

## **Profitability Analysis of Small-scale Pangas Fish Farming in Some Selected Areas of Patuakhali District of Bangladesh**

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**Abstract:** Pangas fish farming is gaining popularity in Bangladesh due to its lower cost and high profitability. This paper aims to analyze the financial profitability of small-scale pangas fish farming in some selected areas of the Patuakhali district of Bangladesh. A survey was conducted in the study area for data collection purposes. A multi-stage random sampling technique was applied to select a total of one hundred and twenty pangas fish farmers from seven Upazilas under the Patuakhali district. The survey was conducted using a structured questionnaire. The data was collected from the fish farmers who are engaged in pangas fish farming. The data has been analyzed with the use of descriptive statistics, cost-benefit analysis, and return on investment analysis. The result revealed that the majority of the pangas farmers were male, owned small land areas, had low levels of education, and had low household incomes. The analysis discovered that the overall profit margin in study areas is 19.63 percent, the return on investment (ROI) is 24.43 percent, and the overall average benefit-cost ratio is 1.24, indicating the high profitability of pangas fish farming. The study also discovered the cost of feed accounts for the highest percentage (78.19) of the total cost structure followed by the cost of labor, fingerling, transportation, pond management, etc. This study also identified some problems in the process of pangas farming. Nonetheless, it was suggested that the government should pay greater attention to fostering this industry by offering financial support and setting up essential training for pangas producers. The study concluded that small-scale pangas fish farming is profitable in the study area and can be adopted by the local farmers for improving their livelihoods. The growth of fish farming especially pangas farming will contribute much more to the country's economy through a significant supply of nutrients and food, creating livelihood opportunities, and is a crucial element in poverty alleviation.

**Keywords:** Profitability, Pangas farming, Profit-Margin.

### **Introduction**

Bangladesh is considered one of the world's most appropriate regions for aquaculture due to its geographical condition and weather (Rahman et al., 2020). More than one-fourth (26.37%) of all agricultural GDP comes from the fisheries industry, which contributes 3.52 percent to the national GDP. About 1.39% of total export earnings come from the export of fish and fish commodities from Bangladesh (Bangladesh Bureau of Statistics, 2020). Including women, almost 12% of the nearly 170 million people are directly or indirectly involved in various activities in the fishing industry for their livelihood. In 2019, the total production was 45.03 lakh MT which is 2.93% of the global production and it supplied 50 percent or more of all the animal protein consumed by humans (FAO, 2022). Bangladesh is currently self-sufficient in fish

production and has started to gain global recognition as one of the world's top fish producers (DoF, 2020). According to the most recent report entitled 'The State of World Fisheries and Aquaculture-2020' published by the Food and Agriculture Organization (FAO) of the United Nations (UN), Bangladesh has reportedly moved up to third place in the production of inland open water capture and fifth place in the production of aquaculture globally.

Among the fish species, Pangas are a popular choice for small-scale farmers in developing countries, as they can be grown with limited resources and still generate a good profit. Pangas are grown for both food and commercial purposes. It has a short life cycle and is easy to breed. Pangas is also a fast-growing species and can reach marketable sizes in about 6 months. The fish can be sold fresh, dried, or smoked, and the high-quality protein they provide is an important source of nutrition for many people in developing countries. Pangas is a popular and profitable fish species to farm in Bangladesh. The entire pangas production in 2019–20 was 405059 MT, which was almost 11% of Bangladesh's total fish production (DoF, 2020)

Pangas fish farming is one of the most common practices among small farmers in some selected areas of the Patuakhali district of Bangladesh. In 2019-20, the total pangas production in the Patuakhali district was 5000 tons, which was about 20 percent of Patuakhali's total fish production (DoF, 2020). With proper management and marketing, farmers can generate a good profit from their pangas. In order to maximize profits, farmers must ensure that their ponds are well maintained and their fish are healthy and well-fed. Farmers must also develop good relationships with buyers and ensure that they are getting a fair price for their fish.

