Asian Journal of Agricultural Extension, Economics & Sociology

40(11): 51-62, 2022; Article no.AJAEES.92214
ISSN: 2320-7027

Shrimp Farming in the North Eastern Coastal Plain Zone of Odisha: A Micro-economic Analysis

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJAEES/2022/v40i111685

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/92214

Original Research Article

Received 18 July 2022
Accepted 23 September 2022
Published 29 September 2022

ABSTRACT

The Present experiment examines and evaluates the socioeconomic status of the household of shrimp farmers, aspects of shrimp cultivation, and the cost and return structures of shrimp farming. Through random selection, farmers from two distinct Balasore district blocks have been purposefully chosen for the study. Additionally, information on various costs and return streams from 40 farmers, twenty (20) from each block, has been gathered. The information was gathered from chosen farmers with the goal of examining the cost and return structure of shrimp farming. Step-by-step regression analysis was used to identify the elements that affect shrimp farming yield when compared to seasonal paddy cultivation. To identify the important variables the Cob-Douglas production function has been used through a stepwise regression model where the cost of feed, amount of labor both for operation and management, and the duration of cultivation in a particular pond are highly significant and the model is also significant in the selected region. From the correlation matrix, the degree of association has also been presented in the discussion. The model is finally 96.8% significant with a 5% threshold of significance in the fifth stage. As a result, it is clear

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that this model is highly significant at the 5% level of significance, meaning that the independent variables can account for 96.8% of the dependent variable (productivity). It is found that each of the models is highly significant at a 5% level of significance.

Keywords: Shrimp farming; C D production function; socioeconomic status; cost and return.

1. INTRODUCTION

Aquaculture is increasingly recognized as a significant source of wholesome food for our people and a more effective means of earning money for farmers. One of them, among others, is the aquaculture of shrimp. It developed into an aquaculture industry that operates in either a freshwater or marine setting. Shrimp aquaculture has developed into a significant area of fish farming in recent years after undergoing a significant change from low-input agriculture. It has evolved from localized, small-scale companies in Southeast Asia into a global sector that is carried out anywhere that offers ideal shrimp cultivation conditions. Both are commonly referred to as shrimp in Australia and New Zealand. Both prawns and shrimp are referred to as "crevettes" in France. Both are referred to as "Cameron" in Spain. However, in India, smaller types are referred to as "shrimps" and somewhat larger ones as "prawns."

Shrimp culture in India dates back to 1970 when shrimp culture technology was first introduced at CMFRI (Cochin). This was followed in 1973 by the All India Coordinated Research Project on brackish water fish farming, and in 1975, research on shrimp breeding and seed production was conducted at Nirkkal (Kerala). In the years 1982–1983, Chilika Lake (Odisha) began a confined pond shrimp culture. Beginning in 1985, Andhra Pradesh's small farmers developed a widespread shrimp culture. At Sandeshkali (West Bengal), 3.5 tons/hectare/crop of semi-intensive shrimp culture was reported for the first time in 1987.

The first commercial shrimp hatcheries were then established in 1987 in Gopalpur (Orissa) and Visakhapatnam (Andhra Pradesh). At Tuticorin (Tamil Nadu), the first intensive shrimp culture with 8 tons/hectare/crop became a reality in 1989. At Nellore, the first example of semi-intensive farming with 4 tons/hectare/crop occurred in 1990. (Andhra Pradesh). Beginning with the 7th plan, the first Brackishwater Fish Farmers Development Agency (BFDA) was established (1985-90). The Marine Products Export Development Agency (MPEDA), a division of the Ministry of Commerce, then established its first prawn-farming division in 1979. In the 1980s, the Andhra Pradesh Shrimp Seed Production and Research Center (APSPARC) and Orissa Shrimp Seed Production and Research Centre (OSSPARC) were established.

