront threats, all while minimizing adverse impacts on nature, ecosystems, and socio-economic aspects. To secure long-term sustainability, the industry must embrace prudent management practices, foster innovation, encourage collaboration, and proactively tackle these challenges. This analysis underscores the multifaceted nature of sustainable aquaculture and underscores the indispensable role of informed, forward-thinking management in ensuring its enduring viability.

Keywords: Aquaculture; SWOT; Strategies; Sustainable development goals; Ba Ria – Vung Tau; Vietnam

1. INTRODUCTION

The world's increasing appetite for seafood, driven by population growth and changing dietary preferences, has placed unprecedented pressure on global fisheries [1,2]. In response to this burgeoning demand and the depletion of natural fish stocks, aquaculture has emerged as a crucial industry to meet the protein needs of the future [2,3,4,5]. Aquaculture, the farming of aquatic organisms, offers the potential for sustainable seafood

production, alleviating the strain on wild fish populations and promoting economic growth [5,6]. However, the rapid development of aquaculture has not come without its share of challenges and concerns [7,8]. The growth of aquaculture, while offering economic benefits and food security, has also raised critical issues regarding its impact on the environment, ecosystems, and socio-economic factors [8]. These concerns are emblematic of the global struggle to balance economic development with ecological sustainability [8,9].

Sustainable aquaculture, the practice of responsible fish and seafood production, represents a critical intersection of environmental conservation, economic growth, and community well-being [9,10]. As the global demand for seafood continues to rise, the need for sustainable aquaculture becomes increasingly apparent [8,10]. This approach seeks to strike a delicate balance, meticulously considering the long-term consequences of industry actions on both the environment and the livelihoods of local communities [8,9]. A SWOT analysis of aquaculture illuminates its internal strengths and weaknesses, as well as external opportunities and threats, further underscoring the significance of this industry in today's world [11,12,13,14,15].

Situated along the southern coast of Vietnam, Ba Ria - Vung Tau Province boasts a rich maritime tradition and a bountiful expanse of marine and brackish water resources. This region has become a significant hub for aquaculture, cultivating a diverse range of aquatic species, including shrimp, fish, and shellfish. As aquaculture operations continue to expand, both in scale and importance, it is imperative to assess the industry's current state and explore strategies for sustainable management. The importance of sustainable aquaculture in the province extends beyond the economic realm. As the province grapples with the complexities of balancing economic development and environmental conservation, the aquaculture sector stands at the intersection of these concerns. Achieving sustainability not only ensures the livelihoods of local communities and the province's economic prosperity but also safeguards the delicate ecosystems of the coastal region. Therefore, it is necessary to have a comprehensive understanding of the aquaculture landscape in the region, shedding light on the factors that contribute to its success and those that challenge its sustainability. At the same time, provides recommendations and insights for sustainable management, which is paramount in ensuring the industry's long-term viability.

This paper aims to delve into a systematic SWOT analysis, exploring the intricacies of aquaculture in coastal waters, and provide specific recommendations to address the challenges, mitigate adverse impacts, and seize the opportunities it presents for Ba Ria – Vung Tau Province. A SWOT analysis serves as a structured framework for evaluating the internal and external factors that impact an industry or organization. In the case of Ba Ria - Vung Tau's aquaculture industry, this analysis would aid in identifying areas where the sector excels and where it requires improvement. It will also pinpoint opportunities for expansion and areas of vulnerability that demand attention.

