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Analysis of Financial Situation and Solutions to Improve the Value Chain of Giant Freshwater Prawn in Ben Tre Province, Vietnam

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Abstract: *This research aims to analyze the financial situation of farming households and propose solutions to improve the value chain of giant freshwater prawn (GFP). The 224 actors participating in the GFP value chain were surveyed for analysis. The results show that the value chain of GFP in Ben Tre province is primarily domestic and has 03 distribution channels. Of which, 80% of shrimp production is consumed through distribution channels: shrimp farmers - collectors, small purchasing warehouses - provincial wholesale markets, Ho Chi Minh City wholesale markets - domestic consumption. Giant freshwater prawn farming is profitable for farmers, generating an average profit of 71.62 thousand VND/kg. The farmers sell all GFP products to collectors and achieve the highest profit proportion (from 47.87 - 64.16%). Howvever, the shrimp farmers in the study mostly cultivate on small farms and are facing several difficulties, including high prices for shrimp seeds but low quality, lack of production capital, and unstable commercial shrimp prices.*

I. INTRODUCTION

Ben Tre is a coastal province. The water resources are abundant all year-round and an ideal habitat for many aquatic species. Among them, the giant freshwater prawn (*Macrobrachium rosenbergii* De Man, 1879) is considered a promising species and is commonly farmed in different forms and with intensive farming. In Ben Tre province, this shrimp is popularly raised due to their highly competitive advantages. According to Pham [1] GFP is a dominant species that adapts well to wide salinity changes from 0 - 25‰. In 2019, Vietnam had 14 provinces and cities raising GFP with a total area of 61,744 hectares, reaching 24,365 tons. Most of the area is mainly concentrated in the Mekong Delta provinces (9 provinces with an area of 61,684 hectares, accounting for 99.89% of the whole country; farming output reached over 24,039 tons, constituting 98.7% of the national

production). All-male GFP (produced using a process of neo-females) is an aquatic species with economic value, with large size and delicious meat, high nutrition, easy to raise, fast growth, much larger size than females, etc. This species has a large domestic market (70%) and 30% of production is exported to China through informal channels [2]

Several previous studies have proposed different farming models for the eastern coastal area of the Mekong Delta to adapt to climate change, such as: GFP -rice fields model; GFP - garden ditches model; GFP farming in ponds with very different stocking densities, productivity, and profits (Table 1). Overall, these findings provide key information on the improvement in GFP farming models in the Mekong Delta.

Table 1: Three main GFP farming models in the Mekong Delta

Model	Stocking density (prawns/m^2)	Productivity (kg/ha)	Profit (million VND/ha)	References
1. GFP – rice field	2	286 - 418	0.78 – 3.77	[3]
	2 - 4	679 - 946	15.6 – 36.6	[4]
	3 - 10	534 - 1.519	17.4 – 49.9	[5]
	9 – 15	2,056 – 2,906	61.6 – 69.0	[6]
2. GFP in ponds	40	715 – 1,190	24.0	[7]
	12	1,600 – 3,364	32.6 – 82.8	[8]
	7	988 – 1,342	74.2 - 199	[9]
3. GFP – Coconut farm	5 - 7	426 - 601	3.9 – 5.3	[10]

Source: Summarized by the author

Previous research found that some factors affect the technical and economic efficiency of GFP farming in the Mekong Delta. Farming area, labor, aquaculture feed, shrimp seeding, and aquaculture drugs and chemicals significantly affect the efficiency of shrimp production [11]. In addition, factors such as salinity, pond preparation, seed, and feeding method strongly influence the efficiency of shrimp farming [12]. Shrimp farming experience, farmers' age, and their education also play a role in determining technical efficiency [13]. To increase profits, it is important to reduce feed costs and drug and chemical costs [14]. Furthermore, improved policies, technical guidelines, and training courses on feed management, feeding practices, water quality management, and disease management can help improve the efficiency of GFP production in the future. By considering these factors and implementing appropriate strategies, the economic and technical efficiency of GFP farming households in the Mekong Delta could be improved.