A number of research have been done to investigate the financial viability of this type of fish farming in Bangladesh and the global arena. For example, Khan et al. (2021) conducted a study to analyze the Profit efficiency of pangas (*Pangasiushypophthalmus*) pond fish farming in Bangladesh–The effect of farm size. Their study revealed that the net income of the farmers was higher than their expenditure, indicating that Pangas fish farming is a profitable venture. Similarly, Adnan et al. (2016) conduct an economic analysis of year-round Pangus production and social impact in some selected areas of Mymensingh district in Bangladesh. Their study revealed that Pangus farming is a type of small-scale agriculture that typically generates the highest profit margins. Thus, the studies suggested that Pangas fish farming is a successful business in the study areas of the Mymensingh district in Bangladesh.

In addition to the studies mentioned above, several other studies have been carried out to analyze the financial profitability of pangas fish farming. For instance, a study by Ali et al., (2018) conduct a study on the Input-output relationship and economics of pangas monoculture and carp-pangas polyculture in two districts of Bangladesh and concluded that the activity was highly profitable and viable both in the short and long run. Similarly, a study by Shafiullah et al. (2019) investigated the Production economics of striped catfish (*Pangasianodon hypophthalmus*, Sauvage, 1878) farming under the polyculture system in Bangladesh and found that the pangas monoculture is highly profitable. A study by Namonje-Kapembwa & Samboko (2020) examined the Profitability of small-scale aquaculture enterprises in Central Uganda. The study discovered that small-scale aquaculture businesses are profitable in the study region. Similarly, Okpeke & Akarue (2015) showed that pangas fish farming is profitable through research work designed to assess the profitability of fish farming in Warri South Local Government Area of Delta State, Nigeria. Overall, the literature review suggests that pangas fish is a highly profitable activity. Most of the previous studies were conducted on a regional or national level, and the results were not specific to the Patuakhali district of Bangladesh. Economic analysis is

an essential means for making a business strategic plan. Having access to initial startup funding, operational resources, and fair prices is crucial for operating the business and implementing better farming techniques to produce higher-quality fish and generate more profit (Yuan et al., 2017). Although pangas fish is one of the most popular aquatic food items in the Patuakhali district, there are few studies examining the financial viability of small-scale Pangas fish farming in the research areas. Therefore, the current study analyzed the financial profitability of small-scale Pangas fish farming in the selected areas of the Patuakhali district of Bangladesh. The aim of this article is to examine the financial profitability of small-scale pangas fish farming in order to give potential investors an understanding of the potential rewards and risks associated with this type of venture. The analysis include a discussion of the costs associated with setting up and maintaining a pangas fish farming business, as well as the potential revenues that can be generated. The research mainly focused on the costs and returns of pangas fish farming in the study area with the following specific objectives:

1. To analyze the financial profitability of small-scale pangas fish farming;
2. To evaluate the various costs associated with operating a small-scale pangas fish farm.
3. To identify the economic opportunities and challenges associated with this type of farming.
4. To provide recommendations to improve the profitability of pangas fish farming

The research questions of this research are listed below against specific objectives. The questions that will be answered with the research are:

1. What are the expenses involved in small-scale Pangas fish farming?
2. What are the income possibilities of small-scale Pangas fish farming?
3. What are the profit margins of small-scale Pangas fish farming?
4. How does the profitability of small-scale Pangas fish farming vary depending on various external factors?

This research explores the expenses, income possibilities, and profit margins of small-scale Pangas fish farming. Additionally, the profitability of this type of farming was analyzed in regard to various external factors. This research provides a comprehensive understanding of the financial aspects of small-scale Pangas fish farming, as well as how external factors can influence the potential for profitability.

## **Methodology**

### **Research design**

The study is conducted through applying quantitative approach with survey method. The study area is selected nearby Patuakhali District of Bangladesh. The study area consists of Seven Upazilas of Patuakhali District; Patuakhali Sadar, Dumki, Bauphal, Mizagonj, Galachipa, Dashmina, and Kalapara.

### **Sampling technique**

The study has adopted a convenience sampling technique, and subsequently a total of 120 small-scale pangas fish farmers from the selected areas of Patuakhali district was selected for the study. The sampling was done using a multi-stage sampling technique (Hasan, 2023).