2. MATERIAL AND METHODS

2.1 Study area

Ba Ria - Vung Tau Province, located in the southern coastal region of Vietnam, is distinguished by its exceptional geographic features. The province boasts a coastline that stretches for approximately 128 kilometers, facilitating access to a wide array of marine and brackish water bodies, including Cua Lap, Dinh, Cha Va and Mo Nhat estuaries and Thi Vai Bay. The province is graced with a tropical monsoon climate that imparts distinct seasons and a harmonious blend of natural elements. There are two distinct seasons, rainy season from May to October, and dry season from November to April of the following year. The

annual average temperature hovers at a pleasant 27°C, with the lowest recorded at approximately 26.8°C, and the highest, around 28.6°C. Sunlight graces this region generously, gifting it with an annual average of about 2,400 hours of sunshine. As for rainfall, the province receives an average of approximately 1,500 mm annually. While the rainy season bears the brunt of this precipitation, Ba Ria - Vung Tau is often spared the worst of tropical storms, making it a more resilient and stable region. These natural resources have made the region a prominent center for aquaculture activities, fostering the growth of various aquatic species ranging from shrimp and fish to mollusks. Moreover, the province is situated in close proximity to the bustling metropolis of Ho Chi Minh City, making it a strategic hub for the export of aquaculture products both domestically and internationally.

2.2Socioeconomic Survey

Certainly, to conduct a SWOT analysis involving aquaculture, data were collected from the interviews and then organize it into a SWOT framework (Figure 1). A SWOT analysis serves as a structured framework for evaluating the internal and external factors that impact an industry or organization. By systematically assessing the strengths, weaknesses, opportunities, and threats, stakeholders can gain a holistic understanding of the current state of affairs and formulate informed strategies for the future. In the case of Ba Ria - Vung Tau's aquaculture industry, this analysis aided in identifying areas where the sector excels and where it requires improvement. It will also pinpoint opportunities for expansion and areas of vulnerability that demand attention.

Figure 1. Strengths, weaknesses, opportunities, and threats (SWOT) analysis framework for aquaculture (adapted from [16])

In pursuit of a comprehensive understanding of the aquaculture industry and its multifaceted impacts, a rigorous research initiative was launched. This comprehensive approach comprised both a socio-economic survey and a series of in-depth interviews with stakeholders deeply entrenched in the aquaculture domain. This combined effort sought to illuminate the diverse and interconnected facets of aquaculture.

The research encompassed the administration of 320 questionnaires, strategically distributed among various sectors of the aquaculture landscape. It is worth noting that the

research extended its scope beyond the core aquaculture to encompass a wide spectrum of stakeholders associated with the industry. Additionally, households residing in the vicinity of aquaculture sites were included in this expansive study.

In tandem with the survey, a select group of around 40 farmers and experts in fisheries sector management was engaged in an intensive dialogue. They were presented with a meticulously crafted series of approximately 20 in-depth questions, all aimed at delving into the intricacies of the aquaculture industry. The primary focus of these inquiries revolved around conducting a SWOT analysis.

2.3Data analysis

The results of the interviews were collected and then processed using Microsoft Excel version 2019.

3. RESULTS AND DISCUSSION

3.1Situation of aquaculture in Ba Ria – Vung Tau province

Over the twelve-year span from 2010 to 2022, there was a notable upward trajectory in aquaculture output, as depicted in Figure 2. Starting at 10,687 tons in 2010, this figure surged to 20,486 tons by 2022, reflecting a substantial growth in the aquaculture industry. The production of farmed fish exhibited a similar pattern, showing a consistent increase from 2010 to 2018, albeit with a decline in 2019, followed by a subsequent resurgence in the years that ensued. In contrast, farmed shrimp production generally witnessed an upward trend during this period, though there were setbacks in 2011 and 2014, attributed to disease-related challenges. Furthermore, a noteworthy shift in the aquaculture structure and output from other contributors played a pivotal role in boosting the overall aquaculture output for these entities, particularly during the span from 2019 to 2022. These developments underscore the dynamic nature of the aquaculture sector and its capacity for adaptation and growth.

The aquaculture sector in Ba Ria - Vung Tau has demonstrated a remarkable degree of stability, with the aquaculture area consistently fluctuating within the range of 6.7-7.1 thousand hectares, accounting for approximately 5.59-0.68% of the national aquaculture landscape. In the year 2020, the region allocated a total of 5,562 hectares for aquaculture activities, and 1,201 hectares dedicated to integrated farming practices. Within this domain, the combined marine and brackish farming area encompassed 3,863 hectares, with 392 hectares implementing advanced technology for aquaculture. Additionally, 358 hectares were devoted to brackish water fish farming, whereas mollusk farming occupied 205 hectares. Cage farming made use of 174 hectares of waters, housing a substantial total of 12,702 cages. The output from brackish water aquaculture was particularly noteworthy, reaching 10,833 tons, and marine aquaculture contributed an additional 3,504 tons, with a notable concentration in the coastal regions.

