THE JOURNAL OF INDONESIA SUSTAINABLE DEVELOPMENT PLANNING

VOL. 6 NO. 2 – AUGUST 2025

E-ISSN: 2722-0842 | P-ISSN: 2721-8309

Available online at
http://journal.pusbindiklatren.bappenas.go.id/

Ministry of National Development Planning/Bappenas Republic of Indonesia

Policy Paper

Overcoming Structural Barriers in Shrimp Downstreaming: Toward Sustainable Aquaculture in Sumbawa Island

Yasir Arafat[1*], Mustaqim[2], Irfan Thofiq Firdaus[3], Lalu Suhaimi[4], Alfie Fahruz Zubaidah[5], and Rully Puji Agung[6]

[1,2,5,6] National Development Planning Agency, Jakarta, Indonesia
[3]Division of Geography and Tourism, Faculty of Science, KU Leuven, Belgium
[4]Faculty of Environmental and Mineral Technology, Universitas Teknologi Sumbawa, Indonesia

***Correspondence author**: yasir.arafat@bappenas.go.id*

Abstract

This study aims to identify the structural barriers of shrimp downstreaming in Sumbawa Island, Indonesia, from a sustainable aquaculture perspective, highlighting its significance for the environment, economic diversification, and social inclusivity. A mixed-methods approach was employed, combining a Systematic Literature Review (SLR) of scientific articles and policy documents with two Focus Group Discussions (FGDs) involving 35 participants, and field observations. These data sources were integrated through thematic policy analysis to triangulate insights from literature, lived experience, and empirical realities. The findings reveal that in 2023, Sumbawa accounted for 71.51% of NTB's shrimp production and 14.78% of national output, equivalent to 139,201 tons. Despite its substantial contribution, the downstream sector remains underdeveloped due to limited cold storage, low adoption of advanced technology, and weak cooperative institutions. Realizing Sumbawa's potential as a regional hub requires coordinated infrastructure investment, institutional strengthening, and an integrated roadmap with spatial planning that embeds sustainable aquaculture principles. Addressing these structural gaps will not only enhance competitiveness in domestic and export markets but also generate more inclusive benefits for coastal communities, thereby advancing sustainable territorial development.

Keywords: Sustainable Aquaculture; Shrimp Downstreaming; Sumbawa Island; Indonesia.

ARTICLE INFO
Received: January 17, 2025
Received in revised form: April 25, 2025
Accepted: August 31, 2025

doi: 10.46456/jisdep.v6i2.731

This is an open access article under the CC BY-SA license
©Arafat *et al* (2025)

THE JOURNAL OF INDONESIA SUSTAINABLE DEVELOPMENT PLANNING
Published by Centre for Planners' Development, Education, and Training (Pusbindiklatren), Ministry of National Development Planning/National Development Planning Agency (Bappenas), Republic of Indonesia

Address: Jalan Proklamasi 70, Central Jakarta, Indonesia 10320
Phone: +62 21 31928280/31928285
Fax: +62 21 31928281
E-mail: journal.pusbindiklatren@bappenas.go.id

Supported by Indonesian Development Planners Association (PPPI)

Please cite this article in APA Style as:
Arafat, Y., Mustaqim, M., Firdaus, I. T., Suhaimi, L., Zubaidah, A. F., & Agung, R. P. (2025). Overcoming structural barriers in shrimp downstreaming: Toward sustainable aquaculture in Sumbawa Island.*The Journal of Indonesia Sustainable Development Planning, Vol 6(2),* 313-327. https://doi.org/10.46456/jisdep.v6i2.731

1. Introduction

Situated centrally within the Lesser Sunda Islands chain, Sumbawa has been identified as a major shrimp-producing area in West Nusa Tenggara, with production reaching 139,201 tons in 2023, approximately 71.51% of the province's total output and 14.78% of national output (BPS, 2025; BPS NTB, 2025). It grew approximately 36% within 5 years between 2016 and 2020. The expansion of shrimp ponds across the island is driven by the availability of land, electricity infrastructure, and skilled human resources, alongside favorable water quality conditions that are critical to aquaculture success (Kasnir, 2014; Astriana *et al.,* 2023; Heriyati *et al.,* 2024). Although the region plays a major role in shrimp production, it must advance by improving downstream processing rather than depending on fresh shrimp producers, which need integration from all stakeholders through value chain processes.

In general, Indonesia's blue food sector indicates substantial and untapped value-added potential across the supply chain. The value creation remains heavily concentrated in primary production. Fish sales across the province recorded that 87.3% were raw, rather than processed products. Some processing is often limited to basic activities, such as cutting and cleaning, which limits overall profitability (Bappenas, 2025a). The limited advancement of processing facilities has hindered the competitiveness of locally produced shrimp in both domestic and international markets. Consequently, Indonesia remains positioned as the fourth-largest shrimp exporter globally—behind Ecuador, India, and Vietnam—while the economic benefits accruing to local communities remain constrained, alongside broader efforts to ensure the long-term sustainability of the industry (Rubel *et al.,* 2019; Kusuma & Sari, 2021).

Downstreaming *('hilirisasi')* is intended to enhance added value, product quality, competitiveness, and compliance with international standards, thereby positioning the products as preferred choices in global markets (Umamaheswari *et al*., 2025). Fish processing activities contribute 73.23% of Gross Value Added (GVA) as an end-use, while fish marketing accounts for 87.74%, largely through distribution and trade margins, indicating that downstream activities capture most value creation on the consumer side (Cai *et al*., 2019). Processors often act as exporters who respond directly to international market demands and regulatory requirements, thereby encouraging the production of high-quality and responsibly farmed shrimp, while simultaneously reducing disease risks to secure supply stability (Rubel *et al*., 2019). Unfortunately, the drawback is that shrimp processing typically generates 50–60% waste (Nirmal *et al*., 2020). It underscores the importance of investing in advanced processing technologies and diversified product development to improve efficiency and sustainability across the value chain. Transitioning toward a circular economic approach could reduce shrimp-related waste by up to 52%. Processing of this waste may contribute an estimated IDR 278 trillion to Indonesia's GDP and generate employment, with approximately 75% of these opportunities benefiting women (Bappenas, 2025a).

In response, downstreaming has been designated as a national priority in the RPJMN 2025–2029, to maximize Indonesia's abundant natural resource potential by transforming raw commodities into high-value and globally competitive products. Within the framework of the Blue Economy, the government has set ambitious targets, including raising the maritime sector's contribution to 15% of GDP by 2045 and generating 12% of national employment from blue economy sectors. These targets are expected to be achieved, in part, through the development of marine-based manufacturing industries, including shrimp processing (Sambodo *et al*., 2023). Furthermore, sustaining an annual fisheries sector growth rate of approximately 5-6.6% is deemed essential to support Indonesia's transition toward a high-income economy and accelerated economic growth (Efrizal et al., 2025).

The Blue Economy is an approach to managing Indonesia's diverse coastal and marine resources, ensuring ecosystem health and sustainable benefits for current and future generations. The fisheries and marine-based manufacturing sector is a key driver of the blue economy in Indonesia. In the context of shrimp farming and its downstream operations, this approach emphasizes that production does not harm coastal and marine resources, shifts to more sustainable pathways, prioritizes sustainable economic well-being, improves community welfare, and creates good governance as a supportive environment (Sambodo *et al*, 2023). In line with this, other approaches are used to examine the broader framework. Using the standards used by the Aquaculture Stewardship Council, as one of the ecolabel providers, to assess sustainability. Emphasis on energy efficiency from cultivation to processing, providing for the rights of surrounding communities, traceability, and waste management to reduce environmental impacts are highlighted in the principles of the shrimp farming and downstream industry standards (ASC, 2023).