**Data collection**

Through a structured questionnaire, data is collected from the selected small-scale pangas fish farmers. The questionnaire includes questions related to the farming practices, socio-economic characteristics of the respondents, input costs, output income, and profitability of the farming activity. In order to accomplish the study's goals, secondary data was collected from both published and unpublished sources, including books, journals, papers, and websites. Descriptive and inferential statistical techniques was used to analyze the data. The profitability of small-scale pangas fish farming analyzed using financial analysis.

**Analytical Frame Work**

To accomplish the goals of the study, a variety of analytical techniques was applied. Simple statistics used to measure demographic traits, such as frequency distributions, tables, averages, and percentages, etc. Farm financial profitability calculated in different ways such as Net profit, Profit Margin Ratio Benefit-Cost ratio and Return on Investment.

Net profit is a firm's total earnings or profit after subtracting all of its expenses, including taxes and other obligations. It is considered the bottom line of a firm's financial performance and is also known as net income or net earnings. Net profit can be calculated by subtracting total expenses from total revenue. In fish farming, net profit is normally calculated by deducting the cost of feed, labor, and other expenses related to producing and selling fish from and selling fish from the amount of revenue generated by the sale of fish. Here total revenue refers to the total income that a farmer generates from all sales of fish and the by-products from fish processing. Total cost was divided into the total variable cost (TVC) and fixed cost (TFC), where total fixed cost comprises the lease amount of pond, permanent labour cost, net, and other types of equipment cost.

To calculate the net profit we have used the following formula-

$$\text{Net profit} = \text{TR} - \text{TC} \dots\dots\dots \text{i}$$

Where TR = Total Revenue

TC = Total cost

Further, TR = (average price per units sold) × (number of units sold)

TC = TFC + TVC

Where, TFC = Total fixed cost,

TVC = Total variable cost

The net profit margin ratio is a calculation that measures the amount of profits a company earns relative to its overall sales revenue. It is calculated by dividing net income by total sales revenue and is shown as a percentage. This ratio is used to assess a company's financial health and its ability to generate profits. It is an important indicator of how efficiently a company is utilizing its resources to generate profits and how effective it is in controlling its costs. Here we employed it to determine how much profit a farmer can earn from total sales.

To calculate the net profit margin ratio we have used the following formula -

$$\text{Profit Margin Ratio} = (\text{Net Income} \div \text{Total Revenue}) \times 100 \dots\dots\dots \text{ii}$$

The benefit-cost ratio (BCR) is a ratio used to measure the net benefits (or gains) from a project or investment relative to its costs. It is the most common measure of the efficiency of an investment. The ratio is determined by dividing a project's or investment's benefits by its costs. A ratio of greater than 1 indicates a positive return on the investment, while a ratio of less than 1 indicates a net loss.

To calculate benefit-cost ratio we use following formula-

$$\text{Benefit – Cost ratio} = \text{Total Revenue} \div \text{Total cost} \dots\dots\dots\text{iii}$$

ROI is a measure of investment performance that calculates the return on an investment relative to the amount of money invested. It can be calculated by dividing the net gain or loss from an investment by the entire amount invested and typically stated as a percentage. ROI is a popular measure of investment performance because it is simple to calculate and provides a quick assessment of the return on an investment relative to the amount of money invested.

To calculate the benefit-cost ratio we use the following formula-

$$\text{Return on Investment (ROI)} = (\text{Net Profit} \div \text{Total Cost}) \times 100 \dots\dots\dots\text{iv}$$

### **Results and Discussion**

#### **Exploration of Socio-economic Factors**

Fish farming is one of the most important economic activities in Bangladesh and is a major source of income for many of the poorer communities in the coastal areas of the country(Lauria et al., 2018; Hasan et al., 2021). The Socioeconomic factors of the fish farmer have a significant influence on the success of fish farming (Dickson et al., 2016; Hasan & Rahman, 2022). The research findings reveal that this sector is dominated by the Male and it was 100% among the study population. The age of a person has a great impact on farm operations. About 43.33% of respondent’s age is between the years of 35-44, indicating that middle-aged people are engaged in fish farming. Bwala & John (2018) discovered that younger farmers—those between the ages of 30 and 49 are more capable and willing to take the risk in the hope of making a higher profit than older farmers. Understanding the situation, planning, taking the right decision at the right time, and operating the farm, an educational experience is badly needed. The research shows that about 35% of the respondents have secondary educational knowledge, indicating that the lack of higher education remains this sector behind in success. This study also focused on the land condition before use in fishing, where findings reveal that the majority of the land (64%) were left unused, which come into fishing and contributes a lot to the earning of the farmers as well as the economy of the country as a whole.