With seven coastal districts and a 480 km long coastline, Odisha is a maritime state in India (Excluding Chilika with 790 ha of water spread area). The state was regarded as the nation's least developed (Economic survey, 2003-04). Agriculture and fishing are two primary sector industries that are important to the state's economy. The state has severe unemployment and poverty. Despite this, the state has great potential for developing its fisheries. Orissa had the highest rate of pond fish stocking (579/ha), according to records. According to data from 1980–1981, it was also the top supplier of fish seed, providing 226 Lakh fingerlings to the other states. In light of this, the state government launched the brackish water shrimp culture project under the BFDA plan with the stated goals of reducing rural poverty and fostering employment possibilities.

In the current experiment, we analyze shrimp farming, its return on investment, cost structure, and factors that affect yield to sustain shrimp farming for the Socio-economic upliftment of small and marginal young and dependent farm families residing in coastal brackish water ecosystems.

2. MATERIALS AND METHODS

The goal of the current study is to evaluate the socioeconomic status of the household of shrimp farmers, aspects of shrimp cultivation, and the cost and return structures of shrimp farming. Through random selection, farmers from two distinct Balasore district blocks have been purposefully chosen for the study. Additionally, information on various costs and return streams from 40 farmers, twenty (20) from each block, has been gathered. The information was gathered from chosen farmers with the goal of examining the cost and return structure of shrimp farming. Step-by-step regression analysis was used to identify the elements that affect shrimp farming yield when compared to seasonal paddy cultivation.

Several approaches for figuring out the return and cost structure of shrimp farming have been used. These approaches include returns at constant pricing and returns on discounts. Using project appraisal approaches such as NPW (185068.36 rupees), BC ratio (1.10) at a 10% opportunity cost of capital, and Financial Rate of Return, the economic viability of the shrimp farm has been calculated (over 50 percent). The regression analysis has been used to determine the elements that determine yield, and the results show that the duration of cultivation, feed costs, and labor costs for both daily operations and pond management are highly significant. The correlation matrix has been used to examine the degree of relationship between the variables. Here, the variables that affect yield have been identified.