Accordingly, this study addresses the stagnation in the development of shrimp downstreaming in Sumbawa. The research is guided by three interrelated questions: (1) How can shrimp downstreaming in Sumbawa be designed to align with sustainable aquaculture principles while enhancing regional competitiveness in domestic and export markets? (2) What gaps and inconsistencies exist between current national and regional policies on shrimp downstreaming, and how can these be addressed through more integrated and cross-sectoral policy design? and (3) What new policy instruments can be formulated to create an inclusive and resilient shrimp downstreaming ecosystem in Sumbawa?

This study aims to formulate new policy design and strategic recommendations for both the central and local government, as well as the private sector, by comprehensively exploring structural barriers of shrimp downstream development in Sumbawa Regency. The focus lies in strengthening supporting infrastructure, enhancing community institutional capacity, and integrating cross-sectoral policies to create an inclusive and sustainable downstream ecosystem. This study holds significant relevance in supporting national agendas outlined in the 2025–2045 Long-Term Development Plan (RPJPN) and the 2025–2029 Medium-Term Development Plan (RPJMN), both of which prioritize commodity downstreaming and the development of Eastern Indonesia as part of broader economic transformation. The findings from this study can inform evidence-based policymaking to accelerate the development of a sustainable fisheries sector and to help realize Indonesia's vision as a global maritime axis.

This study is structured into several key sections. Following this introduction, the methods section outlines the analytical approach and data sources. The subsequent findings and discussion section present key insights into the structural barriers of shrimp downstreaming in Sumbawa. The final section provides conclusions and policy recommendations for advancing shrimp downstreaming as part of national development strategies.

2. Methods

This study employs a descriptive qualitative approach within a policy analysis framework, integrating FGD and field observations with a Systematic Literature Review (SLR). Primary data were obtained through direct documentation, observations of production facilities and infrastructure, and notes from two FGDs with participants from central and local government institutions, business associations, and academics. Secondary data were systematically gathered from the Central Bureau of Statistics (BPS), peer-reviewed journals, international institutional reports, and national planning documents such as the RPJPN and RPJMN. This mixed-methods approach was employed to triangulate lived experiences captured through FGDs, empirical realities observed in the field, and policy insights derived from literature to bridge knowledge into policy.

Focus group discussions (FGDs) and field observations were conducted to examine regional characteristics, potentials, and constraints associated with shrimp downstreaming in Sumbawa. Complementary data obtained from Bappenas, BPS, and local government institutions provided the empirical basis for assessing recent trends, thereby facilitating an evaluation of both progress achieved and persisting gaps. Furthermore, the systematic literature review (SLR) was employed to identify solutions, innovations, and best practices from diverse regions and countries that have effectively implemented sustainable aquaculture principles and blue economy framework in shrimp production. This triangulation of methods enhances the robustness and validity of the findings while ensuring that the research questions are addressed from comprehensive references (shown in Table 1).

FGDs were conducted at the Sumbawa Bappeda office and a selected sample pond site, involving 35 participants representing national ministries (Bappenas, PUPR), Sumbawa regional governments (Bappeda, Marine and Fisheries, Public Works and Spatial Planning, Cooperatives-SMEs-Industry-Trade, Transportation, and Investment and One-Stop Services), Shrimp Club Indonesia (SCI) as private/NGO entities, and local pond farmers. The FGDs were structured into two sequential sessions: presentations from each representative and a guided Q&A discussion focused on pre-defined themes, including supporting infrastructure for regional commodity value chains, challenges and opportunities in vannamei shrimp cultivation, transportation system development for supply chains, and policy directions for the shrimp industry. Complementing the FGDs, a structured field observation was carried out from October 30th to November 1st, 2024, using a paper-based questionnaire covering six thematics: observation object

profile, production, processing, distribution and marketing, capital structure and investment, and open-ended questions. Site selection followed a purposive sampling method based on recommendations from the Sumbawa Regional Government and SCI.

The qualitative data analysis was conducted in three sequential phases. First, transcription and data organization structured the dataset into two components: (a) SWOT analysis derived from FGD sessions, focusing on strategic insights and challenges related to the shrimp commodity in Sumbawa Regency, and (b) field survey responses from key stakeholders including the Marine and Fisheries office, SCI, and pilot pond operators providing both quantitative data and qualitative accounts of operational practices and constraints. Second, open coding was applied through a comprehensive review of the data to identify recurrent issues such as inadequate cold storage, high logistics costs, price disparities, traditional pond dominance, low productivity, seed quality issues, high feed costs, unreliable electricity, regulatory hurdles, and limited value-added processing. Finally, axial theming grouped these codes into five core thematic aspects, capturing fundamental structural, operational, and strategic dimensions shaping the competitiveness and sustainability of the local shrimp industry.

Search strategy for SLR was conducted across multiple academic databases, including but not limited to Scopus and ResearchGate. A set of representative keywords, such as “sustainable aquaculture”, “shrimp downstreaming” or “shrimp aquaculture”, and “Indonesia”. The inclusion criteria consisted of peer-reviewed journal articles published in either English or Indonesian that specifically addressed shrimp production within the Indonesian context. Conversely, exclusion criteria eliminated non-peer-reviewed literature, studies published outside the 2015–2025 period, publications in languages other than English or Indonesian, and articles determined to be irrelevant based on title and abstract screening. The selection process followed a sequential procedure, beginning with initial title and abstract screening, followed by a comprehensive full-text review to ensure compliance with the predefined eligibility standards. This rigorous screening process yielded a total of 25 eligible scientific articles for in-depth analysis. Data extraction was conducted using a structured matrix designed to systematically record key information, including authorship, publication year, research objectives, methods, findings, and study conclusions.

Table 1. Analytical Framework of This Study

Detailed Research Objectives	Research Questions	Analytical Methods and Data Sources
To design a sustainable shrimp downstreaming model that enhances regional competitiveness	How can shrimp downstreaming in Sumbawa be designed to align with sustainable aquaculture principles while enhancing competitiveness in domestic and export markets?	Thematic Analysis of FGD and field observations to identify structural and operational gaps; Triangulation with literature on best practices; SWOT Analysis of regional value chain and infrastructure.
To address policy gaps and inconsistencies between national and regional frameworks and propose integrative solutions	What gaps and inconsistencies exist between current national and regional policies on shrimp downstreaming, and how can these be addressed through integrated design?	Policy Analysis Framework applied to FGDs and official documents (RPJMN 2025-2029, RPJPN 2025-2045, and regional plans); Comparative Review using SLR to benchmark governance and regulatory models in other regions with best practices.
To formulate innovative policy instruments for an inclusive and resilient downstreaming ecosystem	What new policy instruments can be formulated to create an inclusive and resilient shrimp downstreaming ecosystem in Sumbawa?	Systematic Literature Review (SLR) of 25 peer-reviewed studies; Synthesis of Triangulated Findings (FGDs, field observations, SLR) to develop a policy design framework and strategic recommendations.

3. Results and Discussions

This study shows that despite its significant shrimp production, Sumbawa faces significant potential of economic loss due to a lack of downstream processing. As a strategic commodity, shrimp downstream processing is primarily focused on meeting international demand. Therefore, the potential loss can be seen by comparing the export value and volume. As shown in Table 2, Sumbawa Regency has emerged as the leading shrimp-producing area in West Nusa Tenggara Province (NTB), contributing approximately 139,201 tons in 2023, thereby positioning it as the highest-producing regency in the province. Figure 1 represents around 71.51% of the province’s total shrimp production (194.648 tons) and 14,78% of national output, with an estimated economic value of IDR12,26 trillion (KKP, 2025). Private investment in

shrimp aquaculture has shown promising trends, with 67 business operators managing 4,341 hectares of shrimp farms, totaling over IDR550 billion in investment (DKP Sumbawa, 2024).

