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Whiteleg Vannamei Shrimp (*Penaeus vannamei*) Production in Glan, Sarangani Province, Philippines: A Value Chain Analysis

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Abstract

This study analyzed the value chain of whiteleg shrimp production in Glan, Sarangani Province, Philippines, involving 42 individuals: 14 grow-out farms, two hatcheries, 22 traders (wholesalers, commission agents, and retailers), two processors, and two enablers. Data were interpreted using descriptive statistics, as well as cost and return analysis. The value chain map of vannamei shrimp in Glan includes input supply, production, processing, distribution, and consumption, with distinct stakeholders involved at each stage. The product flows through six marketing channels, from production to consumption, producing five by-products (raw, fresh, peeled/cooked/frozen and nobashi), which are distributed domestically within the Philippines. Shrimp production incurs costs of approximately ₱194.65 ($3.32) per kilogram, with grow-out farms earning a return on investment of 40%, indicating that shrimp farming remains feasible despite facing challenges. However, production volume continues to decline due to viral diseases like White Spot Syndrome Virus and Early Mortality Rate Syndrome, along with issues such as higher cost of inputs, capital shortages, and fry seed availability. To further improve the industry, the government may consider strengthening biosecurity measures, investing in research and development projects, crisis management plans, and promoting environmental sustainability.

Keywords: *value chain, marketing channels, vannamei shrimp, profitability*

How to Cite:

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Introduction

The Philippines' aquaculture industry was described by the United Nations Food and Agriculture Organization (FAO) as having a promising growth potential (Towers, 2015). Aquaculture is the fastest-growing food supply sector in the world, contributing to global, regional, and local food security. In the Philippines, it plays a vital role by addressing poverty and providing employment opportunities to Filipinos. Globally, aquaculture expanded by over 600% between 1990 and 2020, with an average annual growth rate of 6.7% (Food and Agriculture Organization, 2009).

Penaeus vannamei, also known as the Pacific White Shrimp and the Whiteleg Shrimp was introduced into Asia experimentally from 1978 to 1979, and started commercially in Mainland China and Taiwan in 1996, followed by coastal Asian countries, including the Philippines from 2000 to 2001 (FAO, 2020). In tropical countries like the Philippines, *P. vannamei* is the most preferred aquatic shrimp species for culture due to its advantageous qualities, including short culture period, consistent production, availability in high stocking density, disease resistance, and high economic returns (Chiu & Chien, 2011).

In 2019, aquaculture's export volume decreased by 43% from 464,248 MT in 2018 to 264,254 MT in 2019. The three major export

commodities were tuna, seaweeds, and shrimp/ prawn in 2019 Southeast Asian Fisheries Development Center (SEAFDEC, 2005). Amid the declining production in 2019, the Philippines still ranked 8th among the top-producing countries worldwide. The downward trend continued in 2020 and 2021 because of the crisis caused by the Coronavirus Disease 2019 (COVID-19) pandemic, but Filipinos remained committed to farming. As a result, the Philippine shrimp and prawn growers brought pride to the country, with the Philippines ranking 4th in Southeast Asia and 10th globally in shrimp and prawn production output in 2021 (Department of Agriculture- Bureau of Fisheries and Aquatic Resource [DA-BFAR], 2019). Despite the challenges, in 2022, aquaculture production had a positive shift, increasing by approximately 102,936.24 MT or 4.58%, compared to the previous year (DA-BFAR, 2022).

Region XII, consisting of South Cotabato, Cotabato, Sultan Kudarat, Sarangani, and General Santos City (SOCCSKSARGEN) remained the top producer of Pacific White Shrimp in 2022, having 9,313.38 MT, followed by Region VI and Region VII (BFAR, 2022) Glan, Sarangani, a key contributor to the region, faced various problems that significantly affected the entire industry due to the declining number of producers. Out of 26 registered grow-out farms, only 14 are currently in operation (Office of the Municipal Agriculturist – Glan, 2023), this caused a significant shift in production and marketing dynamics.

Moreover, the population growth and rising per capita consumption suggest that farmed seafood commodities will become progressively significant as a supplementary source of food and income, while aquaculture will become increasingly crucial as natural fish supplies continue to shrink (Diana, 2009). Expanding shrimp production will also be a great help to maintain the sustainability of wild-caught species from rivers, lakes, and oceans, as it provides for the losses of captured fish stocks (United Nations, n.d.).

The shrimp industry is a priority commodity in the province based on the Provincial Commodity Investment Plan (PCIP). Thus, given the current situation, conducting a value chain analysis to determine the primary and secondary activities that add value to the final product. This analysis can also propose an alternative approach to enhance the efficiency along the value chain. As well as it is also aligned with the United Nations Sustainable Development Goals (SDG), specifically: Zero Hunger (SDG 2), Decent Work and Economic Growth (SDG 8), Responsible Consumption and Production (SDG 12), and Industry, Innovation and Infrastructure (SDG 9) (United Nations, n.d.).

The result of the analysis can be of help to the Local Government Unit, Department of Agriculture - Bureau of Fisheries and Aquaculture Resources (DA-BFAR) Sarangani, Region XII, and other related agencies in sustaining the industry. It can be a basis for developing policies and programs that would be a great solution to strengthen, enrich, and complement shrimp production in the province of Sarangani.

Consequently, the study was designed to accomplish several key objectives of the vannamei shrimp industry. Specifically, it aimed to map the value chain of the industry, identify various stakeholders involved in each stage, and examine different activities occurring throughout the chain. Additionally, it sought to analyze both the product and payment flow, assess profitability, and identify the constraints and opportunities within the industry. By addressing these objectives, the study presents a comprehensive analysis of the industry's structure and operations.

Materials and Methods

The study utilized a multi-method approach, incorporating multiple forms of quantitative data (Creswell, 2015). This method is widely acknowledged for its ability to combine different forms of data, thus enhancing the overall quality of the research. Structured surveys and questionnaires were utilized to gather data for statistical analysis, while purposive sampling and interviews provided insights into stakeholder perspectives. This ensured a balanced understanding of numerical trends and contextual factors in the shrimp value chain (Benoot et al., 2016).

The study was conducted in Glan, Sarangani Province, covering seven barangays: Padidu, Taluya, Batulaki, Small Margus, Big Margus, Burias, and Baliton, from February to April 2024. Forty-two respondents participated, including 14 grow-out farmers, two hatcheries, 22 traders (wholesalers, commission agents, and retailers), two processors, and two enablers. The shrimp value chain was mapped from input supply (hatcheries) to production (grow-out farms), processing (processors), distribution (traders), and consumption (final sales). Data on grow-out farms and hatcheries were obtained from BFAR XII and the OMAg in Glan, while other participants were identified through referrals. Surveys and interview guides were developed based on literature and expert input to ensure they captured accurate and relevant information.