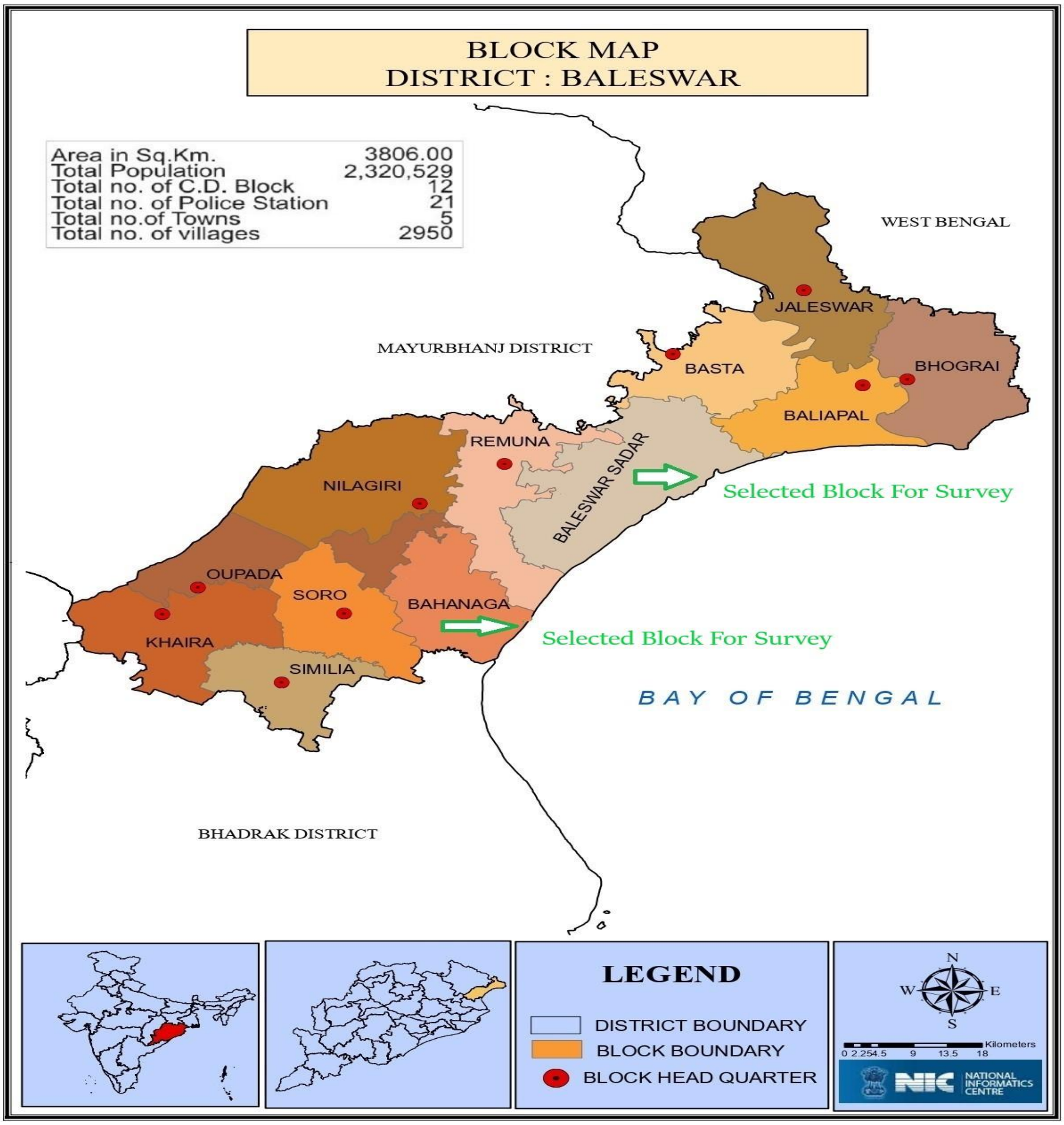

Fig. 1. Demographic position of the study areas

Table 1. District scenario of fisheries (Area, Production & Productivity)

Marine Coast Length (KM)	Area under Ponds and Tanks (Ha)	Marine Fish Production (MT)	No of fishermen per Coastal KM	Marine Fishermen (No)
80.00	7689	35201	1500	270675

Available:https://nfdb.gov.in/ (According to Rural Backwardness and potential for Fisheries Development - State Odisha.)

Table 2. Scenario of the study area of Fisheries (Area, Production and Productivity)

Blocks	Fresh water	Barackish Water	Marine water
Bahanaga	3620.45	2523.75	3832.50
Balasore	4642.75	6338.25	24130.00

Source: D.P.M.U, Balasore (District statistical hand book Balasore 2018)

Out of these 2,70,675 marine fishermen, 40 brackish water shrimp producers were selected to participate in the survey work.

3. RESULTS AND DISCUSSION

3.1 Demographics of the Respondents

The socioeconomic circumstances of the respondents are significant for the social sciences since some social and economic factors also directly or indirectly support the production system. The respondent's age and educational background have been taken into account in the analysis in this first section in order to capture their overall production and marketing experiences. In addition to these, the total number of household members, including their age distribution, is crucial because, in developing nations, the availability of labor in the production and management of agriculture and related industries improves the utilization of excess labor, leading to the generation of additional family incomes.

One of the most important economic assets that drive all agricultural-based activity is operational holdings, which are also covered in this section using tabular approaches. It is a key component of the farm household system that represents how they accept new technology, make decisions, and eventually manage the entire farm enterprise. The sample in this instance is broken down into three age groups: young (18-35), medium (36-50), and old (>50).

One of the key criteria in determining the potential productive human resources is knowledge of the shrimp farmers' ages (Hussain, et al., 2009). Here, it is found that 42.5% of respondents, or the maximum age range of the sample, are fewer than 20. This demonstrates that the majorities of farmers are still in their prime and may be able to get more cutting-edge technologies and take prudent risks. Chaudhari [1] in Maharashtra, Koteswari et al. [2] in Andhra Pradesh, and Sahuet et al. (2014) in the Balasore and Puri districts of Odisha all reported making similar types of observations. Previous research revealed that this occupation attracted the biggest percentage of people (18–35) (45%) [3]. The age distribution of shrimp producers offers important insights into their capacity for making decisions and conducting effective farming operations [4]. It is crucial to note that the younger generations showed no interest in shrimp fishing [4], which suggests that if the scenario persists, difficulties are about to come.