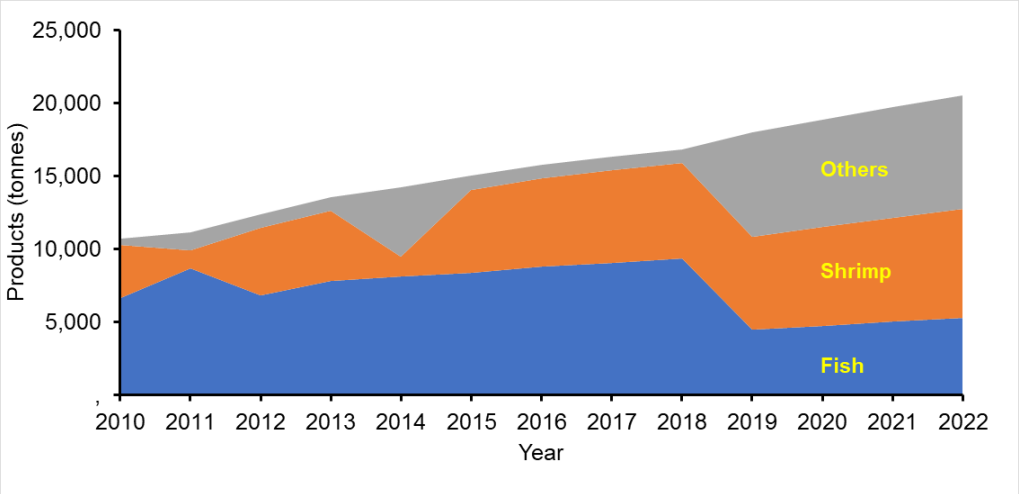

Figure 2: Aquaculture products in BàRịa – VũngTàu province

Figure 3: Some types of marine aquaculture in BàRịa – Vũngtàu

In Ba Ria - Vung Tau, coastal aquaculture encompasses a diverse array of forms and practices, reflecting the region's rich aquaculture landscape (Table 1). These practices include shrimp farming in ponds, spanning from super-intensive farming to improved extensive farming, and innovative approaches like shrimp farming combined with mangrove planting. Moreover, the region embraces oyster culture through methods such as raft, longline, and rack oyster culture, as well as cage farming for fish, lobster, and mollusks (Figure 3). Although coastal aquaculture planning has been in place since 2021, the developmental process has revealed inadequacies in various aspects, including farming areas, methods, techniques, breeds, food, waste management, and environmental sustainability. This has led to conflicts both within the aquaculture sector and with other industries, particularly concerning the allocation of coastal space. In light of these challenges, the application of a SWOT analysis in coastal aquaculture becomes crucial, enabling the identification of key issues that need resolution and the formulation of strategies for the sustainable development of aquaculture within localized coastal areas.

Table 1. Features of aquaculture practices in coastal regions of Ba Ria – Vung Tau province, Vietnam