Households believe that GFP farmers find it difficult to sell products because there are few buyers, and it depends entirely on traders. While the seeding price is high, the output price experiences a great fluctuation. Additionally, shrimp often die suddenly in cages while waiting to be sold because of high salinity, and their color turns white, resulting in a low selling price. Therefore, farmers have some expectations: The state agencies should have policies to control the input price, manage the quality of shrimp seeding, support product output, encourage the farmers to participate in cooperatives, provide training on farming techniques, offer low-interest loans to farmers, and improve rural infrastructure. Besides, the farmers should utilize many available and cheap feed sources locally to feed shrimp to reduce the production cost [15]. However, there has been no research on the market and solutions for developing the value chain of all-male GFP in Ben Tre. Therefore, research on the market and the actors of the distribution channel of the all-male GFP chain is performed to assess the status of the distribution channels, the economic efficiency of GFP chain, and solutions for developing the value chain of GFP.

II. Research methodology

This study was carried out from May 2021 February 2022. The study was conducted in 8 communes of Thanh Phu district, Ben Tre province.

Primary data is collected through direct interviews with related actors comprising shrimp farmers, collectors, wholesalers, retailers, and consumers. The designed questionaires are used to get information of 224 participants comprising of 143 shrimp farmers (61 in GFP-rice field model, 32 in GFP- coconut farm model, and 50 in GFP-semi-intensive farming model), 10 collectors/traders, 05 wholesalers, 10 retailers, 24 representaive manergers of communes and district, and 30 consumers. The shrimp farmer lists are provided by the locality. The other actors are introduced by the previous agents in the value chain. In this study, the value chain linkage approach of GTZ [16] is applied in order to discribe a series of interrelated business activities (or functions), from providing specific input values for a product to processing, transforming, marketing, and finally selling that product to consumers.

The study applies both quantitative and qualitative methods for data analysis. Qualitative analysis is used for mapping the relationship of actors in the value chain and summarizing the advantages and disadvantages of the shrimp farmers. The quanlitative method applies cost-benefit methods to calculated the income and expenditure related to shrimp production activities of farmers. Input costs for farmers include pond renovation costs, seeds, chemicals, feed, and electricity. Costs for collectors, retailers, wholesale markets, and restaurants are the purchase price of 1 kg of product. The additional costs of collectors, retailers, wholesale markets, and restaurants are transportation costs, electricity, water, and communication costs

- Total cost = input cost + added cost
- Value added per kg: VA- value added = GO – total cost is the difference between the price that the chain operator sells - the intermediary cost. GO: Total revenue.
- Percentage of added value = Added value/Total revenue of the chain.

III. Results and Discussion

The financial status of farming households of all-male GPF

The selling price of all-male GPF depends on the size and harvest point; different shrimp farming models have different shrimp selling prices (Table 2). In the GFP - rice model, the average selling price is 149±0.02 thousand VND/kg, resulting in the total income for the farming household of 66.92±11.76 million VND/ha/crop. The total investment cost for all-male GPF farming is 27.47±6.26 million VND/ha/crop, the average profit from shrimp is 39.35±11.91 million VND/ha/crop, and the profit margin is 1.54 times. In the GFP – coconut farm, the total cost averages 39.31±13.69 million VND/ha/crop. The average selling price and total income are 176.03±29.94 thousand VND/kg and 73.32±19.04 million VND/ha/year, respectively. The profit and profit margin are 34.02±14.02 million VND/ha/crop and 1.02±0.59, respectively. For the semi-intensive GFP farming model, the total financial investment cost in the farming model of the farming household is 102.5±22.96 million VND/ha/crop. The selling price and total income are 150.6±4.33 thousand/kg and 153.94±54.68 million VND/ha/crop, respectively. The profit is 51.44±40.35 million VND/ha/crop and the profit margin is 0.48. From the above results, it can be seen that all-male GPF is becoming an effective species and chosen by many farming households in areas affected by saline intrusion.