Upon initiating the study, the researcher first sent permission letters to the Department of

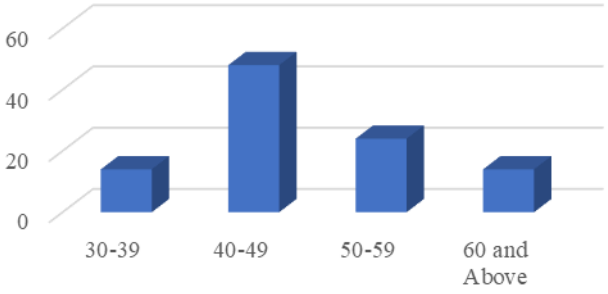
Agriculture – Bureau of Fisheries and Aquatic Resources XII (DA-BFAR XII) and the Office of the Municipal Agriculturist (OMAg) in Glan, Sarangani. After receiving approval, data collection began with permission letters sent to shrimp stakeholders, utilizing 14 structured survey questionnaires, emails, and other communication platforms, particularly to those outside the municipality. This approach relied on individual responses through a quantitative method to gather standardized data.

The gathered data were analyzed using descriptive statistics. To determine the profitability of the shrimp industry, a cost and return analysis was conducted, which utilized the following parameters:

- Total Costs = Fixed Costs + Variable Costs
- Gross revenue = Price per kg × Quantity
- Net Income = Gross Revenue – Total Costs
- Marketing margin (₱) = Selling Price – (Purchasing Price + Added Cost or Total Costs)
- Net profit margin (%) = (Net Income / Gross Revenue) × 100
- Return On Investment (ROI) = (Net Income / Total Investment) × 100
- Benefit-Cost Ratio (BCR) = Total Benefits / Total Costs

Figure 1

Age distribution of the key players in the value chain of shrimp in Glan, Sarangani Province, 2024.



Results and Discussion

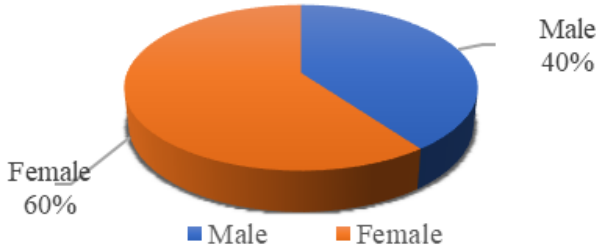
Socio-Demographic Profile

Age

The majority of the respondents (48%) were aged 40-49 years. Followed by 24% in the 50 to 59 age group, while both 30 to39 and 60 and above age group accounted for 14%. These results indicates that most key players in the shrimp industry are already in middle age.

Figure 2

Gender distribution of the key players in the value chain of shrimp in Glan, Sarangani Province, 2024

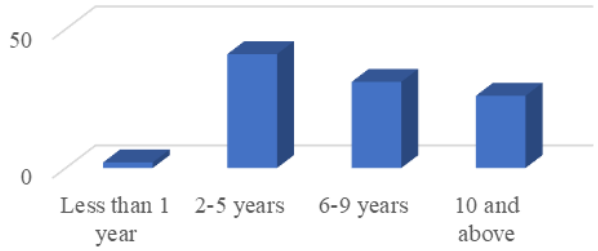


Gender

Results revealed that most respondents are female (60%) while only 40% are male. 25 were female, while 17 were male. Exhibiting that in the value chain of shrimp, there is a larger proportion of females compared to males, they were involved in various stages such as post-harvest processing and marketing. In several Southeast Asian countries like Vietnam and Indonesia, women form the majority of workers (FAO, 2019), noting that women are often the primary workers in the early or final stages of shrimp production, while men dominate in management or more technical roles (Pomeroy & Sandhu, 2017).

Figure 3

Years of in-service distribution of the key players in the value chain of shrimp in Glan, Sarangani Province, 2024.

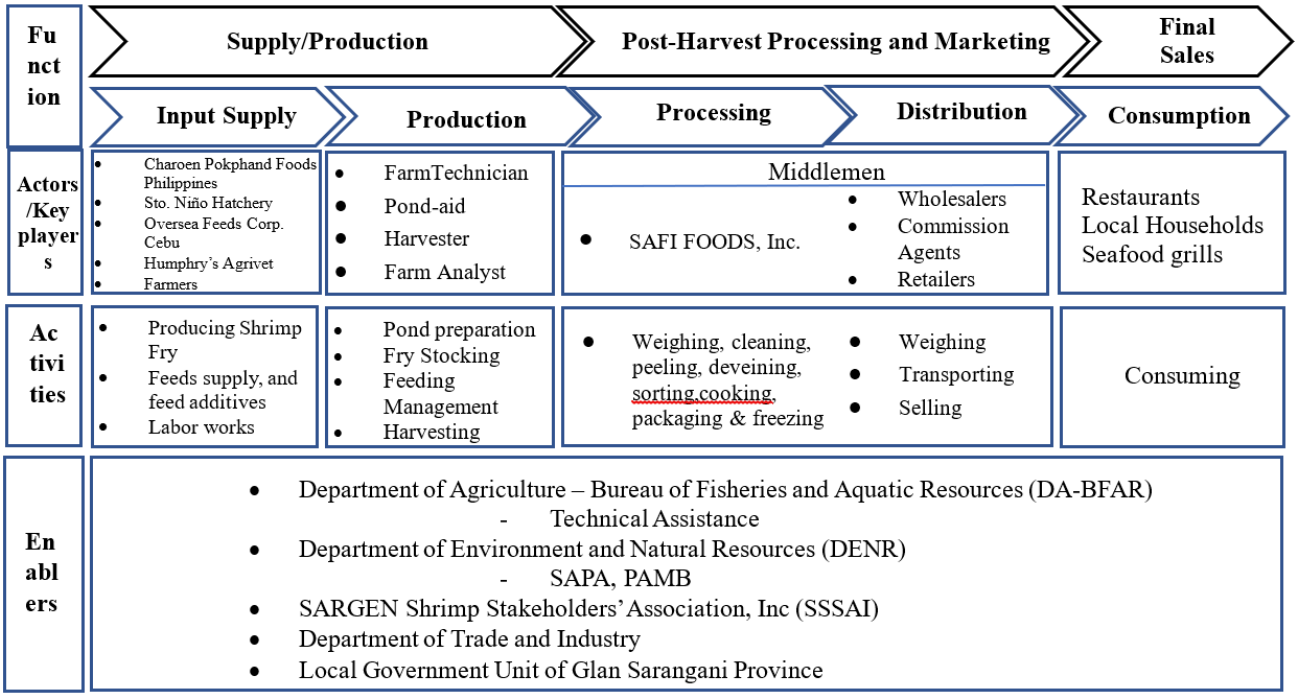


Years in Industry

The result shows that the majority of the key players have been in the shrimp industry for 2-5 years (41%), and there were 31% of the respondents who have been in the industry for 6-9 years. Hence, it implies that the shrimp industry in Glan Sarangani is in its early stages of