Table 2. Indonesia Shrimp Production by Province and City/Municipality in NTB (2023)

Province	Shrimp Production (tons)	% of National Total
West Nusa Tenggara (NTB)	**194.648**	**20,67%**
- Sumbawa	139.201	14,78%
- Bima	36.668	3,89%
- East Lombok	13.583	1,44%
- West Sumbawa	2.520	0,27%
- North Lombok	1.357	0,14%
- Dompu	1.020	0,11%
- Central Lombok	231	0,02%
- Bima City	64	0,01%
- West Lombok	3	0,00%
- Mataram City	0	0,00%
West Java	132.599	14,08%
East Java	118.330	12,57%
South Sulawesi	66.577	7,07%
Lampung	49.697	5,28%
Aceh	45.493	4,83%
Southeast Sulawesi	35.735	3,79%
Central Java	34.884	3,70%
North Sumatera	34.265	3,64%
South Sumatera	33.872	3,60%
East Kalimantan	30.217	3,21%
Other Provinces	*165.329*	*17,56%*
Indonesia	**941.646**	**100%**

Source: BPS (2025) and BPS NTB (2025)

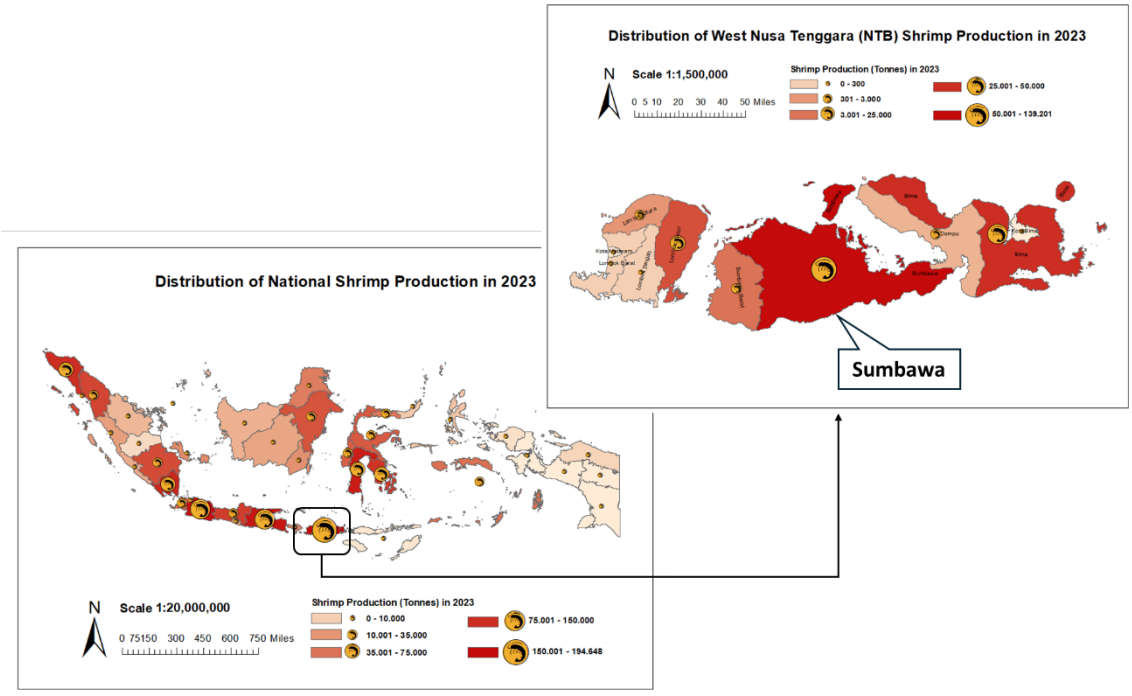

Figure 1. The distribution of National Shrimp Production in 2023 illustrates that Sumbawa contributes the largest share of shrimp production within West Nusa Tenggara Province (NTB), while NTB itself ranks as the leading shrimp-producing province in Indonesia.

Despite its position as a leading shrimp-producing region, in contrast, the shrimp export ratio originating in West Nusa Tenggara is relatively low compared to its production, as shown in Table 3. It accounts for only 0.78% or 1,518 tons with a value of only USD 12.3 million. Compared to the other top 3 producing provinces, East Java holds the highest ratio of 69.8%, followed by South Sulawesi and West Java, with 9.83% and 1.92% respectively. Therefore, East Java has become the highest shrimp exporter with 37.39% the total national export volume, or about 82,582.66 tons.

Table 3. Indonesia Shrimp Export by Province (2023)*

Province	Export Value (USD)	Export Volume (Ton)	Relative Price Per KG (USD)	Ratio of Production and Export Volume (%)
West Nusa Tenggara	12,358,445.49	1,518.11	8.14	0.78 %
West Java	23,539,356.18	2,552.02	9.22	1.92 %
East Java	695,989,392.98	82,582.67	8.43	69.8 %
South Sulawesi	55,306,171.86	6,543.37	8.45	9.83 %
Bali	789,484.05	90.27	8.75	1.02 %
Indonesia	**1,729,521,194.24**	**220,889.26**	**7.83**	**23.46%**

*) Shrimp commodities may include the capture of shrimp products
Source: MMAF (2025), processed by authors.

Furthermore, the ratio between national total production and export volume is approximately 23.46%, in contrast with the ratio of West Nusa Tenggara. It indicates that the shrimp is predominantly processed in other provinces, out of the significant value that potentially can be generated through processing and product diversification. It also indicates that it takes a long time and transports the shrimp from the shrimp farm to the processing plant or the market. The process can reduce shrimp quality and freshness and is prone to microorganisms that can affect food safety (ADB, 2022). Consequently, the lack of downstreaming costs in West Nusa Tenggara, assuming the national ratio being used, with potential value loss is about USD 359.31 million. In addition, competitiveness can be seen by its relative price per kg. Compared to the top 4 producers and the nearest provinces of Bali, West Nusa Tenggara has lower export prices per kg. However, it is quite a bit higher than the national relative price.

Therefore, based on field surveys and focus group discussions conducted in October 2024 with stakeholders across the shrimp aquaculture sector in Sumbawa Regency, several areas for improvement were identified, which can be categorized into five key dimensions: infrastructure and technology gaps, policy and regulatory misalignments, constraints on social inclusion, environmental management vulnerabilities, and limitations in financial mechanisms. This is aligned with Boettiger et al. (2017), who identify a set of common institutional, organizational, and political components that increase the success of a government's good agricultural transformation policies and investments. These findings underscore that Sumbawa's shrimp sector has yet to be effectively integrated into a sustainable and value-added aquaculture ecosystem and supply chain (Figure 2).

3.1 Infrastructure and Technology Gaps

According to ADB (2022), the shrimp industry can be divided into three segments: upstream, processing/production, and downstream. Each segment continues to face challenges, particularly limited infrastructure, and tends to operate in a fragmented manner as stand-alone business processes. Only a few large corporations, such as Japfa and CP Prima, have developed fully integrated value chains that encompass feed mills, hatcheries, farms, processing facilities, and export operations (Rubel *et al.,* 2019).