**Table I.** Socio- economic factor analysis of the farmers (Respondents, n=120)

<b>Variable</b>	<b>Percentage %</b>	<b>Variable</b>	<b>Percentage %</b>
<b>Sex</b>		<b>Number of ponds</b>	
Male	97.51	1-2	52.29
Female	02.50	3-4	29.17
<b>Age of Farmer</b>		5-6	10.83
Below 24 Years	01.04	7+	7.71
25-34 Years	20.21	<b>Working Hours</b>	
36-44 Years	43.33	1-2 Hours	22.92
45-54 Years	27.08	3-4 Hours	39.58
Above 55 Years		5-6 Hours	22.92

<b>Educational Background</b>		Above 7 Hours	14.58
No Formal Education	10.42	<b>Area of Pond</b>	
Primary Education	19.79	1-20 Decimal	12.5
Secondary Education	34.38	21-40 Decimal	19.79
Higher Secondary Education	27.08	41-60 Decimal	31.25
Graduation	8.33	61-80 Decimal	10.08
<b>Size of Family</b>		80-100 Decimal	12.84
1-3 members	4.17	Above 100	13.54
4-6 members	73.96	<b>Land Condition Before</b>	
7-9 members	19.79	Agricultural land	35.83
Above 10	2.08	Unused Land	64.17
<b>Occupation of the farmer</b>		<b>Training on Fish Farming</b>	
Fish Farmer	13.40	Yes	89.86
Agriculture	32.99	No	10.14
Service	4.12	<b>Sources of Capital</b>	
Business	36.09	Own	52.08
Others	13.40	Collected from Family	9.38
<b>Years of Fish Farming</b>		Relatives	2.08
1-5 Years	26.04	Brow from Financial Institutions	36.46
6-10 Years	43.75		
11-15 Years	20.83		
16-20 Years	8.33		
Above 21 Years	1.04		

**Source:** Field survey (February – April 2022)

The research points out that the majority of the farmers managed their capital from their own savings (52.08%) and 36.46% get from different microcredit organizations. Besides these, the study keeps an eye on the occupation of the farmer, years of experience, training, etc. which have a significant impact on the success of pangas farming.

### **Financial profitability of pangas farming**

Pangas farming can be a lucrative business if managed correctly. The profitability of pangas farming depends on several factors, including the costs of production, the type of fish raised, and the market for the fish (M. M. Alam et al., 2019; Hasan, 2022). The purpose of analyzing financial profitability like profit margin, ROI, and the benefit-cost ratio is to have a precise understanding of the company's overall strength or vulnerability (Muema, 2018). The aim of this study was to analyze the relationship between costs and returns for pangas fish farmers in the southern part of Bangladesh. Among aquaculture species, pangas is one of the most common and widely distributed fish throughout Bangladesh. However, the increasing demand for pangas is having a positive effect both domestically and internationally. This can be seen as an opportunity for Bangladesh due to its favorable production environment and resources related to fishing.

**Table II.** Analysis of revenues, expenses, Profit/Loss, Profit Margin Ratio, and Benefit-Cost ratio in the study areas.