Culture species		Form of farming	Seed sources	Seed size (cm)	Market size (kg)	Feed used	Note
Fish	Cobia	Cage culture	Domestic: Nha Trang, Phan Rang, Bình Thuận, Ba Ria – Vung Tau	8-20	3-10	Pellet, Trash fish	>3 kg
	Barramundi	Cage culture	Domestic: Nha Trang, Phan Rang, Bình Thuận, Ba Ria – Vung Tau	5-10	0,5-1,5	Pellet, Trash fish	
	Pompano	Cage culture	Domestic: Nha Trang, Phan Rang, Ba Ria – Vung Tau	3-8	0,5-1,5	Pellet, Trash fish	>0,5kg
			Imported: China	3-5			
	Rabbitfishes	Cage culture	Domestic: Nha Trang	2-5	0,3-0,5	Pellet, Trash fish	Seed collected from nature
	Red snapper	Cage culture	Domestic: Nha Trang	5-10	0,5-2	Pellet, Trash fish	>0,5 kg
			Imported: Taiwan				
	Grouper	Cage culture	Domestic: Nha Trang, Phan Rang, Bình Thuận	6-12	0,8 -1,5	Pellet, Trash fish	>0,8 kg
			Imported: Taiwan, Indonesia, Malaysia	4-6			
Shrimp	Penaeid shrimp White leg shrimp	Pond culture	Domestic: Nha Trang, Bình Thuận, Ba Ria – Vung Tau Imported: Indonesia	Post larvae 10 days		Pellet, Trash fish	
Lobster	Lobster	Cage culture	Domestic: Bình Thuận Imported: Indonesia	6-8	*Panulirus homarus*: > 0,2 kg *Panulirus ornatus*: > 0,8kg	Trash fish, pellet	Seed collected from nature
Bivalvia	Oyster	Raft, longline and rack culture	Domestic: Nha Trang	0,7-1	10-22 Inds/kg	Natural	

3.2. A SWOT analysis for aquaculture

A SWOT for aquaculture of Ba Ria - Vung Tau province was indicated in Table 2. This aquaculture sector possesses several key strengths that position it for growth and success. First of all, its favorable coastal location offers extensive coastlines for various aquaculture activities, including fish, shrimp, and mollusk farming. Additionally, the region benefits from a diverse array of aquatic species, enabling a wide range of products and market opportunities. The growing global demand for seafood presents a significant opportunity for the province. Supportive government policies, a skilled workforce, and easy access to both domestic and international markets further bolster the aquaculture industry. However, there are notable weaknesses and threats to consider. Rapid expansion could lead to environmental concerns, while limited infrastructure and technology advancements may hinder growth. There is a need to bridge technology and knowledge gaps among aquaculture farmers. Disease outbreaks and market volatility pose additional risks. Nevertheless, embracing sustainable practices, investing in research and innovation, and tapping into export potential provide opportunities for long-term success. The industry should remain vigilant against market competition, climate change, regulatory compliance challenges, price volatility, and land conflicts to ensure sustainable growth in the face of these threats.

Table 2. A SWOT analysis for aquaculture in Ba Ria - Vung Tau province based in-depth interview

Strengths	Weaknesses
- Favorable Coastal Location: Ba Ria - Vung Tau is a coastal province with extensive coastlines, providing ample opportunities for aquaculture activities, including fish, shrimp, and mollusk farming. - Diverse Aquatic Species: The region's waters support a wide variety of aquatic species suitable for aquaculture, allowing for a diverse range of products and market opportunities. - Growing Demand: As global demand for seafood continues to rise, aquaculture in Ba Ria Vung Tau has significant growth potential. - Supportive Government Policies: Government has been encouraging and supporting the aquaculture industry through various policies and incentives. - Skilled Workforce: The region has a pool of skilled workers experienced in aquaculture practices. - Access to Markets: The region's proximity to major urban centers and export facilities allows for easy access to both domestic and international markets, enhancing the economic viability of aquaculture products.	- Environmental Concerns: Rapid aquaculture expansion may lead to environmental degradation, including water pollution, habitat destruction, and overuse of natural resources, which can negatively impact the ecosystem and long-term sustainability. - Infrastructure challenges: Limited infrastructure and technology advancements may hinder the industry's growth and efficiency. Inadequate infrastructure, such as transportation and processing facilities, may hinder the efficient distribution and value addition of aquaculture products. - Technology and Knowledge Gaps: Some aquaculture farmers may lack access to modern technologies and best practices, limiting productivity and efficiency in their operations. - Vulnerability to Disease Outbreaks: Dense aquaculture practices can increase the risk of disease outbreaks among farmed species, potentially causing significant economic losses. Market Volatility: The aquaculture market can be volatile, with fluctuating prices and