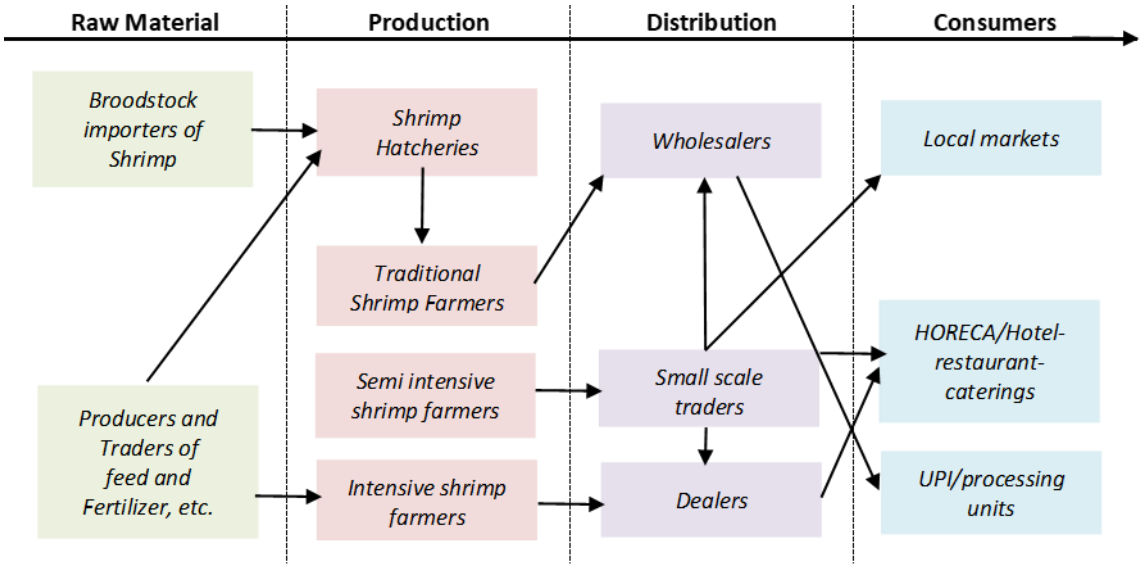

Figure 2. Shrimp Supply Chain (Zamroni, *et al.* 2021)

Figure 3 shows the identified infrastructure that needs attention in Sumbawa. While the focus is on downstream facilities, other business processes cannot be ignored. This is related to traceability systems, which are the international market standard (Mokodenseho *et al*., 2023). For example, for the ecolabel Aquaculture Stewardship Council (ASC), they will assess whether the standard is applied throughout the entire process of the shrimp product (ASC, 2023). Lack of downstream facilities can be divided into 4 parts: the harvest and post-harvest; the logistics and distribution; the processing plant; and the waste management center. During harvest and post-harvest handling, shrimp farmers face challenges related to the availability of ice for maintaining product quality during transportation and throughout the cold chain prior to processing. Ice is essential for preserving freshness, inhibiting microbial and bacterial growth, and extending shelf life by rapidly reducing shrimp temperature immediately after harvest. Infrastructure, such as cold storage units, product testing laboratories, and export logistics infrastructure like bulk terminals or quarantine services. Ministry of Marine Affairs and Fisheries (MMAF) noted that the cold storage in West Nusa Tenggara is only 52 units with 14,133 tons of capacity. Meanwhile, in Sumbawa, there are only 5 units that can hold up to 200 tons (KKP, 2025).

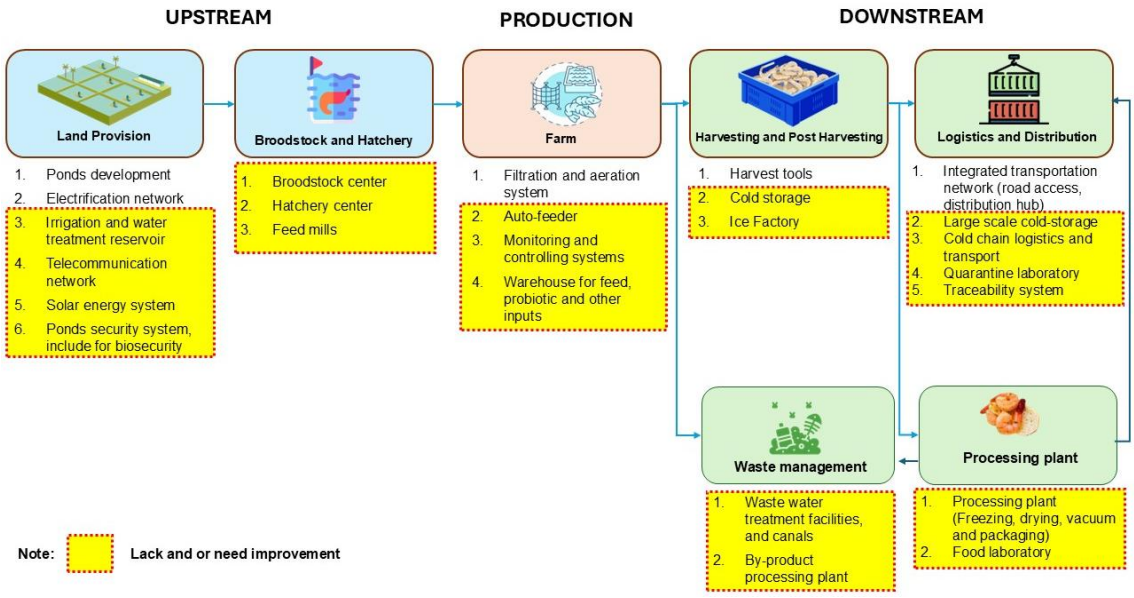

Figure 3. Indications of Priority Infrastructure for Supporting the Shrimp Industry in Sumbawa Regency, NTB Province, Indonesia (Derived from: Sector Assessment Infrastructure Improvement for Shrimp Aquaculture Project - ADB, 2022; and FGD notes at the Sumbawa Bappeda Office, October 31st, 2024)

The absence of local processing facilities results in significant economic losses for Sumbawa's shrimp producers. According to the Shrimp Club Indonesia (SCI), shrimp harvested in Sumbawa are sold in raw form and subsequently transported to Surabaya via land and sea. This supply chain generates a price disparity between Sumbawa and Surabaya, which buyers attribute to covering transportation costs. The journey spans nearly 2,000 km and requires around 48 hours, positioning Surabaya as the primary export gateway for Sumbawa's shrimp. A proposal to address this issue is expected to be implemented in Sumbawa, where a cold storage facility will be built to maintain the quality of shrimp harvests and reduce the price differences. The construction of a cold storage facility would require IDR 120-150 billion with a capacity of 30 to 40 tons per day. The benefits of constructing a cold storage facility in Sumbawa include the ability to label originally and authentically as 'Sumbawa products', which can enhance the brand value. Another benefit is that all transactions entering and exiting Sumbawa can be properly recorded, leading to improved management of the shrimp commodity, which will impact an increase in regional revenue.

Moreover, most farmers rely on shrimp fry from outside the region (primarily Bali) due to the insufficient quality and availability of local hatcheries. As a result, potential added value is largely captured by other regions in the broader national distribution chain. In terms of technology, Internet of Things (IoT)-based tools for water quality monitoring, feeding systems, and cold chain management have not been widely adopted.

3.2 Policy and Regulatory Misalignments

From a policy standpoint, the lack of a clear roadmap for shrimp downstreaming, inconsistencies in spatial planning, and cumbersome licensing procedures pose serious barriers to investment and strategic programming. This stands in contrast to national policy directives, such as those articulated in the RPJMN 2025–2029 and presidential addresses, which emphasize the importance of downstream development to generate employment, raise local incomes, and reduce poverty. In his inaugural address before the People's Consultative Assembly (MPR RI), President Prabowo highlighted the importance of national self-sufficiency and commodities downstreaming (Setneg, 2024). He stated, *"Indonesia must be self-sufficient in food and energy, manage water resources effectively, ensure that every Indonesian child has access to nutritious food at least once a day, pursue downstream development across all commodities—including shrimp—eradicate poverty, engage actively in global affairs, and eliminate corruption so that all Indonesians can attain a prosperous standard of living."* The prioritization of shrimp downstreaming under President Prabowo's administration, as formalized in the 2025–2029 National Medium-Term Development Plan (RPJMN), is illustrated in Figure 4.