		Bauphal	Dashmina	Dumki	Galachipa	Kalapara	Mirzagonj	Patuakhali	Total
Revenues:	Average Price (per kg)	Amount in Tk.	Amount in Tk.	Amount in Tk.	Amount in Tk.	Amount in Tk.	Amount in Tk.	Amount in Tk.	Amount in Tk.
Sales Revenue	120 to 150	52708000	79800000	28541000	6058900	14160000	6487500	29115000	216870400
Others Revenue		110700	467400	93000	125000	98000	57700	148100	1099900
<b>Total Revenue</b>		<b>52818700</b>	<b>80267400</b>	<b>28634000</b>	<b>6183900</b>	<b>14258000</b>	<b>6545200</b>	<b>29263100</b>	<b>217970300</b>
<b>Expenses:</b>									
<b>Fixed Cost:</b>									
lease Value		4380	34500	11850	10200	9700	5150	10350	86130
Measurement Tool Cost (Weight Machine)		44200	88200	44300	35900	37900	38300	45000	333800
Pump Machine Cost		376300	855000	377000	131400	234900	250600	345500	2570700
<b>Total fixed cost</b>		<b>424880</b>	<b>977700</b>	<b>433150</b>	<b>177500</b>	<b>282500</b>	<b>294050</b>	<b>400850</b>	<b>2990630</b>
<b>Operating costs:</b>									
<b>Pond Preparation:</b>									
Labor cost		5191400	3652200	841000	264600	594700	152550	845900	11542350
<b>Pond Management:</b>									
Cost of Fingerlings		908200	4820400	1451250	298620	576550	272025	1622000	9949045
Transportation cost		81500	264000	242900	18500	54300	24100	235500	920800
<b>Expense for Net Round Fencing</b>		<b>466400</b>	<b>999000</b>	<b>112450</b>	<b>90150</b>	<b>151000</b>	<b>98500</b>	<b>151500</b>	<b>2069000</b>
Water Supply cost		366500	438000	174600	54200	94000	66500	177200	1371000
Medicine and Fertilizer		349999	312942	123436	46312	84312	22000	148490	1087491
Feed Cost		34353389	49372290	17881522	3773682	8897421	3992572	18705130	136976005
<b>Harvesting Costs:</b>									
Catching Fish Labour		242000	285000	48450	54000	188000	246800	273500	1337750
Transportation Cost		227500	1710000	950000	36900	134000	38800	456000	3553200
Catching Net costs		381100	660000	308000	88100	186000	154000	206800	1984000
<b>Total Operating Costs</b>		<b>42567988</b>	<b>62513832</b>	<b>22133608</b>	<b>4725064</b>	<b>10960283</b>	<b>5067847</b>	<b>22822020</b>	<b>170790641</b>
<b>Others Cost</b>		<b>229100</b>	<b>477840</b>	<b>179100</b>	<b>150100</b>	<b>135500</b>	<b>122100</b>	<b>229100</b>	<b>1522840</b>
<b>Total Costs = TFC+ TOC + others</b>		<b>43221968</b>	<b>63969372</b>	<b>22745858</b>	<b>5052664</b>	<b>11378283</b>	<b>5361897</b>	<b>23451970</b>	<b>175182011</b>
<b>Net Profit/loss = TR-TC</b>		<b>9596732</b>	<b>16298028</b>	<b>5888142</b>	<b>1131236</b>	<b>2879717</b>	<b>1183303</b>	<b>5811131</b>	<b>42788289</b>
<b>Profit Margin Ratio= (Net Income ÷ Total Revenue) × 100</b>		18.17%	20.30%	20.56%	18.29%	20.20%	18.08%	19.86%	19.63%
<b>Benefit-Cost ratio= Total Revenue ÷ Total cost</b>		1.22	1.25	1.26	1.22	1.25	1.22	1.25	1.24

<b>Return on Investment (ROI) = Profit/Total Cost × 100</b>	22.20%	25.48%	25.89%	22.39%	25.31%	22.07%	24.78%	24.43%
<b>Feed Cost percentage= (Feed cost/ Total Cost) × 100</b>	79.48%	77.18%	78.61%	74.69%	78.20%	74.46%	79.76%	78.19%