	demand.
Opportunities	**Threats**
- Growing Global Demand: As the world's population increases, so does the demand for seafood, presenting an opportunity for Ba Ria - Vung Tau's aquaculture industry to cater to domestic and international markets. - Sustainable Practices: Embracing sustainable aquaculture practices can enhance the region's reputation and appeal to environmentally-conscious consumers, contributing to long-term success. - Export Potential: With its access to international markets and demand for seafood products, Ba Ria - Vung Tau can further boost its aquaculture exports and contribute to economic growth. - Research and Innovation: Investing in research and innovation can lead to improved aquaculture techniques, disease management, and product diversification, increasing competitiveness in the industry. Implementing advanced technologies can enhance productivity and efficiency in aquaculture operations. - Eco-friendly Practices: Implementing sustainable and eco-friendly aquaculture practices can appeal to environmentally conscious consumers and markets. - Tourism Integration: Combining aquaculture activities with tourism can create unique experiences and additional revenue streams. - Value-Added Products: Developing value-added products like processed seafood and ready-to-eat meals can increase profitability.	- Market Competition: Ba Ria - Vung Tau's aquaculture industry faces competition from other regions within Vietnam and other countries, which could impact market share and prices. The aquaculture industry faces competition from other seafood-producing regions worldwide. - Climate Change: Rising sea levels, extreme weather events, and ocean acidification pose threats to aquaculture operations, affecting water quality and the health of farmed species. - Regulatory Compliance: Adherence to stringent domestic and international regulations related to food safety and environmental standards can be challenging for small-scale aquaculture operations. - Price Volatility: Aquaculture products may experience price fluctuations due to market demand, currency exchange rates, and geopolitical factors, impacting the profitability of aquaculture businesses. - Land Conflicts: Competition for land use between aquaculture and other industries or communities may create conflicts and affect operations.

3.3. Strategies for sustainable aquaculture in Ba Ria Vung Tau

S-O (Strengths-Opportunities) strategies: Ba Ria Vung Tau's aquaculture sector can formulate effective S-O strategies to maximize its potential and further its development (Table 3). Leveraging its advantageous coastal location and government support, the region should actively expand aquaculture operations, harnessing the potential for export market access and attracting investments through supportive policies. Furthermore, diversifying aquatic species production in response to specific international market demands can diversify revenue streams and reduce reliance on a single product. To drive progress, the skilled workforce should be continually trained in modern aquaculture techniques, improving productivity and profitability. The development of value-added products like frozen or canned seafood can tap into premium markets, while aggressive marketing strategies can capitalize on the increasing global demand for seafood. Embracing sustainable practices, securing recognized certifications, investing in research and development for innovation, and promoting public-private partnerships will collectively advance the industry's sustainability and competitiveness. Lastly, integrating eco-tourism and agri-tourism with aquaculture can

create a unique visitor experience while generating additional income and increasing awareness of responsible aquaculture practices.