<table>
<tr><td colspan="4">PN 02 - Strengthening the state's defense and security system and encouraging national independence through self-sufficiency in food, energy, water, sharia economy, digital economy, green economy, and blue economy</td></tr>
<tr><td colspan="2">02.10 PP - Food self-sufficiency</td><td colspan="2">02.22 PP - Development of Blue Economy as a New Source of Growth</td></tr>
<tr><td colspan="2">02.10.09 KP:
<u>Aquatic Food Development (Blue Food)</u></td><td colspan="2">02.22.03 KP:
<u>Increasing Integrated, Modern, and Sustainable Fisheries Productivity</u></td></tr>
<tr><td>Target: 01 - Increasing fish supply for community consumption</td><td>Indicators: 01 - Fish production volume: 6.2 million tons (2023 baseline) and 8.52 million tons (2029 target)</td><td>Target: 01 - Increasing added value, productivity, and competitiveness of the marine and fisheries industry</td><td>Indicator: 07 - Realization value of PMA/PMDN shrimp downstreaming: IDR 659,210 million (2024 baseline) and IDR 697,500 (2029 target)</td></tr>
<tr><td colspan="2">➢ 02.10.09.01 Pro-P: Development of Fisheries Production Input Cultivation
➢ 02.10.09.02 Pro-P: Development of Fisheries Production Facilities and Infrastructure</td><td colspan="2">➢ 02.22.03.02 Pro-P: Management of Capture Fisheries Production Infrastructure</td></tr>
</table>

➢ 02.10.09.03 Pro-P: Development of Areas Based on Leading Aquaculture Commodities and Revitalization of Community Shrimp Ponds ➢ 02.10.09.04 Pro-P: Strengthening governance supports the transformation of fisheries ➢ 02.10.09.09 Pro-P: Improvement of Facilities and Processing Infrastructure, Cold Chain System, and Fisheries Logistics	➢ 02.22.03.03 Pro-P: Development of Facilities and Infrastructure and Area-Based Fish Farming Clusters ➢ 02.22.03.06 Pro-P: Improving the Quality, Standards, and Competitiveness of Fishery Products ➢ 02.22.03.07 Pro-P: Increasing the Capacity of Marine and Fishery Business and Investment ➢ 02.22.03.08 Pro-P: Expanding the Fishery Product Market ➢ 02.22.03.09 Pro-P: Strengthening Logistics and Cold Chain Systems for Fishery Products

Figure 4. Cascading of Shrimp Downstream Policy in RPJMN 2025-2029 (Bappenas, 2025b). Notes: PN = Prioritas Nasional/National Priority, PP = Program Prioritas/Priority Program, KP = Kegiatan Prioritas/ Pirority Activity, P*ro*-P = Proyek Prioritas/Priority Project, PMA = Penanaman Modal Asing/foreign direct investment, PMDN = Penanaman Modal Dalam Negeri/domestic direct investment.

Nevertheless, in the policy and regulatory misalignments, the implementation of downstream initiatives is prone to encountering significant challenges at the operational level. However, there is considerable opportunity to adopt blue economy principles, given the government's commitment to sustainable development outlined in the 2025–2045 RPJPN (Bappenas, 2024). Specifically, the regional policy direction of the 2025–2029 RPJMN for Sumbawa emphasizes the development of aquaculture centers, with a particular focus on shrimp cultivation (Bappenas, 2025b). This includes the establishment of regions based on high-value aquaculture commodities and the revitalization of community ponds, with targeted outputs such as shrimp hatcheries, clustered revitalized pond areas, processing facilities, storage units, and logistics infrastructure for aquaculture products. In parallel, the policy also supports the advancement of shrimp aquaculture through superior broodstock breeding programs, irrigation network improvements, and the revitalization of shrimp pond lands, particularly for traditional-plus pond systems. Additional measures include dredging sedimented river estuaries, simplifying cross-sectoral licensing procedures, enhancing product quality, and expanding access to export markets. Collectively, these initiatives aim to strengthen the competitiveness and sustainability of the shrimp industry in the region.

Within the framework of Indonesia's Blue Economy roadmap, the downstreaming of shrimp commodities is positioned as a strategic priority to enhance value creation, sustainability, and economic inclusivity in the marine and fisheries sector. The Ministry of Marine Affairs and Fisheries (KKP) has actively advanced the development of integrated shrimp estates, with the goal of boosting national shrimp production to two million tons annually by 2024. This initiative is coupled with efforts to improve post-harvest infrastructure, including the expansion of cold chain systems, processing facilities, and certification services to align with export requirements (KKP, 2023). Equally important, the policy agenda strongly emphasizes supporting small-scale farmers in a variety of manners, including through building cooperatives, training on diversification, and equitable integration into the shrimp value chain. The downstream processing of shrimp is therefore crucial to the provision of blue foods, necessitating the implementation of sustainable aquaculture practices to sustain its long-term contribution to global food security (Tigchelaar *et al*., 2022).

3.3 Constraints on Social Inclusion

The local societies have not been significantly involved in the shrimp downstreaming process. Insufficient knowledge of product diversification and entrepreneurial skills has confined most of the farmers to upstream production functions. This result aligns with Yusuf *et al.* (2020)'s investigation in South Sulawesi, which determined systemic imbalances in Indonesia's shrimp value chain, revealing that most of the value addition is appropriated by the exporters and processing companies. In Sumbawa, the absence of powerful farmer groups or producer organizations undermines the scope for establishing an inclusive and sustainable value chain. Local involvement in downstreaming activities remains minimal, and there has been minimal coordinated effort to pursue training in intensive aquaculture or product

development. In the absence of cooperatives and Village-Owned Enterprises (BUMDes) as support institutions, smallholders consistently encounter serious difficulties in accessing value-added opportunities and strengthening their bargaining position in the industry. Umbas *et al.* (2024) argue that enhancing multi-stakeholder governance mechanisms in the shrimp value chain has the potential to significantly enhance farmers' bargaining power, besides redressing value imbalances in their benefit.

Strengthening the capacity of local communities through cooperatives and BUMDes is important in creating a more inclusive and sustainable shrimp downstreaming process in Sumbawa. Cooperatives serve as a vehicle for enabling smallholder farmers to access collectively important resources, including production inputs, suitable technologies, post-harvest facilities, and market linkages, thereby enhancing their bargaining power throughout the value chain (FAO, 2022b). In national development planning, BUMDes are envisioned to play a significant role in operating locally owned infrastructure, like processing facilities, cold storage, and logistic facilities, while simultaneously generating economic profits back into society (Nugroho et al., 2020; Kemendesa, 2021). These institutional mechanisms not only promote value retention at the local level but also reduce dependence on middlemen and external investors (World Bank, 2021). By fostering community ownership and capacity building, cooperatives and BUMDes help ensure that the benefits of shrimp downstreaming are equitably distributed and contribute to long-term rural prosperity (KKP, 2021). Moreover, Barusman et al. (2019) developed an institutional model of joint business partnerships in Indonesian shrimp farming (Figure 5), which involves multiple stakeholders, including government, the private sector, universities, NGOs, civil society, the media, and the Regional Shrimp Farmers Association (P3UW). This model offers potential applicability in Sumbawa to promote a more inclusive and collaborative approach to shrimp farming.