**Source:** Field survey (February - April 2022)

The study focuses on measuring the financial profitability of pangas farming in the study area. To measure the financial performance, efforts were made to evaluate the cost and revenue of the pangas farmers' based on gathered data from the respondents at different levels in the study area. The cost and return analysis in Table-II, presented that the revenue comes from the sale of pangas fish and other sources, respondents highlighted here that they cultivated some vegetables and bananas on the unused land around the pond, and they sold it in the local markets. Understanding of costs and returns is an important prerequisite for maximizing profits or controlling the production cost. In the cost section, the cost analysis exposed that the feed cost accounted for the major percentage (78.19%) of the total cost of pangas farming in the study area where a larger amount of money spent by the farmer mainly on the acquisition of commercial feed. On the other hand, fixed costs are those costs which are not varying with the level of operation and remain fixed up to a certain limit. Here major fixed costs consist of pump machine purchased, measurement tool cost, lease cost, etc. Most of the costs were required one-time initial investment but monthly utilization costs are very low here because one-time investment costs are depreciated over the useful life. The profit margin is a ratio of farms net profit (sales minus all expenses) divided by its total net revenue. The profit margin ratio measures the profit against each taka of sales and tells how well the pangas farmers is handling its capital efficiently and effectively. It's always expressed as a percentage. The research also revealed that the net profit margin per farm in Patuakhali Sadar Upazila is 19.86%, Galachipa Upozila is 18.29%, Dashmina Upozila is 20.30%, Kalapara Upazila is 20.20%, Mirzagonj Upozila is 18.08%, Dumki Upozila is 20.56%, Bauphal Upozila is 18.17% were realized respectively and overall in Patuakhali District is 19.63%, this means that pangas fish farmer cuts net profit about 20taka against each 100 taka. From the analysis, it is clear that pangas fish farming is profitable in the southern belt of Bangladesh, especially in the Patuakhali district. The average return on investment (ROI) for the farmers was estimated at 24.43%. The Benefit-Cost Ratio (BCR) is used as a common tool for estimating the profitability of a potential investment or commercial enterprise. Have an eye on the findings, the Benefit-Cost Ratio (BCR) in Patuakhali Sadar Upazila is 1.25, Galachipa Upozila is 1.22, Dashmina Upozila is 1.25, Kalapara Upazila is 1.25, Mirzagonj Upozila is 1.22, DumkiUpozila is 1.26, Bauphal Upozila is 1.22 have been realized respectively and total in patuakhali district is 1.24. As a rule of thumb, a Business with a benefit-cost ratio greater than one (BCR >1) indicates investment choice is profitable, equal to one (BCR = 1) indicates investment choice is neither profitable nor loss and less than one (BCR < 1) indicate investment option generates losses. Since the ratio of every single Upazila in Patuakhil district is more than one, so it's far believed that pangas farming is to be profitable here.

### **Problems associated with pangas fish farming**

Though the success of pangas farming is remarkable in the study area due to the availability of water resources, low-cost labor, and favorable agro climate condition (Das et al., 2022; Hasan, 2022b). Fish farming is an important source of income for many small-scale farmers in



Bangladesh, particularly in the coastal areas of Patuakhali District. While it is a lucrative business, it is also associated with several challenges. The study found that the lack of quality feed is one of the major constraints for the small-scale Pangas fish farmers in the district. It was observed that the farmers were not able to purchase quality feed due to a lack of financial resources and limited access to the market. This resulted in low productivity and low income for the farmers. The study also found that the fish farmers had to face high input costs such as feed, labour, and other operational costs. Moreover, the low productivity and low prices of fish in the market resulted in low profitability for the farmers. The study concluded that the financial profitability of the small-scale Pangas fish farming in the studied areas of the Patuakhali district was low due to the lack of quality feed and high input costs. Additionally, the higher cost of feed can lead to a lower quality of fish, which can also lead to a decrease in the market value of the product. Fish diseases are one of the most common causes of lower profitability in small-scale pangas fish farming in some selected areas of the Patuakhali district of Bangladesh. The most common fish diseases are bacterial infections, viral diseases, fungal infections, and parasites. Further, the profitability of pangas fish farming is largely dependent on the availability of credit facilities to the farmers. The lack of credit facilities is also limiting the ability of the farmers to expand their operations and increase their production. Without access to credit, the farmers are unable to invest in modern farming techniques and inputs such as good quality seed, fertilizer, and feed. However, the lack of access to credit facilities is preventing the farmers from taking full advantage of their potential. The lack of credit facilities is significantly affecting the profitability of the small-scale pangas fish farming in the area. Besides these inadequate knowledge about fish farming, lack of adequate preliminary capital, absence of government help and guidance, high-interest rates on loans, storage transportation facilities, and unfavorable weather conditions, Water supply problems in the dry season, market price fluctuation, and lower selling price these are the problems are founded in the study. In order to improve the financial profitability of the fish farmers, it is recommended that the government should provide subsidies for the purchase of quality feed and provide financial and technical assistance for the development of the small-scale pangas fish farming sector in the district.