Table 3. Advantage Strategies for aquaculture in estuaries of Ba Ria – Vung Tau

Factors	Strengths (S)	Weaknesses (W)
Opportunities (O)	S-O strategies	W-O strategies
	- Exploit leverage geographical location and government support to expand aquaculture activities, attract investments and promote sustainable aquaculture practices; - Capitalize on diversification of aquatic species to diversify revenue streams and reduce dependency on a single product; - Harness skilled workforce for technology adoption to enhance productivity, quality, and efficiency in aquaculture operations, leading to higher profitability; - Explore opportunities for value-added product development; - Market expansion and promotion to increase export volumes and to create awareness about the quality and sustainability of aquaculture products - Embrace sustainable practices and certifications to promote Ba Ria Vung Tau's aquaculture products in environmentally conscious markets; - Invest research and development for innovation to improve regional position as a leader in sustainable aquaculture; - Foster public-private partnerships to create a conducive ecosystem for aquaculture development; - Integrate eco-tourism and agri-tourism to attract tourists interested in experiencing sustainable seafood production practices.	- Environmental certification and sustainability initiatives to address the weakness of environmental concerns; - Investment in infrastructure development to reduced environmental impact, better disease control, and increased operational efficiency, positioning the aquaculture industry to meet the growing demand for sustainable seafood; - Disease prevention and control measures to address the vulnerability to disease outbreaks; - Value-added product diversification to enhance the product portfolio by investing in value-added processing facilities; - Technology adoption for efficiency: address infrastructure challenges by embracing advanced aquaculture technologies; - Partnerships for market access to explore and enter new export markets; - Training and Capacity Building to address workforce skill gaps and weaknesses by investing in comprehensive training and capacity-building programs; - Eco-tourism and Agri-tourism integration to provide an additional revenue stream and raise awareness about responsible aquaculture practices; - Brand building for quality assurance to figure consumer trust and confidence; - Product differentiation to gain a competitive advantage.
Threats (T)	S-T strategies	W-T strategies
	- Strengthen market to counter threats from increasing competition; - Diversification of aquatic species to mitigate the threats posed by	- Environmental sustainability measures to address weaknesses related to environmental concerns by implementing strict environmental

	disease outbreaks and market volatility; - Government support for climate resilience - Develop and implement climate-resilient practices for given the threats of climate change; - Collaborative research for disease management to address the threat of disease outbreaks; - Sustainable practices as a competitive advantage; - Product innovation and value addition to counter threats posed by market fluctuations and price volatility; - Technology adoption for efficiency and quality to remain competitive in the face of technological threats; - Supply chain resilience through collaboration to build resilience against market-specific threats; - Public awareness on regulatory compliance to address the threats related to regulatory compliance; - Resource management and conservation to mitigate threats related to overexploitation and habitat degradation; - Government-industry collaboration to address threats related to market access and regulatory barriers.	sustainability measures; - Infrastructure development for disease management (disease prevention and control); - Diversification of export markets to mitigate threats related to market volatility and competition; - Technology adoption to overcome threats related to market access barriers; - Value-added product development to address threats of market volatility and price fluctuations; - Disease prevention research and collaboration to mitigate threats posed by disease outbreaks; - Capacity building for workforce resilience to address weaknesses related to workforce skill gaps; - Climate-resilient aquaculture practices to tackle threats related to climate change; - Engaging in public awareness on sustainable aquaculture to overcome weaknesses in public perception; - Collaborative risk management to address threats collectively by fostering collaborations among aquaculture stakeholders, industry associations, and government bodies.

W-O (Weaknesses-Opportunities) strategies: The aquaculture industry can devise W-O strategies to overcome its challenges and harness new opportunities for growth and sustainability. To address environmental concerns, the industry should prioritize environmental certification and sustainability initiatives. Obtaining recognized certifications such as SQF, ASC, GlobalGAP, BAP, AquaGAP, Naturland, VietGAP,… cannot only mitigate environmental weaknesses but also enhance marketability, attracting eco-conscious consumers and accessing premium markets. Infrastructure development investments are crucial to surmount infrastructure challenges, with modern facilities and improved waste management systems reducing environmental impact and increasing operational efficiency. Additionally, investments in disease prevention and control measures will fortify the industry against disease vulnerabilities while capitalizing on growing demand for aquaculture products. Value-added product diversification, technology adoption for efficiency, strategic partnerships for market access, and workforce training can collectively address weaknesses while capitalizing on opportunities, leading to enhanced competitiveness, product diversification, and market expansion. Furthermore, the integration of aquaculture with eco-tourism and agri-tourism ventures can generate additional revenue and raise awareness of responsible aquaculture practices, while brand building and product differentiation can further establish the region as a source of high-quality seafood products with unique selling points.