Table 2: Financial performance of shrimp farmers in different farming models

Indicator	Unit	GFP Model		
		GFP-rice field	GFP- coconut farms	GFP in semi-intensive ponds
Selling price	Thousand VND/kg	149.00±0.02	176.00±29.94	150.60±4.23
Total cost	Million VND/ha/crop	27.47±6.26	39.31±13.69	102.50±22.96
Total income	Million VND/ha/crop	66.92±11.76	73.32±19.04	153.94±54.68
Profit	Million VND/ha/crop	39.35±11.91	34.02±14.02	51.44±40.35
Profit margin	Times	1.54	1.02	0.48

Source: Field survey, 2022

Advantages and disadvantages in GFP farming

The results of interviews three groups of GFP farming in three communes (My An, An Dien, and My Hung) using Participatory Rural Appraisal method of [17] are presented in Table 3. The research results showed that there are some advantages in shrimp farming including easy to raise, less disease, less labor-intensive, easy to prepare feed by farmers, trained in farming techniques, and the completeness of the water supply and drainage system. However, households also face some difficulties, including high shrimp seed prices, unstable shrimp selling prices, and shrimp being greatly affected by the high salinity of water sources. The results from the interview also recommend that the local government should have some policies to help farmers overcome these difficulties.

Table 3: Advantages and disadvantages of farmers in GFP farming

Content	Results of PRA in 03 communes of Thanh Phu district		
	My An	An Đien	My Hung
Advantages	- Easy to raise, less disease, less labor-intensive, easy to prepare feed by farmers, less environmental pollution - Farming area is large enough, with settling ponds, nursery ponds, water supply, and drainage system	- Less disease, less labor-intensive - The canal system is easy for water supply and drainage	- Favorable weather for raising GFP - GFP is easy to raise and has few diseases - There are many feed agents in My Hung - Farmers have been trained in GFP raising techniques
Difficulties	- The price of seed is high - GFP is harvested many times/crop and gets white back disease while waiting to sell - GFP die suddenly due to salinity. - Pond renovation is not good	- The farming area is too small to achieve farming efficiency. - Lack of investment capital - Impact of drought and salinity - The selling price is	- The price of seeding is high, and difficult to distinguish the quality of seeds. - The output price of commercial GFP is unstable - Lack of investment capital - Salinity of water sources

	enough, trash fish are not completely removed	unstable, depending on local traders.	increases - The water supply and drainage system are not good enough
Solutions	- The State agencies support loans for GFP production, establish cooperatives, provide technical training on the disease of GFP, construct and upgrade infrastructure, and roads. - The State agencies implement farming area planning, policies to reduce the costs of seedings and feed, and support the inspection of the input quality of GFP seeds.	- The State agencies support creating brands for GFP (logo) - Local government needs to forecast drought and salinity to farmers **- Policies for price stabilization** of shrimp seeds and commercial GFP	- Repair the dike system, internal roads for transporting GFP, bridges, and electricity systems - Support the development of cooperatives to expand GFP farming areas - Policies for price stabilization of feed, shrimp seeds, and commercial GFP - Policies to control and manage the quality of GFP seed.

Source: Field survey, 2022

The above results were also mentioned in the report of [2] which stated that the GFP production of households in the Mekong Delta is mainly on a small scale, so it faces many difficulties. First of all, access to the network of input service providers is quite difficult, so so the seeds, feed, etc. are purchased from many sources, making it difficult to control the quality, high prices. Secondly, the shrimp are harvested sporadically, in small quantities, so it takes a lot of time and labor to collect. Finally, GFP is often collected by traders, the quantity of products is unstable, and the price is forced down, especially during peak harvest times. In particular, breeding is considered one of the important factors influencing the sustainable development of the GFP.