Figure 4

Value Chain Map of Whiteleg Vannamei Shrimp by-products in Glan, Sarangani Province, 2024 – for the domestic market (Source: Authors' illustration).



development and is steadily expanding. As the demand for shrimp is increasing (DA-BFAR, 2023), there is a clear need to strengthen the industry to ensure its sustainability and long-term success.

Value Chain Map of Vannamei Shrimp

According to the Bureau of Fisheries and Aquatic Resources – to date, Region XII remained the top producer of *P. vannamei* in the Philippines (BFAR, 2022). One of its major contributors was grow-out farms located in Glan, Sarangani Province. The survey revealed that before the final product reaches its end consumer, it goes through various activities and actors. Figure 4 below is the value chain map of shrimp in Glan, Sarangani. The process covers all stages, from supply and production to post-harvest processing, marketing, and final sales.

Value Chain Map (fig.4)

A value chain map provides a concise overview of the value chain process that outlines the sequence of activities, key players, and interrelationships. It also presents different methods and illustrations with key elements including superior value delivery, customer-perceived value, and lifetime value—factors that are essential in driving customer satisfaction (Kumar & Rajeev, 2016).

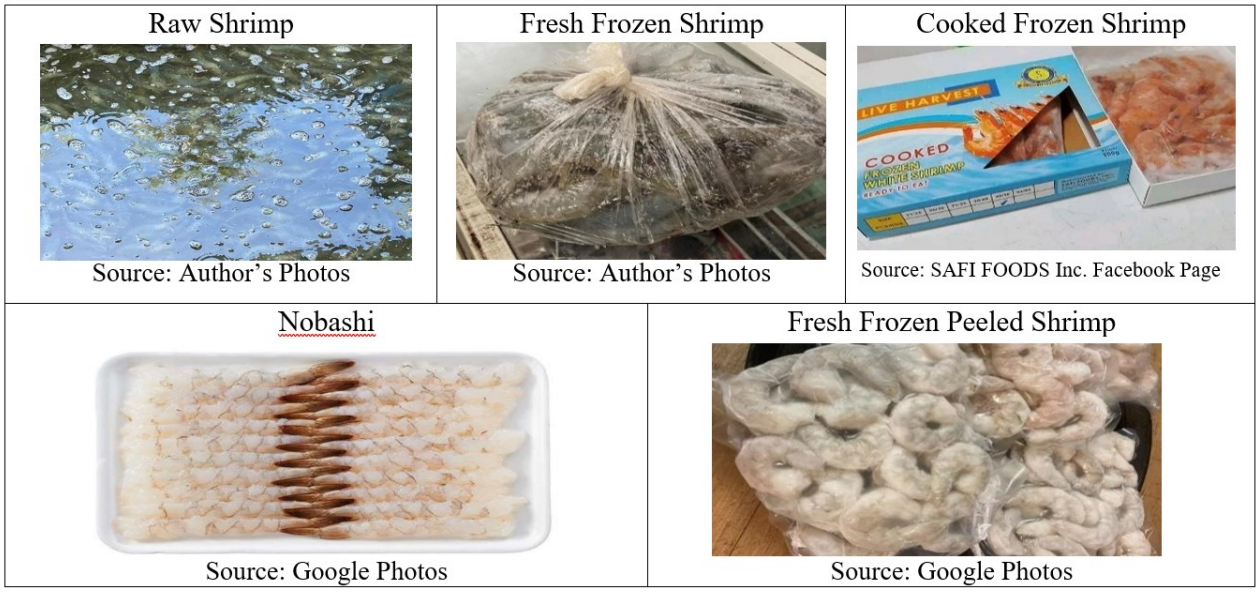
First, it commences with the primary processes of procuring raw materials and supplies used in producing the final product. These essential inputs include brood stocks, fry, feeds, live feeds, feed additives, fuel, electricity, and labor. The survey revealed that Charoen Pokphand Foods Philippines Corporation is the only shrimp hatchery in General Santos City that imports its brood stocks directly from Thailand and Hawaii, while Sto. Niño Hatchery got their post-larval from Cebu City. Whereas, other materials were from various stakeholders including hatcheries, agricultural suppliers, local farmers, processors, and traders.

Second, in the production phase, farmers acquire their seeds and feed from shrimp hatcheries (CPF & Sto. Niño). The inputs enable the production phase, encompassing critical activities such as pond preparation, stocking, feeding, nurturing, and harvesting.

Lastly, the harvested product is sold to commission agents, wholesalers, processors, and retailers for further processing, distribution, and consumption. Products delivered to processing plants and processor-retailers undergo additional activities such as sorting, peeling, deveining,

Figure 5

Vannamei Shrimp By-Products, 2024 – for domestic market



packing, and freezing before reaching the final consumers.

The study highlights the interconnected roles and significance of each actor in forming the shrimp value chain — from sourcing the right inputs to processing and distribution, where each stage adds value that contributes to the overall competitiveness of the sector. By identifying key players, stakeholders can better understand their roles and pinpoint major opportunities for development. For instance, the reliance on international imports for broodstocks, together with local suppliers of other materials, presents both opportunities for strengthening local supply chains and challenges related to cost and dependency (Lugendo & Mwaijande, 2015).

Value Chain Actors and their Functions

Input Suppliers

Different suppliers play a vital role in providing essential inputs for shrimp production in Glan, Sarangani Province. Input provision including fry for stocking materials, feeds, feed additives, fuel, and electricity. As contemplated from the farmers' response, it was reported that the farmers' fry stocking source was from hatcheries. The study revealed three hatcheries where they acquire fry stockings, mainly Charoen Pokphand Foods Philippines Corporation located in Tinoto, Maasim, Sto. Nino Aquaculture Corporation (larval rearing facility), and Oversea Feeds Corporation in Cebu City.