The level of education a person has determines where they fall in the social hierarchy. Education generally has an impact on attitude, creativity, and decision-making. The goal of the current study was to evaluate the respondents' educational backgrounds.

Table 3. Age distribution of survey respondents

Sl. No.	Age (in years)	No. of Respondents	Total in %
1	Young (18-35)	17	42.50
2	Mid-age (36-50)	15	37.50
3	Old(>50)	8	20.00

Table 4. Distribution of responders by educational backgrounds

Sl. No.	Education level	No of respondents	Total in %
1	Secondary education	23	57.50
2	Higher Secondary	15	37.50
3	Graduation	2	0.05

According to the table, 57.7% of the respondents have completed secondary education, while 37.5% have completed upper-level education. There are 5% graduates among farmers. This demonstrates the producers' commitment to educational advancement in shrimp culture. The fact that only 8% of farmers have a university degree is concerning. According to Das et al. [3], 75% of the fishing community was illiterate. However, our study showed a distinct pattern that is thought to be improving as a result of the increase in the socioeconomic status of the communities that practice shrimp farming. According to Rahman [5], the fishermen are socially, economically, and educationally disadvantaged and do not have enough money to devote to their schooling. Low or no education was found to be a defining aspect of rural life in several communities by Karim [6] and the Bangladesh Agricultural Research Council [7]. Similar findings were made by Patil et al. [8] in their study in the Palghar region of Maharashtra, where they noted that the biggest percentage of shrimp farmers (50.91%) had graduate degrees, followed by shrimp farmers (29.09%) with higher secondary education. The findings of the present study and those of Hossain & Pingali [9] and Shahjahan et al. are comparable in this regard [10].

3.2 Family Size and Members' Engagement in Shrimp Farming

In rural Odisha, family members frequently work in agriculture in addition to the family head. Family members must participate in numerous agricultural operations and keep an eye on the activities because shrimp farming is a specialist commercial farming activity. In their study in the Palghar area of Maharashtra, Patil et al. [8] found that more shrimp farmers (54.55%) had experienced between six and 10 years. Similar findings were found by Kumaran et al. [11] who noted that 94.65% of East Coast India farmers had more than five years of experience.

According to the two Tables 5 and 6, 47.5% of respondents had families with less than five members, while 55% of respondents had more than one member of their family working in the shrimp industry. Due to the higher subsistence level, the seasonal and sometimes professional fishers are engaged in multiple earning activities on a part-time basis, especially during the low season for fishing [4]. Many fishers were also involved in agricultural activities [12-15]. The increasing percentages of executive involvement are noticeable in the study area, a promising sign for the shrimp farming community. Akber et al. [16] have reported similar findings in previous studies targeting the same locality. The substantial economic benefit is the primary reason for the increased commercial saline-water Bagdash Shrimp farming [17,18]. The saltwater ascension worked as a double-edged sword. It resulted in a decline in rice production while acting as a more profitable farming source for the coastal communities. The saline water intrusion was the prime cause that forced the study area people to do shrimp farming instead of rice cultivation [18].

Table 5. Distribution of responders based on the number of family members

Sl. No.	No of a family member	No of respondents	Total in %
1	< 5	19	47.50
2	>5	21	52.50

Table 6. Distribution of responders by member engaged in shrimp farming

Sl. No.	No of the family member are involved in shrimp farming	No of respondents	Total in %
1	< 1	18	45
2	>1	22	55

Table 7. Distribution of responders according to their operating holdings size

Sl. No.	Holding size	Total operational holding		The area under shrimp farming	
		Frequency	**%**	**Frequency**	**%**
1	< 2.5 acre	14	35.00	34	85.00
2	2.5- 5 acre	22	55.00	6	15.00
3	> 5 acre	4	10.00	0	0.00