Functions in the shrimp value chain

The survey results show that the GFP value chain in Thanh Phu district, Ben Tre province, has only one main market, which is the domestic market (Figure 1). This market has 03 distribution channels with actors participating and performing specific functions as follows:

- Input function: Suppliers of seeds, feed, drugs for prevention of shrimp disease and and other inputs for GFP production activities.
- Production function: Participants in this function are mainly farmers who are raising GFP according to 3 popular models: GFP - rice field model, GFP - coconut farm model, GFP in semi-intensive farming model.
- Collection function: The subjects performing this function are small traders and small purchasing warehouses in hamlets of communes.
- Commercial function: After purchasing GFP, traders often classify shrimp at the warehouse before distributing. The main participants in the commercial stage include retailers in local consumers; retailers in markets of district, province, other provinces and Binh Dien wholesales market (Ho Chi Minh City); and (3) restaurants and supermarkets (Ben Tre City, Ho Chi Minh City, and Binh Duong).
- Consumption function: Local consumers, people inside and outside the province.

Value chain diagram and economic analysis

The GFP value chain includes the following three main distribution channels: (1) Households - Traders, small purchasing warehouses - Local retailers, district markets, provinces, other provinces - Domestic consumption; (2) Households - Traders, small purchasing warehouses - Provincial wholesale markets, Ho Chi Minh City wholesale markets - Domestic consumption; and (3) Households - Traders, small purchasing warehouses - Restaurants, supermarkets - Domestic consumption. Among these, channel 2 accounts for the largest share of shrimp production (80%).

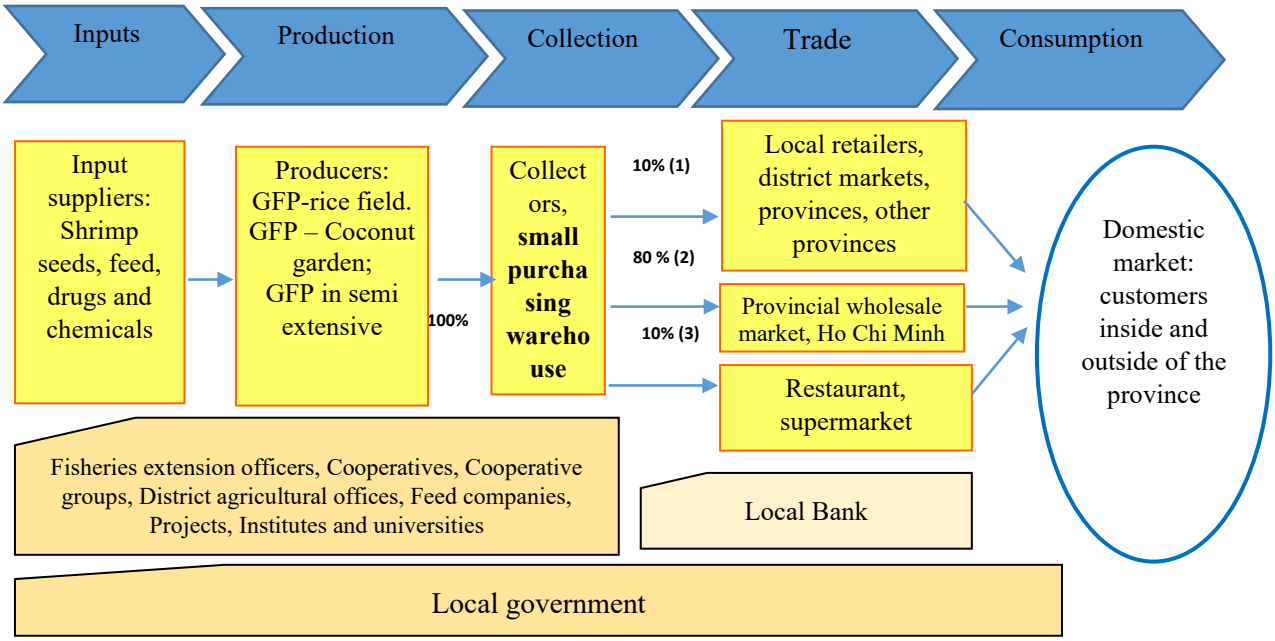

Figure 1: Diagram of value chain for all-male GFP in Thanh Phu district, Ben Tre province. Source: Field survey, 2022