Additionally, shrimp feeds were also acquired from hatcheries, while other feed additives were bought from different agricultural supplies stores in General Santos City and other nearby cities and provinces. When it comes to farm materials like aerators and paddle wheels, grow-out farms source equipment from foreign countries like China. As these farms are privately owned by individuals and corporations, all inputs are financed through their own capital. The availability of diverse suppliers has significantly contributed to the operations and productivity of shrimp grow-out farms.

Farmers

Shrimp producers are the key players in the value chain, as they perform various activities essential to the production stage. They oversee the entire process, from input management to the production of the final product. In Glan Sarangani Province, most farms are managed by farm technicians or managers. Farm personnel are typically categorized as farm technicians/farm managers, pond-aid, farm analysts, and harvesters. The farm technician serves as the supervisor, overseeing tasks such as pond preparation, procurement of supplies, feeding, and harvesting. However, this role is primarily supervisory; the technician directs tasks and guidance, rather than performing all the work personally.

Traders

Shrimp farms sell their product to different

intermediaries, namely commission agents, wholesalers, processors, and retailers. Traders exhibit the post-harvest processing activities such as classifying, weighing, sorting, transporting, and packing. They associate with the farms and offer them competitive value in purchasing their product. Through building strong connections with farms, traders gave markets and ensured adequate value for their products, helping to prevent production losses.

Processors

In the shrimp value chain of Glan, Sarangani, only one farm among the respondents directly supplies a shrimp processing plant—SAFI FOODS, Inc., located in Ladol, Alabel, Sarangani Philippines. Shrimp processors are responsible for value-adding processes, including cleaning, peeling, deveining, cooking, sorting, and packing. The process begins with purchasing raw shrimp from farms and delivering them to processing plants for additional processing. Value-added products such as Fresh Frozen White Shrimp Head On/Less Shell On/Less Semi/IQF, Cooked Frozen White Shrimp Head On/ Shell On/Less, Semi/IQF, Fresh Frozen White Shrimp Peeled and Un/ Deveined, Semi/IQF and Fresh Frozen White Shrimp, NOBASHI. Once the processing is complete, these products are distributed through various channels, making them available for consumers to purchase.

Enablers

The existence of different agencies plays a big part in supporting the success and sustainability of shrimp farming in the region. These institutions are responsible for issuing the legal documents required for farm operations. Enabling bodies such as Local Government Units (LGU), the Department of Agriculture – Bureau of Fisheries and Agricultural Resources (DA-BFAR), and the Department of Environment and Natural Resources (DENR) are tasked with guiding farmers in the responsible and sustainable use of resources to help protect the ecosystem. On the other hand, the Shrimp SarGen Stakeholders Association, Inc. (SSSAI) provides seminars and different activities to promote aquaculture.

The findings emphasize the diverse range of actors involved, from hatcheries to farmers, traders, processors, and enablers, and highlight the importance of collaboration across all stages to ensure a smooth, efficient flow of goods and services. Notably, most key players are located outside the municipality including equipment that can only be imported from other countries (e.g., aerators), which adds complexity to local market access and coordination. This geographic distribution indicates the need for more regional linkages and supply chain integration to reduce dependency on external sources and lower transaction costs. Each underscores the critical role of tailored market access challenges and optimizing engagement within the value chain (Ezeudu&Obimbua, 2024).

Activities at Different Stages of the Shrimp Value Chain

Input Supply

Grow-out farms acquire essential inputs directly from hatcheries, including fry stocking and feeds. Materials like bio plus, molasses, chlorine, various probiotics, fuel, and other farm inputs were bought from different agricultural supplies (i.e., Humphry Agrivet Supply). However, due to the unavailability of other products, some farmers purchased supplies from other cities.

Farming (Production)

A step-by-step activity done in farming Vannamei shrimp.

a) Pond Preparation. Before drying, pond aids and laborers cleansed the ponds by scrubbing them thoroughly to remove algae and wild species that might harm and affect the production. Refilling water to the desired level. Conduct chlorination by adding a chlorine-based product to water to kill bacteria and viruses. After five days, put probiotics (preferably organic probiotics) to increase the shrimp's resistance to disease infestations.

b) Fry Stocking. Another crucial step in shrimp farming. Before stocking the fry seeds in the ponds, make sure that the temperature and salinity of the water from the hatchery and the farm ponds are the same, to avoid shrimp fry getting stressed. Also, put aside one bag of fry stock to determine fry pieces that were being cultured and to be able to calculate feeding management. Stocking density relies on the production capacity of the farm and the culture system.

c) Management. In managing the shrimp production, the farm manager or technician is responsible for planning and making key calculations related to farm operations. Other workers, such as pond-aids, follow the technician's directives and carry out tasks based on the established farm management plan.

d) Harvesting. When shrimp reaches 12 grams, the farm is ready for thinning out, also known as the first harvest. Harvester then used protective gears for safety, then went into the pond putting the net under the pond, to collect the shrimps and slowly pull the net upward. If farms harvest all the production, the process will be draining the water out before harvesting, leaving

enough water for shrimp to survive. Following the same step for thinning out.

Shrimp farming typically takes 90 to 120 days from stocking to harvest. The harvesting schedule may vary among producers based on the weight requirements set by their buyers. The production stage offers livelihood opportunities, even to rural women, and it has other value-adding activities, which provide employment and poverty alleviation for the country (Bassig, et al., 2022).

Procurement Stage (Post-harvest Processing)

Farmers do not harvest immediately when there is no buyer. Traders inspect first what stage (grams) the farm's shrimp are in if it's ready to be sold. In contrast, some wholesalers have their own harvesters, when they buy shrimps, the ones who will harvest them are their harvesters.

After collecting (harvesting), shrimps are transferred to the sorting area. Shrimps were put in a chilling tank to preserve their freshness, then drained, and weighed, ready for packing. Products were picked up by the traders.

Shrimp prices are determined based on their average body weight, starting with a standard reference point of 10 grams, known as "base 10." Beyond this weight, the price increases by approximately 5 pesos per additional gram. This pricing framework is uniformly applied across producers and serves as the basis for traders in determining purchase rates, ensuring consistency and fairness in valuation. Farmers are in charge of harvesting, while wholesalers and commission agents are in charge of transportation and storage.