The table clearly shows that the majority of farmers (55%) are small farmers. Only shrimp farming is done on less than 2.5 acres for 85% of farmers. No farmer uses more than 5 acres for shrimp aquaculture. According to Mohite's 2007 research, 65.79% of shrimp farmers had farms that were smaller than two hectares. The findings from this study concur with those from Salunkhe [19], Srinivas and Vankatraylu [20], Randive [21], and Gawade [22]. In their study conducted in the Palghar district of Maharashtra, Patil et al. [8] found that the majority of shrimp farmers (40.00%) had farms with an area of between 2 and 5 hectares.

3.3 Cost of Production

Shrimp aquaculture is carried out commercially in the research region. They operate the business on their own land. However, because it is strictly commercial, the rental value of the land is set at 30% of the entire yield for the establishment of agriculture as a business strategy. Major farm equipment like aerators and water motors are in the hands of the growers. Farm equipment depreciation and maintenance costs are also included in the assessment. Other farming expenses are covered by adhering to the CACP rules, even if this is primarily an investment strategy for the long term as opposed to the growing of seasonal food grains. The cost of labor is calculated at Rs. 300 per man-day.

According to the project analysis approach, the flow of financial costs and returns at 2018–19 prices has been estimated for this study. Based on the facts gathered during data collection, the enterprise's lifespan is likewise fixed. Table 8 details the price of farming.

3.4 Earnings and Return

The gross return, total cost, and net return are estimated as per acre of cultivation of (*L. vannamei)* during the survey year from the sample holding and are shown in table 8. The output from each pond is multiplied by the prawn price per kg. The average price for the survey year in that locality was determined to be Rs. 280/Kg despite the fact that prices there vary slightly. Local farmers are becoming more and more interested in shrimp growing as it promotes job creation and is profitable. Estimated returns from shrimp farming are: (I) Fixed price (II) Reduced price.

(I) Fixed pricing: Table 8 provides the return per acre of shrimp according to pond age. By using the formula of the weighted average of the acquired data for the respective age of the pond, the per-acre cost and return at the constant price are determined. The difference between the entire return and the total expenditure incurred is the net return.

Twice a crop year is dedicated to shrimp cultivation. Since shrimp farming has a gestation period of only one season out of a lifespan of ten, the net return was negative only for the first year of cultivation. The net return then showed a positive return from the second to the eighth year. Shrimp farming generates a maximum net return of Rs. 168508.00/- in the second year. The net return then gradually dropped, showing a negative value in the ninth and tenth years. The pond is currently in its second year of cultivation, with maximum cost, return, and net return estimates.

Discounted price: The return at discounted pricing is determined using the project appraisal technique. In this manner, the discounted factor for each year is multiplied by the gross return, total cost, and net return, respectively. Table 9 displays the discounted values of gross return, total cost, and net return.

Net present worth: It is the simplest discounted cash flow measurement of the project value. The opportunity cost of capital is assumed to be 10% for the purpose of calculating net present worth. Net return at various ages is multiplied by the 10% discount factor for that specific year. In table 9, the net return for ponds of various ages is shown. The net present worth, which is projected to be Rs. 185068.36/- when discounted net return is added up, demonstrates the investment potential of this enterprise.

B:C Ratio: One indicator of a project's economic viability is the benefit-cost ratio. The benefit-cost ratio is not frequently employed in developing nations, despite the fact that the ratio's value will vary based on where the netting out of cost and return streams takes place. The opportunity cost of capital was set at 10% in this study to determine the benefit-cost ratio. The value of the gross benefit stream at 10% is currently worth Rs. 12062840.00, whereas the value of the gross incremental cost stream at 10% is currently worth Rs. 11877771.63. Dividing the present worth of the gross benefit stream by the present worth of the gross cost stream, the benefit-cost is estimated to be 12062840.00 / 11877771.63 = 1.01

3.5 Financial Rate of Return (FRR)

$$Financial\ rate\ of\ return = 50 + (53 - 50) \times \left(\frac{3380.353}{6039.245}\right) = 50 + 1.679 = 51.67\%$$