The economic analysis for the distribution channels is displayed in Table 4 and described as follows

- Distribution channel 1

The average production cost of 1 kg of GFP is 87.05 thousand VND, including costs of seeds, feed, drugs and chemicals, and electricity. Farmers sell GFP to collectors at an average price of 158.53 thousand VND/kg, getting a net added value of 71.62 thousand VND/kg and accounting for 58.9% of the total added value of the whole chain. Collectors spend 10 thousand VND/kg for additional costs (costs of transportation, electricity, and water) and then sell directly GFP to retailers with a profit of 20 thousand VND/kg (accounting for 16.4%). Finally, retailers sell this product to consumers at 218,530 VND/kg, getting a profit of 30,000 VND/kg (accounting for 24.7%).

- Distribution channel 2

This is the main channel of the GFP value chain. After buying the shrimp from the farmers, the collectors then transport 80% of the shrimp to the wholesale market in Ho Chi Minh city. The collectors and wholesalers spend the same additional costs of 12 thousand VND/kg and their profit are 17 and 23 thousand VND/kg (accounting for 15.23% and 20.61%, respectively).

Table 4: Theeconomic analysis for the distribution channels of the GFP value chain

Criteria	Farmer	Trader	Retailer	Wholesale market	Restaurant, supermarket	Total
Distribution channel 1						
Selling price (1000 VND/kg)	158.53	188.53	218.53			
Input costs (1000 VND/kg)	87.05	158.53	188,53			
Additional cost (1000 VND/kg)	0	10	4.00			
Total cost (1000 VND/kg)	87.05	168.53	192.53			
Net value added (1000 VND/kg)	71.62	20	30			121.62
% Net value added	58.9	16.4	24.7			100
Distribution channel 2						
Selling price (1000 VND/kg)	158.53	187.53		222.53		
Input costs (1000 VNDkg)	87.05	158.53		187.53		
Additional cost (1000 VNDkg)	0	12		12		
Total cost (1000 VND/kg)	87.05	170.53		199.53		
Net value added (1000 VND/kg)	71.62	17		23		111.62
% Net value added	64.16	15.23		20.61		100
Distribution channel 3						
Selling price (1000 VND/kg)	158.53	208.53			258.53	
Input costs (1000 VND/kg)	87.05	158.53			208.53	
Additional cost (1000 VND/kg)	0	12			10	
Total cost (1000 VND/kg)	87.05	170.53			218.53	
Net value added (1000 VND/kg)	71.62	38			40	149.62
% Net value added	47.87	25.40			26.73	100

Source: Field survey, 2022

- Distribution channel 3

In this distribution channel, after buying the shrimp from the farmers, the collectors then sell them directly to restaurants and supermarkets. The additional costs of collectors remain unchanged while that of restaurants and supermarkets is lower (12 and 10 thousand VND/kg). However, the profit of these two actors are quite high, 30 and 40 thousand VND/kg.

It can be seen that the farmers sell all GFP production to collectors indicating that collectors play a major role in purchasing and transporting shrimp from farmers to wholesalers or restaurants and supermarkets. Although this kind of consumption helps the farmers no need to spend transportation costs, they are not the agents who determine shrimp prices. This means that farmers have to share some profits with these actors. However, farmers' profit accounts for the highest proportion (from 47.87 - 64.16% in 3 channels) in the GFP value chain in Ben Tre province. In comparison to the farmers' profit (71.62 thousand VND/kg), collectors' profit ranges from 23.74% - 53.06%, retailers and wholesalers earn 41.89% and 32.11%, and restaurants and supermarkets account for 55.85%. The results of the chain value analysis clearly show that the profit per kg of shrimp of the farmers is the highest but the time to get this profit is quite long compared to other actors.