The main role of traders in the value chain is to maintain the quality and freshness of the shrimp. The preservation process involves putting shrimp in a container with ice and water. Shrimp and ice are carefully packed into the containers before being sealed. After which, these are piled onto trucks to sell them to the next actor-distributor.

In Glan, Sarangani most of the traders come from different regions across the Philippines, which serves as an institution that facilitates the sale of goods. According to Sudrajat et al, 95% of farmers recognized the positive impact of middlemen in the agricultural sector (Sudrajat, Isytar, & Arifin, 2021). Though they have a significant role in product transportation, they often capitalize on farm gate prices (Lalu, 2021). This study aims to contribute to the development and enforcement of policies that benefit all stakeholders.

Processing Stage

Shrimp processors were responsible for value-adding processes, including peeling, cleaning, deveining, cooking, sorting, packing, and freezing. The process began with purchasing raw shrimp from farms and delivering it to processing plants for additional processing. Value-added products such as Fresh Frozen White Shrimp Head On/Less Shell On/Less Semi/IQF, Cooked Frozen White Shrimp Head On/ Shell On/Less, Semi/IQF, Fresh Frozen White Shrimp Peeled and Un/ Deveined, Semi/IQF and Fresh Frozen White Shrimp, NOBASHI.

Once the final product is done, processors distribute it to various sellers or outlets, making it accessible to consumers. Expanding the shrimp industry especially processing plants will not just help people's employment (Tahiluddin & Terzi, 2021), but it will also maximize profit through value-adding activities (BFAR, 2023; APEDA, 2019) and can reduce waste (KALFish, 2024), fostering a more environmentally friendly and sustainable industry. Thus, it could boost local economies, improve food security (SDG 2), enhance water management practices (SDG 6), and increase global competitiveness by creating innovative, high-quality products.

Final Sales

Two final products are being consumed by the consumers; raw shrimp and processed shrimp. Starting from the grow-out farms, products were collected by commission agents, wholesalers, and retailers, who handled the marketing and distribution processes. These distributors then link shrimp to different buyers to reach the end consumers. Raw and processed shrimp were being distributed to different areas in the Philippines.

Final consumers identified by the key players in the value chain: Sarangani (Glan and Malapatan), General Santos City, Polomolok, Bukidnon, Cagayan De Oro, Lanao Del Norte, Osamis Occidental, Butuan City, Surigao, Iligan, Bacolod and Manila.

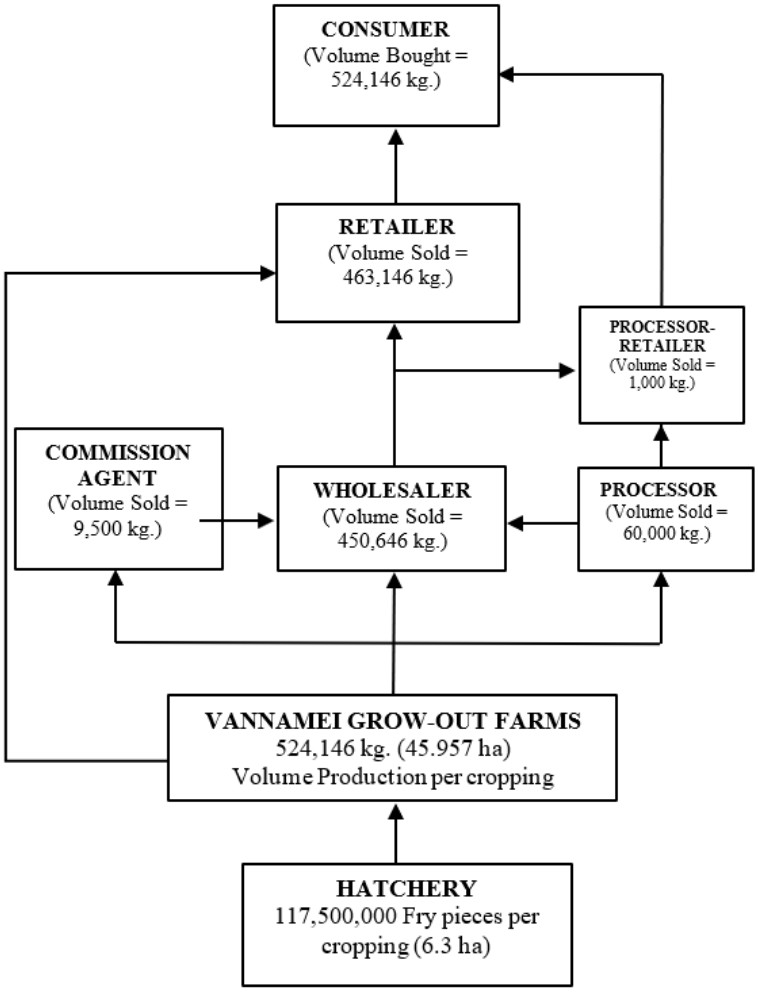
These findings indicate a strong and expanding domestic market for shrimp, with products now reaching consumers across the Philippines (DA, 2023). This nationwide distribution not only plays a role in reducing food insecurity (FAO, 2023), but also opens doors for enhanced export potential, positioning the shrimp industry as a key contributor to both local livelihood and international trade (APEDA, 2019).

Product Flow of Whiteleg Shrimp within the Chain

Figure 6 illustrates the overall flow of shrimp production in Glan Sarangani Province. The result showed a well-structured distribution system and a backward & forward mapping to determine the shrimp value chain. Every cropping,

Figure 6

Overall Marketing Chain of Whiteleg Vannamei Shrimp.



approximately 90 days, accredited hatcheries in Maasim and Malapatan, Sarangani Province have an average of 117,500,000 fry pieces per cropping with a total production area of 6.3 hectares. Out of 117,500,000 fry production of hatcheries, 32% or 37,775,882 fry pieces were procured by grow-out farms in Glan, Sarangani Province. During 2023, the total production area of grow-out shrimp farms in Glan Sarangani was 45.957 hectares, where its volume of production reached 524,146 kilograms per cropping.

Moreover, in the post-harvest and marketing stage, the volume sold of grow-out farms was distributed directly to commission agents (9,500 kg.), wholesalers (450,646 kg.), retailers (3,000 kg), and processors (61,000 kg.). Wholesalers and retailers provided raw shrimp to the general public, while processor-retailers distributed processed shrimp products directly to consumers. The result showed that by the end of 2023, the total volume bought by consumers was equal to 524,146 kg. of shrimp products.