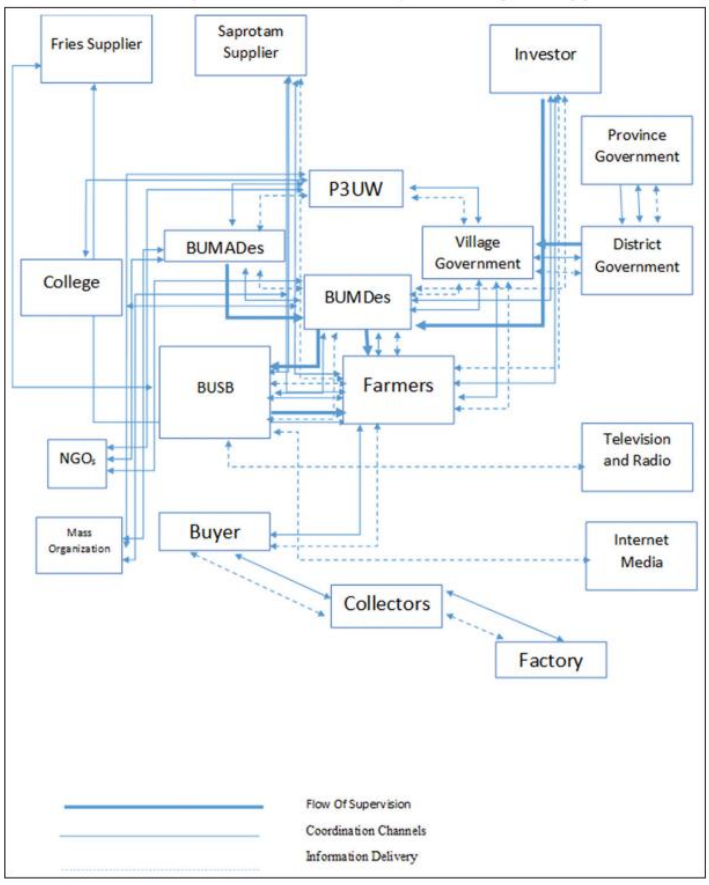

Figure 5. Institutional model of joint business partnerships in shrimp farming (Barusman *et al*., 2019)

3.4 Environmental Management Vulnerabilities

From an environmental perspective, Tamariska *et al*. (2024) emphasized the need for sustainable aquaculture methods such as super-intensive farming systems to reduce ecological impact without compromising productivity. However, such methods have not yet been systematically introduced to

farmers in Sumbawa. Disease risks such as Early Mortality Syndrome (EMS) and White Spot Syndrome Virus (WSSV) remain high, and waste management systems are poorly standardized. Meanwhile, Hidayati *et al*. (2021) demonstrated that chitosan is effective in treating shrimp washing wastewater, reducing color, turbidity, and total dissolved solids (TDS) by 84%, 83%, and 54% respectively. Moreover, Anggoro *et al*. (2021) utilized Indonesian natural zeolite—known for its porous structure and high absorption capacity—to reduce toxic gases NH_3 and H_2S in shrimp ponds. Their study found that optimal absorption occurred at a flow rate of 3 L/min using 18 kg of zeolite, improving water quality for shrimp farming.

To address the environmental challenges of shrimp aquaculture in Sumbawa, greater emphasis must be placed on the adoption of cost-effective and scalable waste treatment technologies. The integration of chitosan-based filtration and zeolite absorption systems into smallholder pond operations could significantly improve effluent quality and reduce ecological risks. However, the widespread implementation of these innovations requires coordinated efforts in technical training, demonstration projects, and policy support (FAO, 2022a; Rusdi *et al*., 2022). In addition, environmental monitoring systems—such as real-time water quality sensors—should be introduced to enable early detection of critical parameters that affect pond health (World Bank, 2021). Hidayati *et al.* (2020) suggest that regular monitoring of heavy metals in aquaculture environments is necessary. Better waste management and sustainable aquaculture practices are recommended to reduce contamination.

Establishing environmentally certified zones and strengthening compliance mechanisms would further support the transition toward sustainable and responsible aquaculture practices in the region (KKP, 2021). In line with findings by Xuan *et al.* (2021) in Vietnam, stakeholders have expressed concerns regarding the social and environmental consequences of conventional shrimp aquaculture. The public tended to emphasize issues such as biodiversity loss and the excessive use of antibiotics and pesticides, whereas producers highlighted challenges related to water quality and the prevalence of disease outbreaks as the primary risks confronting the industry. In this context, nanotechnology and biotechnology innovations provide novel, effective, and environmentally safe tools for disease detection, prevention, and treatment (Seethalakshmi et al., 2021). The adoption of these technologies is expected to improve shrimp health, enhance productivity, and align with global sustainability goals.

3.5 Limitations in Financial Mechanisms

Despite Sumbawa's significant shrimp production, a conducive investment climate to support downstream processing and logistics has yet to be established. As a result, the productivity gains of the shrimp industry have not yet produced a multiplier effect on local incomes or spurred broader economic development in the Sumbawa area. These shortcomings highlight the need for greater institutional coordination and targeted investment incentives to maximize the sector's contribution to local development. At the same time, Kusumanti et al. (2023) emphasize adapting to shifting marketplaces in the post-pandemic situation to uphold the position of improvement for aquaculture. Strategies emphasized during the pandemic were to improve access to information through distribution, digital marketing channels, and compliance with government shipping regulations. Aquaculture companies can become more immune to future disruption by utilizing social media and e-commerce platforms.

Enhancing the financial underpinnings of Sumbawa shrimp aquaculture involves both increasing access to inclusive financial products and tailoring them to the requirements of smallholder farmers. These could involve the introduction of credit guarantee facilities, the development of blended financing models, and the facilitation of investment partnerships between private sector organizations and cooperatives (World Bank, 2021). Additionally, state-supported initiatives for the development of business acumen and financial literacy are necessary for building the managerial capabilities of local producers. The coming together of digital financial instruments—like mobile banking and cooperative-centered digital platforms—has the potential to optimize transaction procedures, minimize operational expenses, and promote transparency throughout the value chain. Public–private partnerships (PPP) can also play a crucial role in derisking investments and cofinancing essential infrastructure, including post-harvest infrastructure and cold chain logistic networks (FAO, 2022b). Lastly, a properly structured financial system will be required to convert shrimp productivity into inclusive and sustainable economic development at the regional level.

Recommendation

Among the most pressing constraints were the need for a shrimp downstreaming roadmap and integrated spatial planning, as well as more adaptive policies. Therefore, the growth of Sumbawa's shrimp downstream needs an interdisciplinary approach. Reflecting on available research indicates that most structural impediments found in Sumbawa are also found in most other shrimp-producing areas. Umbas *et al.* (2024) emphasize that multi-actor governance across the organic shrimp value chain in Sidoarjo is required to address institutional fragmentation and market access shortages. The informal agreements between farmers, intermediaries, and exporters dilute farmers' bargaining power. were smallholders dependent on local collectors and vulnerable to price fluctuations.

Addressing these challenges requires concerted action: developing infrastructure and technology, empowering cooperatives and local institutions, and creating inclusive policies that engage investment and forge multi-stakeholder partnerships. Consequently, Sumbawa's immense shrimp production potential can be harnessed as a catalyst for sustainable and inclusive regional development.

Local governments and academic institutions, such as the Sumbawa University of Technology (UTS), have significant roles to play in the growth of the downstream shrimp industry in the region. The local government can set the pace by simplifying regulatory procedures, enhancing enabling infrastructure, and offering fiscal incentives for investment in cold chain and processing facilities.