Solutions for developing the all-male GFP value chain

Solutions for shrimp farmers

The source of GFP breeding needs to be re-evaluated, both in quantity and quality, to meet the farmers' demand, especially for all-male GFP breeds. Supporting parties, such as local authorities, cooperatives,

cooperative groups, and GFP hatcheries, should establish a specific action plan to produce and provide high-quality shrimp seed and high survival rates for farmers. Most farmers buy shrimp seed from hatcheries outside the province, so they do not know the origin and source of the breeds, and the farmers do not check the quality of the seed, especially for disease testing, before buying. Therefore, to ensure success, farmers should select seed from reputable hatcheries and carefully check information about the seed's origin and certification.

The study found that the current output price of commercial GFP depends mainly on the market and collectors. Therefore, small shrimp farmers in the region should participate in value chain linkages to ensure stable output, and organize and link together into cooperatives or cooperative groups, which could gradually help farmers consume their products at a better price. Farmers should apply standards in clean shrimp farming or harvesting commercial-sized shrimp to create quality and food hygiene products. They also apply the breaking claw of shrimp technique in their farms to increase the percentage of type I and II shrimps. Furthermore, the 2-phase or 3-phase farming process is adopted to shorten the farming time and create new environmental conditions for shrimp growth.

Solutions for wholesale/retail agents

There should be preferential loan policies for wholesale/retail and price stabilization for GFP to limit risks, especially for groups lacking investment capital.

Solutions for supporting agents

Supporting the traceability of GFP products is an inevitable trend and a mandatory requirement to allow consumers to have full upstream information from the final product to the original production site. The current trend is to use information technology and electronic devices to facilitate information updating, data management, and product traceability towards promoting the typical GFP products and advantages of the region, towards sustainable development. Continuing to maintain technical training to transfer new technology to farmers, encourage farmers to use high-quality breeds to change production practices, and apply safe production standards.

IV. Conclusion and Recommendations

Giant freshwater prawn is one of the popular farming species in the Mekong Delta due to its high economic value and good adaptability to many different farming conditions, especially in combined ecological farming models. The semi-intensive GFP farming model brings the highest profit to farmers (51.44 million VND/ha/crop), followed by the integrated farming model in rice fields (39.35 million VND/ha/crop), and finally the integrated farming model in coconut farms (34.02 million VND/ha/crop). The shrimp farmers are facing some difficulties such as high prices of shrimp seeds and unstable quality; the effects of drought, salinity; and unstable output prices of shrimp.

The survey of the status of the GFP value chain in Ben Tre province shows that the value chain has only 01 main market, which is domestic consumption, with 03 distribution channels. Of which, channel 2 (Households - Traders, small purchasing warehouses - Provincial wholesale markets, Ho Chi Minh City wholesale markets - Domestic consumption) accounts for the largest share of shrimp production (80%).

Based on the findings of the research, some recommendations are proposed as follows:

- In order to improve the value chain of all-male GFP in Ben Tre province, the farmers need to carefully search the source of all-male GFP breeds before purchasing, as well as choose reputable breeding farms to ensure quantity and quality. To ensure a stable output price of GFP, farmers need to organize and link together to establish inter-commune cooperatives, which will gradually help to consume products at better prices, and local authorities need to have policies to support product traceability activities.
- To improve production efficiency and consumption markets, supporting actors (such as GFP hatcheries, local authorities, banks, and institutes) need to have specific action plans to ensure sufficient quantity and quality of shrimp production for farmers.

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