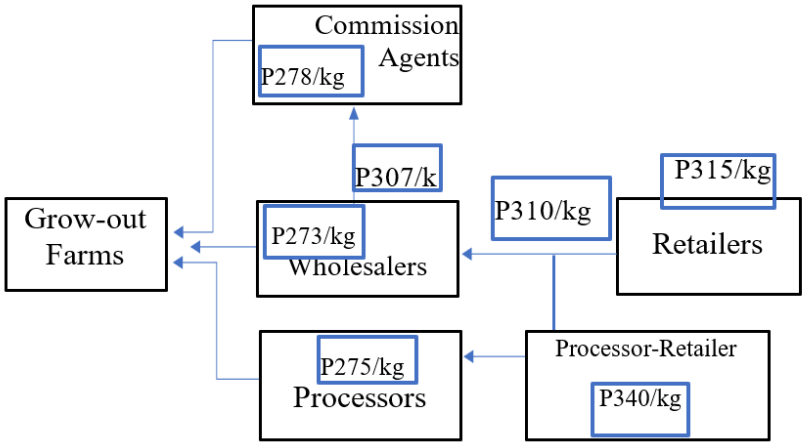
The distribution model (figure 6) highlights the efficiency of the shrimp supply chain in Glan, Sarangani, ensuring diverse market access to raw and processed products, potentially boosting both local consumption and further contributing to economic development while improving resource utilization and sustainability within the industry (DA, 2023).

Payment flow

Figure 7 illustrates the payment flow within the shrimp value chain in Glan, Sarangani Province. The flow starts with farmers selling their products to traders at varying prices: P278 per kilogram to commission agents, P273/kg to

Figure 7

Payment Flow of Vannamei Shrimp.



Note. Arrows indicate the direction of transactions, showing where each trader sources/purchased their shrimp, while inside the boxes represent traders or entities involved in the shrimp trade.

Figure 8

Marketing Channel 1

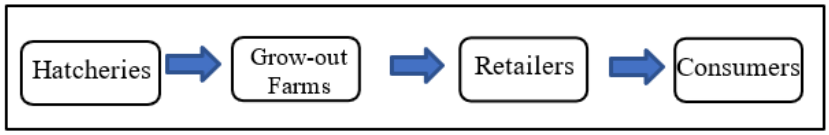


Figure 9

Marketing Channel 2

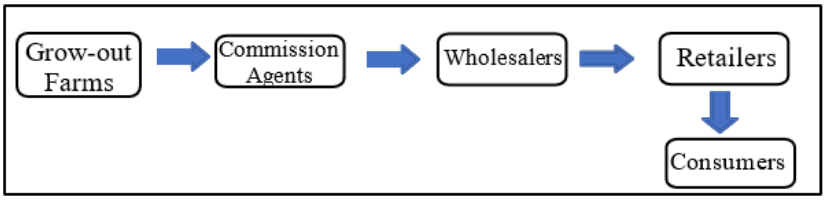


Figure 10

Marketing Channel 3

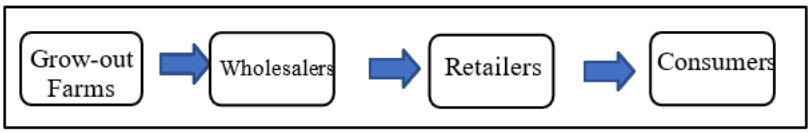


Figure 11

Marketing Channel 4

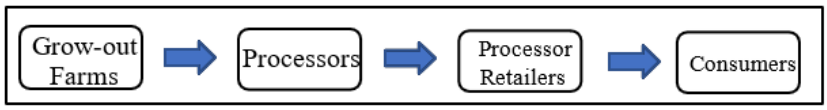


Figure 12

Marketing Channel 5

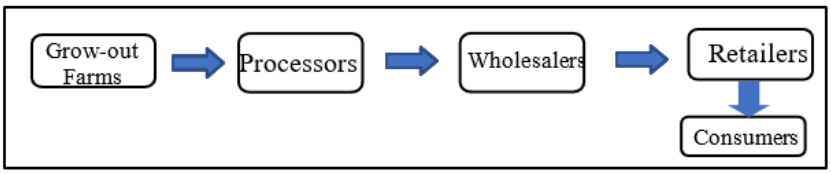
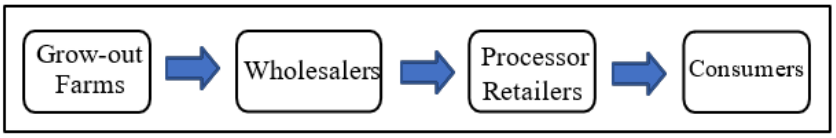


Figure 13

Marketing Channel 6



wholesalers, and P275/kg to processors. Commission agents then resell their products to wholesalers for P307/kg. As the distribution continues, traders then sell their purchased products to retailers and processors at roughly P310/kg. Processors, after adding value. Sell their products to retailers at P340/kg. Finally, retailers sell their products to the end consumers at P315/kg.

Determining price dynamics along the shrimp value chain (figure 7) helps identify inefficiencies, ensure fair profit distribution, and boost competitiveness. Benchmarking factors like price, quality, and supply allows stakeholders to uncover opportunities and address gaps. Engaging with end market buyers provides insights into market trends, guiding strategies for better positioning through price, quality, and innovation (MDPI, n.d.). Adaptable strategies and cooperative relationships among key players and enablers are essential in responding to market conditions (USAID, n.d.).

Marketing Channel of Shrimp

The marketing channel of shrimp exhibited different chains on how shrimp products reached consumers. It revealed (6) marketing channels for vannamei shrimp, from production to consumption.

Marketing channels (Figures 8-13) are

Table 1

Average Cost and Return Analysis for Shrimp Farm Owners in Glan, Sarangani Province, Philippines (2024).

Particulars	**Amount**
Yield/ha (kg)	16,925.00
Price/kg	281.00
Gross Income	4,755,925.00
Less: cost of production	
Pond preparation	102,965.00
Fry stocking	494,242.00
Feeds	1,585,196.00
Feed additives	8,907.00
Fuel and electricity	410,863.00
Labor	202,150.00
Total Cost of Production	2,804,323.00
Net Farm Income	1,951,602.00
ROI	**69.59**
BCR	**1.70**

important for linking producers with consumers, and ensuring the flow of goods through the supply chain (Galvez, 2019). By choosing the right channels, businesses can expand their market, and optimize product availability. The more intermediaries, the higher the prices (LibreTexts, n.d.), which can diminish consumer purchasing power and limit access to products.