S-T (Strengths-Threats) strategies: In order to confront the various threats faced by Ba Ria Vung Tau's aquaculture industry, S-T strategies can be employed to build resilience and maintain competitiveness. Leveraging the region's strengths, particularly its advantageous geographical location and diverse aquatic species, the industry should focus on strengthening its market presence. By intensifying marketing efforts and showcasing its high-quality and reliable products, it can effectively counter the threat of increasing competition. Additionally, the diversification of aquatic species can serve as a risk mitigation strategy against the threats of disease outbreaks and market volatility. Collaborating with the government to develop climate-resilient practices will help the industry adapt to the threats posed by climate change. Similarly, forming collaborative research partnerships and emphasizing sustainable practices can help combat disease outbreaks and differentiate Ba Ria Vung Tau's products in the market. Moreover, the industry should prioritize product innovation and value addition to counter market fluctuations and price volatility, while technology adoption for efficiency and quality can help maintain competitiveness. Collaborative efforts with supply chain partners and public awareness campaigns on regulatory compliance will help the industry navigate the complexities of the market. Additionally, efficient resource management and conservation practices can address threats related to overexploitation and habitat degradation. Lastly, government-industry collaboration for market access can facilitate smoother entry into international markets by addressing regulatory barriers. By implementing these S-T strategies, the aquaculture industry in Ba Ria Vung Tau can bolster its resilience and thrive in the face of various threats.

W-T (Weaknesses-Threats) strategies: To effectively address the weaknesses and mitigate potential threats in Ba Ria Vung Tau's aquaculture industry, the implementation of W-T strategies is essential. First and foremost, the industry should proactively tackle environmental concerns by embracing strict environmental sustainability measures. This approach not only mitigates potential threats of regulatory non-compliance but also helps in creating positive perceptions among consumers and international markets. Overcoming weaknesses in infrastructure by investing in facilities for disease prevention and control is critical, as this enhances the industry's capacity to respond to disease outbreaks and minimize economic losses. Secondly, to counter the threats of market volatility and competition, diversifying export markets should be a priority, reducing reliance on a single market and ensuring stable demand for aquaculture products. Leveraging technology adoption for market access can help overcome market access barriers, ensuring compliance with international trade and safety standards. Investment in value-added product development can effectively address threats of market volatility and price fluctuations, adding value to the offerings and creating stable revenue streams. Lastly, collaboration with research institutions and government agencies for disease prevention research can mitigate threats posed by disease outbreaks, enhancing disease management practices. Workforce capacity building will address weaknesses related to skill gaps and improve adaptability in the face of market challenges and sustainable aquaculture practices. To tackle threats related to climate change, adopting climate-resilient aquaculture practices can enhance industry resilience. Engaging in public awareness campaigns to address weaknesses in public perception and fostering collaboration among aquaculture stakeholders for collaborative risk management will enhance preparedness and response to potential threats.

4. CONCLUSION

Aquaculture holds a pivotal role in Vietnam's coastal provinces, including Ba Ria - Vung Tau, as a significant marine economic sector. The expansion of aquaculture products and their value plays a crucial role in addressing food security and reducing competition for human food requirements. In Ba Ria - Vung Tau, aquaculture occupies an area spanning 6.7-7.1 thousand hectares, with an upward trajectory in output, reaching 20,486 tons. The sector

showcases various farming models, ranging from inland to river and seawater-based systems. Despite stringent local government management, there remain notable inadequacies in environmental management and socio-economic development within the aquaculture sector. To rectify these issues, the results of SWOT analysis are harnessed to promote aquaculture development that harmonizes with environmental management and the well-being of the local community. As the aquaculture industry faces both opportunities, such as the rising demand for sustainably sourced seafood and technological advancements, and challenges, including resource scarcity, market competition, regulatory barriers, climate change, and disease threats, its future hinges on effective stakeholder strategies. These strategies must leverage strengths, address weaknesses, capitalize on opportunities, and confront threats while safeguarding the environment, ecosystems, and socio-economic aspects. Achieving long-term sustainability requires prudent management, innovation, collaboration, and proactive problem-solving, ensuring the industry's continued viability in the dynamic landscape of sustainable aquaculture.

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