### **Theoretical implications**

The study findings have revealed that farming pangas fish is profitable which is consistent with prior studies (Khan et al., 2021; Saha et al., 2022). Furthermore, the current study has confirmed that the benefits-cost ratio is high at farming pangas, which is consistent with previous studies (Salin et al., 2023).

### **Practical implications**

The current study has suggested industry operators to adopt new technique and methods of farming pangas fish in Bangladesh. Further, industry operates and farmers should focus on reduction of feed costing, providing alternative fish feeds to pangas. Furthermore, the industry operators should improve to process of pangas farming by applying integrated farming systems.

### **Conclusion**

The small-scale pangas fish farming in the Patuakhali district of Bangladesh is found to be profitable in terms of financial analysis. The results of the financial analysis indicated that the total cost of fish production was lower than the total income generated. The overall net profit in the Patuakhali District is 19.63 percent and the benefit-cost ratio was 1.24. This indicates that small-scale pangas fish farming in the Patuakhali district of Bangladesh is financially profitable. The results of the study suggest that small-scale pangas fish farming is an economically viable and profitable venture in Patuakhali district of Bangladesh. Therefore, the government should provide technical and financial support to the small-scale pangas fish farmers for further improvement of the fish farming industry in this region. In addition, the government should also provide necessary training to the fish farmers on modern fish farming techniques and management practices. This will help the small-scale pangas fish farmers to increase their production and improve their financial returns. Further research is needed to analyze the factors that affect the financial profitability of pangas fish farming in the Patuakhali district of Bangladesh. This includes studies to examine the influence of technology and market structure on the profitability of the activity. Such studies can provide valuable insights into the financial sustainability of small-scale pangas fish farming in the Patuakhali district of Bangladesh.

### **References**

- Adnan, K. M. M., Sarker, S. A., Akhi, K., & Rahman, M. M. (2016). An economic analysis of year round Pangus production and social impact in some selected areas of Mymensingh district in Bangladesh. *Asian J. Agric. Extension, Econ. Sociol*, 10, 1–11.
- Alam, M. M., Haque, M. M., Aziz, M. S. Bin, & Mondol, M. M. R. (2019). Development of pangasius–carp polyculture in Bangladesh: Understanding farm characteristics by, and association between, socio-economic and biological variables. *Aquaculture*, 505, 431–440.
- Ali, H., Rahman, M. M., Murshed-e-Jahan, K., & Dhar, G. C. (2018). Production economics of striped catfish (*Pangasianodon hypophthalmus*, Sauvage, 1878) farming under polyculture system in Bangladesh. *Aquaculture*, 491, 381–390.
- Bangladesh Bureau Of Statistics, M. O. P. (2020). *National Hygiene Survey 2018*. Bangladesh Bureau of Statistics, Government of the People’s Republic of ....
- Bwala, M. A., & John, A. U. (2018). Profitability analysis of paddy production: A case of agricultural zone 1, Niger State Nigeria. *Journal of the Bangladesh Agricultural University*, 16(1), 88–92.
- Das, S. K., Mandal, A., & Khairnar, S. O. (2022). Aquaculture resources and practices in a changing environment. *Sustainable Agriculture Systems and Technologies*, 169–199.
- Dickson, M., Nasr-Allah, A., Kenawy, D., & Kruijssen, F. (2016). Increasing fish farm profitability through aquaculture best management practice training in Egypt. *Aquaculture*, 465, 172–178.
- Department of Fisheries 2020. Yearbook of Fisheries Statistics of Bangladesh, 2019-20. Fisheries Resources Survey System (FRSS), Department of Fisheries. Bangladesh: Ministry of Fisheries and Livestock, 2020. Volume 37: 141p.