Table 2

Average Cost and Return Analysis for Farm Lessee's in Glan, Sarangani Province, Philippines (2024).

Particulars	Amount
Yield/ha (kg)	10,605
Price/kg	272.78
Gross Income	2,892,951.92
Less: cost of production	
Pond preparation	75,000.00
Fry stocking	240,508.10
Feeds	1,201,005.28
Feed additives	11,905.53
Fuel and electricity	385,095.93
Labor	135,040.00
Rent	15,795.86
Total Cost of Production	2,064,350.70
Net Farm Income	828,601.22
ROI	**40.14**
BCR	**1.40**

Table 3

Cost and Return Analysis for Farm Tenants in Glan,Sarangani Province, Philippines (2024).

Particulars	Amount
Yield/ha (kg)	8,913
Price/kg	274
Gross Income	2,442,162.00
Less: cost of production	
Pond preparation	26,923.08
Fry stocking	129,230.77
Feeds	780,000.00
Feed additives	15,384.62
Fuel and electricity	133,076.92
Labor	95,538.46
Landlords share (30% Net Income)	378,602.45
Total Cost of Production	1,558,756.30
Net Farm Income	883,405.70
ROI	**56.67**
BCR	**1.57**

Profitability of Vannamei Shrimp Production in Glan, Sarangani Province

Type of farmers

Farm Owners. Table 1 presents the data on the financial aspects of a one-hectare-owned shrimp grow-out farm. With a volume production of 16,925 kilograms per crop and an average selling price of P281 per kilogram, the farm obtained a gross income of ₱ 4,755,925. Deducting the production cost from gross income, the result showed a profit of ₱ 1,951,602, an ROI of 69.59%, and a BCR of 1.70. Together, these revealed that the investment has gained significant returns.

As seen in Table 1 shrimp farming is a profitable venture and owning the land helps reduce overall expenses. However, it requires high investment and carries inherent risks, particularly during production. These risks, such as diseases, different management practices, water quality, and natural events can negatively impact profit margins if not effectively mitigated (Dennis, 2008).

Farm Lessee's. Table 2 shows the farm lessee's cost and return analysis. While all farmers shared the same input categories, variations existed in their respective cost, excluding land rental. It revealed that the total production cost accumulated was ₱2,064,350.70, resulting in a net income of ₱828,601.22. This corresponds to a return on investment (ROI) of 40.14% and a benefit-cost ratio of 1.40. These figures concludes that shrimp farming is still profitable even in cases where farmers rent land instead of owning a property.

Farm owners typically achieve higher returns on investment than lessees as reflected in the ROI differences between Table 1 and Table 2, where rental expenses are not included in the farm owner's figures. Rent significantly affects profitability, as it reduces available income. According to Shyian et al. (2020), 27.3% of the total income goes to the payment of land rent, leading to lesser benefits(Shyian, Moskolenko, &Kirichenko, 2020).

Farm Tenants. A tenant is a person who occupies land or property rented from a landlord. One of the farmers responded that the landowner

Table 4

Cost Analysis for Farmers per kilogram of raw shrimp.

Cost Item	Land Rental	Fry seeds	Feeds	Labor	Fuel and Electricity	Total
Total Incurring Cost	15,795.86	240,508.10	1,212,910.81	210,040.00	385,095.93	2,064,350.70
Average Cost	1.49	22.68	114.37	19.8	36.31	194.65
Percentage	0.77	11.65	58.76	10.17	18.65	100%

has a profit share of about 30% of the production's net income. The only difference between farm tenants to other farmers is their landlord's share, which can greatly affect the overall cost. The production cost accumulated ₱1,558,756.30 with a net income of ₱883,405.70 per hectare every cropping cycle. Despite such setbacks, based on its BCR (1.57) and ROI (56.67), tenants consider shrimp farming profitable.

The BCR and ROI (Table 3) show a positive return on investment. However, the landlord's share is crucial in determining the tenant's earnings, as it increases operating costs. This arrangement highlights the importance of managing production efficiency and cost control. Although the financial figures suggest profitability, the profit sharing must be carefully considered, as they can affect long-term sustainability for tenants in the shrimp farming business.

Cost Analysis for Farmers per Kilogram of Raw Shrimp

Table 4 illustrates the average production cost per kilogram of shrimp including land rental, fry seeds, labor, fuel and electricity, and other costs. On average, farmers incurred a cost of 194.65 pesos per kilogram.

In the production stage (Table 4), majority of the cost were attributed to feed inputs, including feed additives which comprised 58.76% of the total production expenses. This was followed by fuel and electricity at 18.65%, fry seeds at 11.65%, labor at 10.17%, and land rental at only 0.77% of the total investment. Beyond feed costs, rising fuel prices presented a significant challenge. Diesel prices reached an all-time high of 83.739 PHP per liter in 2022 (CEIC Data, n.d.). As inputs costs remain volatile, the aquaculture industry must adapt and innovate to ensure its growth (Husfarm, 2024) and sustainability for future generations (Manila Bulletin, 2023).

Table 5

Cost and Return Analysis of Traders per kilogram of shrimp in Glan, Sarangani Province, Philippines, 2024.

Key Players	Average Volume (kg)	Purchasing Price	Added Cost	Total Cost	Selling Price	Profit	Marketing Margin
Wholesaler	11,263	273	5	278.45	310	37	31.55
Agent	3,950	278	19	298	307	29	8
Processor	1,010	265	5.94	270.94	305	40	34.06
Retailer	690	271	9.60	280.60	304	33	23.4

Cost Analysis for Traders per kilogram of Shrimp

Table 5 shows the financial dynamics of

Table 6

Summary of Cost and Return Analysis among all Actors in the Value Chain of Shrimp in Glan, Sarangani Province, 2024.

Item (in average value)	Hatchery[1]	Grow-Out Farms[1]	Wholesaler[3]	Agent[2]	Processor[3]	Retailer[3]
Gross Revenue (PhP)	6,294,642.86	2,892,951.92	3,491,530.0	1,212,650.00	308,050.00	209,760.00
Cost (PhP)	746,031.74	2,064,350.70	3,136,037.5	1,177,545.00	273,650.00	193,613.81
Cost per Unit (PhP)	0.04	194.65	278.45	298.11	270.94	273.2
Net Income (PhP)	5,548,611.12	828,601.22	316,525.00	35,105.00	34,400.00	16,146.19
Marketing Margin (PhP)	0.30	78.13	31.55	8	34.06	23.4
Net Profit Margin (%)	743.75	28.64	9.07	2.89	11.17	7.70
Return on Investment (PhP)	7.44	0.40	0.10	0.03	0.13	0.08

the shrimp supply chain, showing value addition and cost distribution across Wholesalers, Agents, Processors, and Retailers. Processors achieve the highest profit per kilogram (₱40) with a marketing margin of ₱34.06, followed by wholesalers and retailers, while Agents face higher costs, reducing their profitability. The cumulative costs and margins across the chain highlight potential inefficiencies, particularly for Agents, and opportunities to optimize costs and improve overall profitability (refer to materials and methods for the formula used, p. 2-3).