Meanwhile, UTS may make its own contribution via applied research and technological innovation, e.g., the development of small-scale shrimp processing equipment and IoT-based water quality monitoring systems. Beyond research, the university may also be a lead facility for entrepreneurship training, business incubation, and certification programs for capacity and competitiveness upgrading of local stakeholders. Thus, universities in Sumbawa can implement the "Tri Dharma Perguruan Tinggi" (education and teaching, research, and community service) thematically on shrimp downstreaming. Strengthening university-industry-government collaboration is essential to building an inclusive, innovative, and sustainable shrimp value chain in the region.

Figure 6. Focus Group Discussion (FGD) and field observations in Sumbawa

Conclusion

This study has provided empirical insights into the structural barriers and opportunities for shrimp downstreaming in Eastern Indonesia, with Sumbawa as a case study. The findings confirm that, despite Sumbawa's strategic potential as a national hub, the region's downstream development remains constrained by limited infrastructure and technology, regulatory and governance misalignments, weak social inclusion, and insufficient financial mechanisms. Environmental management challenges further underscore the need for systemic improvements to ensure that shrimp downstreaming contributes not only to economic competitiveness but also to long-term sustainability and community welfare. This study suggests the need for a regionally based policy design for shrimp downstreaming that integrates economic, social, and environmental dimensions. Without targeted and coordinated interventions, the value-added potential of Sumbawa's shrimp sector will remain underutilized, limiting both regional development outcomes and Indonesia's broader blue economy agenda.

At the same time, the research revealed critical gaps that justify directions for future inquiry, such as the limited evidence on viable institutional models for shrimp cooperatives, data on differentiated

value-added export, and long-term ecological impacts of intensified aquaculture practices. Furthermore, while financing constraints were consistently identified, information on the feasibility of innovative financing schemes and fiscal incentives tailored to downstream actors was limited. Future research should therefore examine these gaps more systematically. Addressing these knowledge gaps will be essential for designing policy instruments that move beyond short-term problem solving toward a more integrated, inclusive, and sustainable shrimp downstreaming ecosystem in Sumbawa and similar regions.

References

Anggoro, D. D., Sumantri, I., & Buchori, L. (2021). Indonesia's Natural Zeolite as an Adsorbent for Toxic Gases in Shrimp Ponds. Journal of Ecological Engineering, 22(6), 202–208. https://doi.org/10.12911/22998993/137921

ADB. (2022). Infrastructure improvement for shrimp aquaculture project ADB project 55020-001. https://www.adb.org/projects/documents/ino-55020-001-rrp. Accessed on August 22, 2025.

ASC. (2023). ASC Shrimp Standard V.1.2.1. https://asc-aqua.org/producers/asc-standards/shrimp/. Accessed on August 22, 2025

Astriana, B.H., Putra, A. P., & Ali, I. (2023). Peningkatan Produksi Udang dan Potensi Pencemaran Perairan Laut di Kabupaten Sumbawa (The Increase in Shrimp Production and Potential Pollution of Marine Waters in Sumbawa District). Jurnal Tambora, 7(3): 53-59. https://doi.org/10.36761/jt.v7i3.2923

Bappenas. (2024). Rencana Pembangunan Jangka Panjang Nasional (RPJPN) 2025-2045 (The 2025-2045 National Long-Term Development Plan). Jakarta: Kementerian PPN/Bappenas RI. https://indonesia2045.go.id/aspirasi. Accessed on August 22, 2025.

Bappenas. (2025a). Blue Food Assessment (BFA) Indonesia. Jakarta: Kementerian PPN/Bappenas RI.

Bappenas. (2025b). Rencana Pembangunan Jangka Menengah Nasional (RPJMN) 2025-2029 (The 2025-2029 National Medium-Term Development Plan). Jakarta: Kementerian PPN/Bappenas RI. https://rpjmn.bappenas.go.id/dokumen. Accessed on August 22, 2025.

Barusman, M. Y. S., Gultom, I. A., & Redaputri, A. P. (2019). Risk Management of the Joint Partnership Pattern: Case Study of Shrimp Farming in Indonesia. International Review of Management and Marketing, 9(1), 72–78. https://doi.org/10.32479/irmm.7390

Boettiger, S., Denis, N., & Sanghvi, S. (2017). Successful Agricultural Transformations: Six Core Elements of Planning and Delivery. McKinsey and Company.

BPS NTB. (2025). Provinsi Nusa Tenggara Barat dalam Angka 2025 (West Nusa Tenggara Province in Figures 2025). Mataram: Badan Pusat Statistik Nusa Tenggara Barat.

BPS. (2025). Statistika Indonesia (Indonesian Statistics). Volume 53, 2025. Jakarta: Badan Pusat Statistik.

Cai, J., Huang, H., & Leung, P. (2019). Understanding and measuring the contribution of aquaculture and fisheries to gross domestic products (GDP). Food and Agriculture Organization of the United Nations.

DKP Sumbawa. (2024). Isu, Tantangan, dan Peluang Komoditas Udang Vannamei Kabupaten Sumbawa (Issues, Challenges, and Opportunities for Vannamei Shrimp Commodities in Sumbawa Regency). Sumbawa: Dinas Kelautan dan Perikanan.

Efrizal, J., Sahara, S., lhaq, I., Syahid., Syarifah, A., & Salam, A. F. (2025). What do we know about the future of the agrifood system in Indonesia? In What do we know about the future of food systems? eds. Keith Wiebe and Elisabetta Gotor. Part Three: What Do We Know About the Future of Food Systems in Selected Countries? Chapter 26, Pp. 151-158. Washington, DC: International Food Policy Research Institute. https://hdl.handle.net/10568/175513

FAO. (2022a). Aquaculture Cooperative Development: A Key to Inclusive and Sustainable Growth. Rome: Food and Agriculture Organization of the United Nations.

FAO. (2022b). Guidelines for Sustainable Aquaculture Value Chains. Rome: Food and Agriculture Organization of the United Nations. https://www.fao.org/documents/card/en/c/cc2845en.

Accessed on August 22, 2025.

Heriyati, E., Ilmi, M. B., & Suryono, C. A. (2024). Impact of Water Quality and Phytoplankton on Juvenile Vannamei Shrimp Growth in Low-Salinity Ponds. Journal of Marine Biotechnology and Immunology, 2(3), 6–11. https://doi.org/10.61741/af5rq076

Hidayati, N. F., Rahman, M., Fauzana, N. A., & Aisiah, S. (2021). Effectiveness of Chitosan to Reduce the Color Value, Turbidity, and Total Dissolved Solids in Shrimp-Washing Wastewater. Russian Journal of Agricultural and Socio-Economic Sciences, 115(7), 82–88. https://doi.org/10.18551/rjoas.2021-07.08

Hidayati, N.V., Prudent, P., Asia, L., Vassalo, L., Torre, F., Widowati, I., Sabdono, A., Syakti, A. D., & Doumenq, P. (2020). Assessment of the ecological and human health risks from metals in shrimp aquaculture environments in Central Java, Indonesia. Environ Sci Pollut Res 27, 41668–41687. https://doi.org/10.1007/s11356-020-09967-8

Kasnir, M. (2014). Water Quality Parameter Analysis for the Feasibility of Shrimp Culture in Takalar Regency, Indonesia. Journal of Aquaculture Research & Development, 05(06). https://doi.org/10.4172/2155-9546.1000273

Kemendesa. (2021). Pedoman Umum Pengembangan BUMDesa Tahun 2021 (General Guidelines for Village-Owned Enterprise Development in 2021). Jakarta: Direktorat Jenderal Pembangunan Ekonomi dan Investasi Desa, Daerah Tertinggal, dan Transmigrasi. https://www.kemendesa.go.id/. Accessed on May 27, 2025.