This section analyses the financial viability of shrimp farming by calculating the maximum annual interest rate that the industry would be required to pay for the resource utilized throughout the course of its ten-year life cycle in order to recover its recurring and non-recurring prime costs. The financial rate of return's calculation details is presented in table 9 under the heading "Self-Perpetuating Rate of Return." Using the interpolation method, it is discovered. Calculated are the two interest rates that have

Table 8. Shrimp farming's per-acre output and cash flow stream (in Rupees)

Age of pond (in years)	Yield (in tonne)	Gross return (inRs)	Total cost (in Rs)	Net return (in Rs)
1	4.03	1129333.00	1348646.00	-219313.00
2	8.10	2268000.00	2099492.00	168508.00
3	7.87	2205000.00	2077133.00	127867.00
4	7.74	2168000.00	2075179.00	92821.00
5	7.67	2146667.00	2056241.00	90426.00
6	7.38	2067333.00	2008006.00	59327.00
7	7.10	1988000.00	1959131.00	28869.00
8	7.15	2002000.00	1997826.00	4174.00
9	6.94	1943200.00	1970173.00	-26973.00
10	6.92	1939000.00	1962635.00	-23635.00

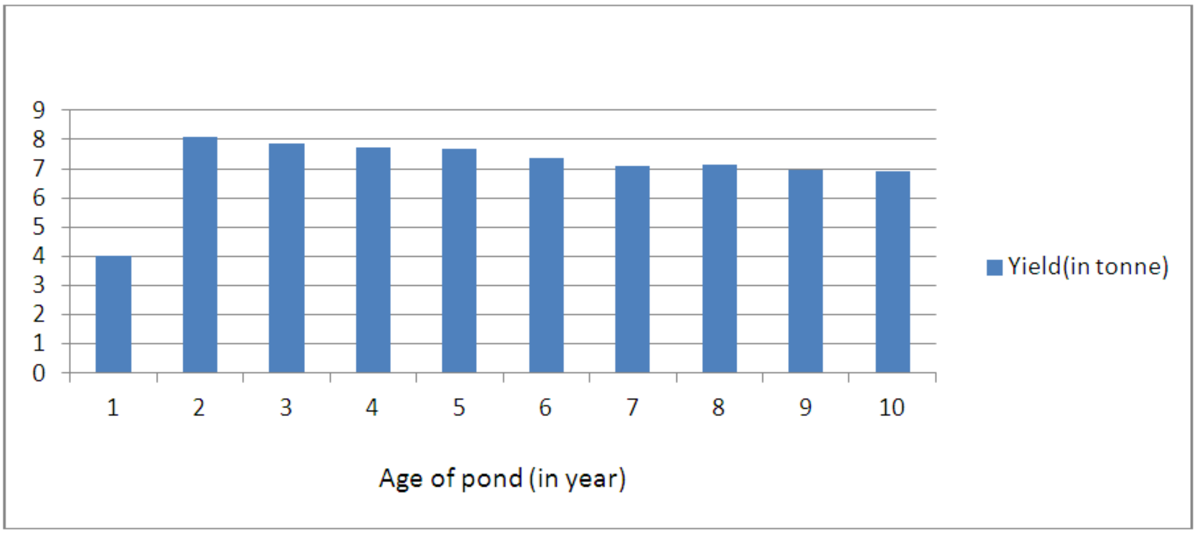

Fig. 2. Yield (in tonne)

produced the fewest positive and negative results. The previously indicated formula is then used to calculate these values.

$$Financial\ rate\ of\ return = 50 + (53 - 50) \times \left(\frac{3380.353}{6039.245}\right) = 50 + 1.679 = 51.67\%$$

Hence, the financial rate of return thus calculated is found to be 51.67%.

According to our research, it is true that shrimp farming has replaced rice cultivation as a lucrative new industry for the residents of the southwest coastal regions [14,16].