Summary of Cost and Return Analysis Among All Actors in the Value Chain of Shrimp

Presented in Table 6 is the summary cost and return analysis among all actors in the value chain of shrimp. It revealed that shrimp hatcheries gained the highest ROI earning 7.44 pesos in every peso they invested. Followed by grow-out farms (.40), processors (.13), wholesalers (.10), retailers (.08), and the commission agents (.03) being the least earning actors among actors in the value chain. Comprehending the results, showed that apart from hatcheries, grow-out farms proved that shrimp production is indeed profitable.

The findings suggest that, apart from hatcheries, grow-out farms demonstrate substantial profitability, affirming the financial viability of shrimp production withing these two segments of the value chain. However, other actors such as processors and retailers tend to generate relatively lower returns, indicating the varying profitability within the shrimp industry (Shinji et al., 2019).

Challenges and Opportunities

Challenges were never non-existent in terms of production in any industry. According to the data gathered, various actors in the shrimp value chain experienced certain issues.

Problems Encountered by Farmers. The main problem that the shrimp industry is experiencing is the White Spot Syndrome Virus (WSSV). According to Chang et. al (2002), WSSV is an extremely virulent causative agent of white spot syndrome, an acute and contagious disease affecting shrimp. When farmers experience this, thinning out/emergency harvesting must be done. This might happen to farms that have a lack of biosecurity (Gonzalez, 2019).

Second, capital shortage for production financing, farmers managed this by reducing their stocking volume and accessing credit loans. Third on the list is the Early Mortality Syndrome (EMS), which is also known as acute hepatopancreatic necrosis disease (AHPND). As reported by Alune (2020), EMS has no quick solution, instead farmers must strengthen their bio-security measures and practice proper farm management to lessen these diseases' impacts. Other problems encountered were fry shortage due to demand and low productivity of hatcheries, and difficulty in processing legal documents.

Problems Encountered by Traders. Traders identified problems such as lack of supply and shrimp quality. The lack of supply happens when production cannot meet the consumer's demand. Shrimps are extremely perishable and traders need to dispose of them immediately. On the problem regarding shrimp quality, where

Table 7

Opportunities and Constraints in the Value Chain.

Segment	Opportunities	Constraints
Input Supply	➢ Existence of hatcheries ➢ Availability of input supplies.	➢ Fry seeds shortage ➢ Purchasing area for machineries far (other countries).
Production	➢ Availability of grow-out farms ➢ Food security	➢ Viral diseases ➢ Softshell shrimp quality ➢ Lack of volume production
Processing	➢ Availability of tools and equipment in post-harvest processing.	➢ Lack of supply to trade ➢ Spoilage
Distribution	➢ Market from farms to traders. ➢ Relationship between buyers, consumers and farms through feedbacks.	➢ Highly perishable, needs to disposed immediately
Consumption	➢ Market	➢ Lack of supply

traders experienced purchasing soft-shelled shrimp and received bad feedback from buyers and to avoid spoilage, traders ensure first they have buyers, and to softshell issue, traders coordinate with the farmers to lessen its effect both to the farmer and the trader. They lessen the price to navigate impacts (Hassoun et al., 2022).

Problems Encountered by Processors. Processors experienced a lack of supply production that greatly affected their operations. While they have limited control over production supply, they remain committed to creating products that meet consumers satisfaction (Seafood Sustainability, 2021).

Opportunities and Constraints in the Value Chain

Improving fry seed availability and facilitating machinery imports can strengthen input supply chains. Enhanced biosecurity measures and adopting intensive aquaculture practices can address production issues like viral diseases and low volume (FAO, 2024) Upgrading cold chain systems and post-harvest handling can reduce spoilage during processing (Kimani, n.d.). Strengthening logistics to handle perishability and speeding up distribution to retail outlets can boost distribution efficiency. Finally, resolving supply bottlenecks can help meet consumer demand and stabilize the market (Huet al., 2024).

Conclusion

The vannamei shrimp industry has become a vital component of Philippine aquaculture, contributing significantly to food security, economic growth, and livelihoods, particularly in key producing regions such as SOCCSKSARGEN. This paper aims to analyze the value chain of the vannamei shrimp production in Glan, Sarangani, Philippines, to identify stakeholders, activities, opportunities and constraints, and provide recommendations for improving efficiency, sustainability, and alignment with the UN Sustainable Development Goals.

In the value chain map of vannamei shrimp in Glan, Sarangani – this study highlights its progression from input supply to consumption, with actors including hatcheries, farmers, processors, distributors, and enablers. The product flow revealed six marketing channels and five key

by-products distributed domestically in the Philippines. Price variations were influenced by added activities across different players in the chain, with processors incurring the highest payment flow of ₱340 ($5.84) per kilogram. Profitability analysis indicates that grow-out farms achieved a 40% ROI, proving shrimp farming to be a viable venture regardless of farm ownership type. Hatcheries yielded the highest benefits, earning ₱7.44 for every peso invested, followed by grow-out farms, processors, wholesalers, retailers, and commission agents.

Despite these promising returns, the sector faces significant challenges, including production declines caused by viral diseases (WSSV and EMRS), fry seed availability due to limited hatcheries, rising input costs, and high investment requirements. These issues can lead to reduced production efficiency and increased operating expenses, directly impacting the profitability of shrimp farming. Furthermore, limited access to quality fry seeds and rising costs can constrain farmers' ability to scale operations and compete in the market.

However, the study's findings are limited to the specific geographic and economic context of Glan, Sarangani Province, and the sample size may not fully represent all stakeholders in the region. To enhance the industry, government intervention, particularly in strengthening biosecurity, supporting R&D, providing financial assistance, and promoting environmental sustainability. Collaborative efforts among stakeholders can significantly boost shrimp farming's resilience and productivity, not only in Glan, Sarangani Province but across SOCCSKSARGEN and the entire Philippines.

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