KKP. (2021). Strategi peningkatan produksi udang nasional 2021–2024 (Strategy for increasing national shrimp production 2021–2024). Jakarta: Direktorat Jenderal Perikanan Budidaya Kementerian Kelautan dan Perikanan.

KKP. (2023). Dokumen Rencana Aksi Ekonomi Biru: Lima Program Prioritas KKP 2021–2024 (Blue Economy Action Plan Document: Five Priority Programs of the Ministry of Marine Affairs and Fisheries 2021–2024). Jakarta: Kementerian Kelautan dan Perikanan.

KKP. (2025). Sebaran Cold Storage di Provinsi NTB (Distribution of Cold Storage in West Nusa Tenggara Province). Portal Data Kementerian Kelautan dan Perikanan (KKP). https://portaldata.kkp.go.id/portals/data-statistik/cold-storage/tbl-dinamis. Accessed on May 27, 2025.

Kusuma, E. F. P, & Sari, L. K. (2021). Analisis Daya Saing Ekspor Udang Indonesia ke Delapan Negara Tujuan Terbesar Tahun 2000–2019 (Analysis of the Competitiveness of Indonesian Shrimp Exports to the Eight Largest Destination Countries 2000–2019). Seminar Nasional Official Statistics. DOI: https://doi.org/10.34123/semnasoffstat.v2021i1.1005

Kusumanti, I., Ramadhani, D. E., Iskandar, A., & Hendriana, A. (2023). Production Performance of Aquaculture: Relationship to Business Sustainability in The New Normal Era. IOP Conference Series: Earth and Environmental Science 1221 (2023) 012036. DOI: https://doi.org/10.1088/1755-1315/1221/1/012036

Mokodenseho, S., Kartika Devi, E., & Priyana, Y. (2023). The Role of Shrimp Breeding Innovation in Improving Aquaculture Productivity and Fisheries Business Sustainability in Sumbawa, West Nusa Tenggara. West Science Interdisciplinary Studies, 1(10) https://doi.org/10.58812/wsis.v1i10.325

Nirmal, N. P., Santivarangkna, C., Rajput, M. S., & Benjakul, S. (2020). Trends in shrimp processing waste utilization: An industrial prospective. Trends in Food Science & Technology, 103, 20–35. https://doi.org/10.1016/j.tifs.2020.07.001

Nugroho, H. Y., Sari, D. P., & Santoso, A. (2020). The Role of BUMDes in Strengthening Rural Economy in Indonesia. International Journal of Scientific and Technology Research, 9(3), 3188–3191. https://www.ijstr.org/final-print/mar2020/The-Role-Of-Bumdes-In-Strengthening-Rural-Economy-In-Indonesia.pdf

Rubel, H., Woods, W., Perez, D., Unnikhrisnan, S., Felde, A., Zielcke, S., Lidy, C., & Lanfer, C. (2019). A Strategic Approach to Sustainable Shrimp Production in Indonesia. Boston Consulting Group.

Rusdi, R., Kasri, & Kodiran T. (2022). Sustainable management of whiteleg shrimp (Litopennaeus vannamei) aquaculture in Barru Regency, South Sulawesi Province based on EAA (Ecosystem Approach to Aquaculture). IOP Conference Series: Earth and Environmental Science, 1119 012074. https://doi.org/10.1088/1755-1315/1119/1/012074

Sambodo, L.A.A.T., Pane, D.D.P., Pertamawati, L. H., Maftukhah, S., Firdaus, I. T., Wikapuspita, T., Harianto, S. K., Nurrahmani, S. M., Nugrahaeni, T. A., Mukhairiq, M. T., Manullang, R. A., Alfarisy, M. A. R., Riyanto, R., Artika, K., Nurhaditia, F., & Tamadhika, R. (2023). Indonesia Blue Economy Roadmap. Ministry of National Development Planning/National Development Planning Agency (BAPPENAS). ISBN 78-623-98276-2-5

Seethalakshmi, P. S., Rajeev, R., Kiran, G. S., & Selvin, J. (2021). Shrimp disease management for sustainable aquaculture: innovations from nanotechnology and biotechnology. In Aquaculture International (Vol. 29, Issue 4, pp. 1591–1620). Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1007/s10499-021-00698-2

Setneg. (2024). Pidato Presiden Prabowo Subianto pada Sidang Paripurna MPR RI dalam rangka Pelantikan Presiden dan Wapres RI Terpilih Periode 2024-2029 (Speech by President Prabowo Subianto at the Plenary Session of the MPR RI for the Inauguration of the Elected President and Vice President of the Republic of Indonesia for the 2024-2029 Period). https://setneg.go.id. Accessed on May 27, 2025.

Tamariska, D., Widiana, I. G. P., & Nugroho, D. (2024). Strategi Budidaya Super-Intensif untuk Peningkatan Produktivitas Udang Vannamei secara Berkelanjutan (Super-Intensive Cultivation Strategy for Sustainable Increase in Vannamei Shrimp Productivity). Jurnal Perikanan Tropis, 17(1), 35–48. https://doi.org/10.12345/jpt.2024.17.1.35

Tigchelaar, M., Leape, J., Micheli, F., Allison, E. H., Basurto, X., Bennett, A., Bush, S. R., Cao, L., Cheung, W. W. L., Crona, B., DeClerck, F., Fanzo, J., Gelcich, S., Gephart, J. A., Golden, C. D., Halpern, B. S., Hicks, C. C., Jonell, M., Kishore, A., Koehn, J. Z., Little, D. C., Naylor, R. L., Phillips, M. J., Selig, E. R., Short, R. E., Sumaila, R., Thilsted, S. H., Troell, M., & Wabnitz, C. C. C. (2022). The Vital Roles of Blue Foods in The Global Food System. Global Food Security. https://doi.org/10.1016/j.gfs.2022.100637

Umamaheswari, T., Sugumar, G., Rajakumar, M., Felix, N., Athithan, S., & Veerabhadran, K. (2025). Value chain analysis of Penaeus vannamei in Tamil Nadu, India. Aquaculture International, 33(3), 229. https://doi.org/10.1007/s10499-025-01910-3

Umbas, G. T., Santoso, R. W., & Hadi, F. M. (2024). Tata Kelola Multi-Actor dalam Rantai Nilai Udang Organik: Studi Kasus Kabupaten Sidoarjo (Multi-Actor Governance in the Organic Shrimp Value Chain: A Case Study of Sidoarjo Regency). Jurnal Ekonomi Maritim dan Pembangunan Daerah, 12(2), 101–117. https://doi.org/10.56789/jempd.2024.12.2.101

World Bank. (2021). Marine Aquaculture and Coastal Livelihoods in Indonesia: Policy and infrastructure assessment. Washington, DC: World Bank Group. https://documents.worldbank.org/en/publication/documentsreports/documentdetail/282651623404460662. Accessed on May 27, 2025.

Xuan, B. B., Sandorf, E. D., & Ngoc, Q. T. K. (2021). Stakeholder perceptions towards sustainable shrimp aquaculture in Vietnam. Journal of Environmental Management, 290. https://doi.org/10.1016/j.jenvman.2021.112585

Yusuf, R., Rosyidah, L., Zamroni, A., & Apriliani T. (2020). Supply Chain and Logistic System of Vannamei Shrimp in Pinrang Regency, South Sulawesi Province. Marina, 6(1), 25–35. http://dx.doi.org/10.15578/marina.v6i1.8494

Zamroni, A., Yusuf, R., & Apriliani, T. (2021). Supply Chain and Logistic of Vannamei Shrimp in Production Areas of Indonesia. J. Sosek KP Vol. 16 No. 2 Desember 2021: 163-178. DOI: http://dx.doi.org/10.15578/jsekp.v15i2.9495