3.6 Determinants of Yield

Correlation matrix: The correlation between sets of variables is displayed in the correlation matrix. The values of each random variable in the tables are correlated with one another. This makes it easier to identify the pairs with the highest correlation. From the table, it can be seen that the correlation between labor costs and stocking costs has a value of 0.930, indicating that the two costs are very closely tied to one another. If one of the variables in this pair increases in value, the other variable will almost certainly increase at the same rate, and vice versa if one variable decreases.

Cobb – Douglas production function: The Cobb Douglas production function has been used in the current investigation to determine the link between yield and yield determining factors. The actual input and output data are converted to log values, which are then regressed stepwise. The dummy variables 1 and 2 are used for location. When there are a total of 10 variables, the stepwise regression is finished in 5 steps. One dependent variable (productivity) and nine independent variables were among them. When only feeding costs are used as the predictor in the first model, the model is 88.7% significant at the 5% level of significance. The model's significance grows over time in little steps. The model is finally 96.8% significant with a 5% threshold of significance in the fifth stage. As a result, it is clear that this model is highly significant at the 5% level of significance, meaning that the independent variables can account for 96.8% of the dependent variable (productivity).

Table 9. Computation of financial rate of return

Age of pond	Net return	Discounted @ 50%	Discounted net return at 50%	Discounted factor at 53%	Discounted net return at 53%
1	-219313	0.660	-144745.92	0.6530	-143210.931
2	168508	0.440	74140.97	0.4270	71953.001
3	127867	0.296	37848.63	0.2790	35674.893
4	92821	0.197	18332.08	0.1820	16893.367
5	90426	0.131	11909.05	0.1190	10778.730
6	59327	0.087	5161.45	0.0770	4568.179
7	28869	0.058	1674.40	0.0500	1443.450
8	4174	0.039	162.79	0.0330	137.742
9	-26973	0.026	-701.31	0.0210	-566.440
10	-23635	0.017	-401.79	0.0140	-330.883
Total			**3380.35**		**-2658.892**

Table 10. Model Summary of stepwise regression through SPSS

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.943[a]	0.890	0.887	0.05855
2	0.969[b]	0.940	0.936	0.04399
3	0.980[c]	0.960	0.957	0.03619
4	0.983[d]	0.967	0.963	0.03350
5	0.986[e]	0.972	0.968	0.03117

a. Predictors: (Constant), feeding cost
b. Predictors: (Constant), feeding cost, age of the pond
c. Predictors: (Constant), feeding cost, age of pond, labor cost
d. Predictors: (Constant), feeding cost, age of pond, labor cost, cost of pond management
e. Predictors: (Constant), feeding cost, age of pond, labor cost, cost of pond management, cost of disease prevention

Table 11. Significance of models (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Significance
1	Regression	1.055	1.00	1.055	307.833	0.000[b]
	Residual	0.130	38.00	0.003		
	Total	**1.185**	**39.00**			
2	Regression	1.114	2.00	0.557	287.848	0.000[c]
	Residual	0.072	37.00	0.002		
	Total	**1.185**	**39.00**			
3	Regression	1.138	3.00	0.379	289.645	0.000[d]
	Residual	0.047	36.00	0.001		
	Total	**1.185**	**39.00**			
4	Regression	1.146	4.00	0.287	255.337	0.000[e]
	Residual	0.039	35.00	0.001		
	Total	**1.185**	**39.00**			
5	Regression	1.152	5.00	0.230	237.195	0.000[f]
	Residual	0.033	34.00	0.001		
	Total	**1.185**	**39.00**			

df: degree of freedom
a. Dependent Variable: productivity (yield/acre)
b. Predictors: (Constant), feeding cost
c. Predictors: (Constant), feeding cost, age of pond
d. Predictors: (Constant), feeding cost, age of pond, labor cost
e. Predictors: (Constant), feeding cost, age of pond, labor cost, pond management
f. Predictors: (Constant), feeding cost, age of pond, labor cost, cost of pond management, cost of disease prevention