- Food and agricultural Organization of the United Nation (2022). The State of World Fisheries and Aquaculture 2022. Towards Blue Transformation. *FAO Rome*.
- Hasan, A. A.-T. (2022a). Afforestation intentions for mitigating carbon emissions in the post-COVID-19 perspective: the case of green hotel visitors in Bangladesh. *International Journal of Tourism Cities, ahead-of-print*.
- Hasan, A. A.-T. (2022b). Technology attachment, e-Attitude, perceived value, and behavioral intentions towards Uber-ridesharing services: the role of hedonic, utilitarian, epistemic, and symbolic value. *Journal of Contemporary Marketing Science, ahead-of-print*.
- Hasan, A. A.-T. (2023). Theory of repeat purchase behavior (TRPB): a case of green hotel visitors of Bangladesh. *International Journal of Tourism Cities*.
- Hasan, A. A.-T., & Rahman, M. T. (2022). Factors influencing green hotel revisit intentions after the COVID-19 in Bangladesh. *International Journal of Tourism Cities, ahead-of-print*.
- Hasan, A. A.-T., Sumon, S. M., Islam, M. T., & Hossain, M. S. (2021). Factors influencing online shopping intentions: The mediating role of perceived enjoyment. *Turkish Journal of Marketing*, 6(3 SE-), 239–253. <https://doi.org/10.30685/tujom.v6i3.132>
- Khan, M. A., Roll, K. H., & Guttormsen, A. (2021). Profit efficiency of Pangas (Pangasius hypophthalmus) pond fish farming in Bangladesh–The effect of farm size. *Aquaculture*, 539, 736662.
- Lauria, V., Das, I., Hazra, S., Cazcarro, I., Arto, I., Kay, S., Ofori-Danson, P., Ahmed, M., Hossain, M. A. R., & Barange, M. (2018). Importance of fisheries for food security across three climate change vulnerable deltas. *Science of the Total Environment*, 640, 1566–1577.
- Muema, M. M. (2018). *Challenges Of Measuring Return On Investment Of Training And Development Programmes At Christian Mission Aid In Nairobi, Kenya*. University of Nairobi.
- Namonje-Kapembwa, T., & Samboko, P. (2020). Is aquaculture production by small-scale farmers profitable in Zambia? *International Journal of Fisheries and Aquaculture*, 12(1), 6–20.
- Okpeke, M. Y., & Akarue, B. O. (2015). Analysis of the profitability of fish farming in Warri south local government area of Delta state, Nigeria. *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)*, 8(12), 45–51.
- Rahman, M. M., Ghosh, T., Salehin, M., Ghosh, A., Haque, A., Hossain, M. A., Das, S., Hazra, S., Islam, N., & Sarker, M. H. (2020). Ganges-Brahmaputra-Meghna delta, Bangladesh and India: a transnational mega-delta. *Deltas in the Anthropocene*, 23–51.
- Saha, P., Hossain, M. E., Prodhan, M. M. H., Rahman, M. T., Nielsen, M., & Khan, M. A. (2022). Profit and loss dynamics of aquaculture farming. *Aquaculture*, 561, 738619.
- Salin, K. R., Subasinghe, R. P., Senarathna, D., & Shinn, A. P. (2023). Cage culture of finfish: its importance, distributions and future modifications in ongoing climate change. In *Climate Change on Diseases and Disorders of Finfish in Cage Culture* (pp. 1–33). CAB International Wallingford, UK.

- Shafiullah, M., Siddique, M. A. B., Rahman, M. S., Mahalder, B., Ali, A., & Rahmatullah, S. M. (2019). Effect of different stocking ratios on the production and survival of indigenous carps and pangas (*Pangasius hypophthalmus*) in a pond system. *Int. J. Fish. Aquat. Stud*, 7(1), 19–24.
- Yuan, Y., Yuan, Y., Dai, Y., & Gong, Y. (2017). Economic profitability of tilapia farming in China. *Aquaculture International*, 25, 1253–1264.