Table 12. Significance of coefficients

Coefficients						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	-9.950	0.679		-14.653	0.000
	Feeding cost	0.878	0.050	0.943	17.545	0.000
2	(Constant)	-11.865	0.617		-19.217	0.000
	Feeding cost	1.027	0.046	1.104	22.172	0.000
	Age of pond	-0.071	0.013	-0.274	-5.507	0.000
3	(Constant)	-10.861	0.559		-19.439	0.000
	Feeding cost	0.396	0.151	0.426	2.622	0.013
	Age of pond	-0.090	0.011	-0.345	-7.816	0.000
	Labor cost	0.659	0.153	0.736	4.318	0.000
4	(Constant)	-10.627	0.525		-20.256	0.000
	Feeding cost	0.355	0.141	0.382	2.526	0.016
	Age of pond	-0.090	0.011	-0.344	-8.439	0.000
	Labor cost	0.567	0.146	0.633	3.899	0.000
	Cost of Pond management	0.129	0.049	0.167	2.650	0.012
5	(Constant)	-10.160	0.522		-19.470	0.000
	Feeding cost	0.285	0.134	0.307	2.134	0.040
	Age of pond	-0.083	0.010	-0.317	-8.048	0.000
	Labor cost	0.482	0.140	0.538	3.458	0.001
	Cost of Pond management	0.116	0.046	0.150	2.541	0.016
	Cost of Disease Prevention	0.138	0.054	0.184	2.534	0.016

a. Dependent Variable: Productivity (yield/acre)

In the 5th step of regression the predictors are constant, feeding cost, age of pond, labor cost, cost of pond management, and cost of disease prevention.

Here the table (Table 11) shows whether the model is significant or not at each model where the different predictors are for different models. Here table shows that each of the models is highly significant at 5% level of significance.

Excluded variables: Stocking density, stocking cost, location, and experience of the entrepreneur. It is clear from the coefficient table whether each coefficient is significant at each level of the model. As can be seen in the table, all five independent variables are significant at the 5% level of significance because their respective significance values for each predictor are less than 0.05. It can be claimed that the age of the pond coefficient is significantly more important than other coefficients. Similar to this, after pond age, the labor cost coefficient is higher than other coefficients.

In this case, the coefficient table reveals that the beta value for pond age is negative, indicating that the relationship between production and pond age is inverse. The output of a pond decreases as its age rises and vice versa. The other coefficients have positive values, indicating that productivity will rise as costs for various independent variables rise and vice versa.

The income level of the stakeholders has significantly changed as a result of shrimp farming [23]. Prior to this, each responder had previously declared how satisfied they were with rice cultivation versus shrimp farming [16,18,24]. The farmers' opinions were stated in light of their current socioeconomic situation and lifestyle choices that might have an adverse impact on the environment [16]. Since many respondents expressed satisfaction, we can therefore draw the conclusion that shrimp farming has benefited the research area. Compared to rice farming, the respondents' income level has significantly increased as a result of shrimp farming [25]. The income from shrimp farming could therefore be unpredictable, which is consistent with earlier results [23,26]. This also offers a plausible explanation for why some shrimp growers are unhappy. These results showed that shrimp farming raised people's income in a way that was acceptable and could be attributed to the coastal towns' improved socioeconomic condition [27].

4. CONCLUSION

The current experiment examines shrimp farming, including its return on investment, cost structure, and factors that affect yield in order to sustain it for future demands [28,29]. The information was gathered from the farmers using a well-planned schedule and questionnaire, together with a purposeful and random sampling method. From the comparison of employment generation between seasonal paddy cultivation and shrimp farming in the study area, it is found that shrimp farming in one acre provides 5 times more employment than one season of paddy cultivation in a year. From the correlation matrix, the degree of association has also been presented in the discussion. The model is finally 96.8% significant with a 5% threshold of significance in the fifth stage. As a result, it is clear that this model is highly significant at the 5% level of significance, meaning that the independent variables can account for 96.8% of the dependent variable (productivity). Here it shows whether the model is significant or not in each model where the different predictors are for different models. It is found that each of the models is highly significant at a 5% level of significance.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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