
Shrimp-Paddy Conflict in the South-West Coastal Region of Bangladesh

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To cite this article:

Mohammed Ziaul Haider, Rabeya Akter. Shrimp-Paddy Conflict in the South-West Coastal Region of Bangladesh. *International Journal of Agricultural Economics*. Vol. 3, No. 1, 2018, pp. 9-13. doi: 10.11648/j.ijae.20180301.12

Received: November 30, 2017; **Accepted:** January 17, 2018; **Published:** February 5, 2018

Abstract: Shrimp cultivation is a comparatively new agricultural practice in the south-west coastal region of Bangladesh. The objective of this study is to analyze the costs and returns of shrimp and paddy cultivation for understanding the behavior of the farmers in the south-west coastal region of Bangladesh. This study compares cost and return of shrimp and paddy cultivation through collecting primary data from 60 randomly selected farmers from the study area. The derived economic benefit-cost ratio (BCR) of shrimp production is 1.67 and that of paddy production is 1.36 indicating that shrimp production is more profitable than paddy production from economic viewpoint. However, the BCR of shrimp production decreases to 1.04 while the associated external cost of land degradation is added in cost side. The ratio would further decrease to less than one if other indirect cost items such as health cost, loss in livestock, mangrove destruction and biodiversity losses are considered. Such results signal that shrimp production is not a profitable option from a society viewpoint. The study findings also indicate that cost of shrimp production increases and return from shrimp production decreases over the time period. The paddy farmers in the study area moved towards shrimp farming in the 1980s for getting short-run higher benefits. However, the unfavorable changes in cost and production and lower BCR from society viewpoint explain the recent reverse move of farmers from shrimp cultivation towards paddy production for re-solving shrimp-paddy conflict in the study area. Shrimp expansion led salinity intrusion creates constraints in the move in some cases. An active cooperation of government through enforcing associated rules and regulations might be helpful for the farmers of the south-west coastal region to protect their livelihood and efficiently re-solve the shrimp-paddy conflict.

Keywords: Shrimp, Paddy, Benefit-Cost Ratio, Social Cost, South-West Coastal Region of Bangladesh

1. Introduction

Bangladesh is an agro-based country. Agriculture sector plays a significant role in the economy of the country. This sector offers job opportunity mainly to rural poor. Almost 80 percent people of the country are involved in agriculture sector for their livelihood. The country has about 2.83 million hectares of land for paddy production [1]. On the other hand, shrimp cultivation is a comparatively new agricultural practice in the south-west coastal region of the country. According to the study [2], about 4 million hectares open inland water body, about 4.3 million hectares closed water body and 710 kilometer coast lines are available in the country for aquaculture.

Salinity is an integral part of both soil and water. Like

other components of soil and water, a specific ratio of salinity is required to keep balance in environment. An increase in the ratio creates negative impacts. This salinity originates from the shrimp cultivation by retaining tidal water. Because of this salinity, the productivity of adjacent paddy fields decreases. In addition to such a decrease in paddy productivity, shrimp cultivation exerts adverse impacts on the environment.

A proper recognition of the said negative impacts of shrimp cultivation might encourage farmers to think about alternatives of shrimp farming. A field level investigation in the south-west coastal region of Bangladesh reveals that cultivation of shrimp has been squeezing since last several years. The farmers are going back to the traditional practice of paddy cultivation in agricultural fields. The aim of this

study is to analyze the associated costs and returns of shrimp and paddy cultivation for understanding the behavior of the farmers in the south-west coastal region of Bangladesh.

2. Material and Methods

Historically paddy cultivation is the main and traditional occupation of farmers in Bangladesh. Farmers have started shrimp cultivation in addition to paddy in the farming fields since 1980s. Several studies [2-6] have tried to compare shrimp and paddy sectors on the basis of Benefit-Cost Ratio (BCR). An intensive review of literature reveals that most of the available studies have captured only the direct costs and benefits [6-12]. However, some other studies have tried to capture some of the indirect costs [3; 13-15]. Following the methodology of the said literatures, this study attempts to address the shrimp-paddy conflict in the south-west coastal region of Bangladesh.

This study tries to analyze the trend and logic for conversion of shrimp farm into paddy field. It compares the economic cost and return of shrimp production with those of paddy production. In addition to economic costs and returns, the social and environmental consequences are also considered in this study and an attempt has been made to internalize those social and environmental issues. Finally, the concept of BCR is applied to draw a conclusion.

For calculating the economic cost of shrimp production, this study considers four elements: a) cost of land (or lease cost)¹, b) labor cost, c) fry cost and d) feeding cost for shrimp. All these costs are measured in US\$. To calculate the return from shrimp production, total shrimp production (in kg) and average market price (US\$ per kg) are considered. Similarly, for calculating the economic cost of paddy production, this study considers five elements: a) cost of land (or lease cost), b) labor cost, c) seed cost, d) fertilizer cost and e) insecticide cost for paddy production. All these costs are measured in US\$. To calculate the return from paddy production, total paddy production (in kg) and average market price (US\$ per kg) are considered.

After calculating the economic cost and return of shrimp and paddy production, Net Revenue (NR) and BCR have been calculated. Following the study of [6], the NR and BCR of shrimp and paddy production have been calculated in this study as per equation 1.

$$NR = GR - TC; BCR = GR/TC \tag{1}$$

where, NR=Net Revenue; GR=Gross Revenue; TC=Total Cost; BCR=Benefit-Cost Ratio

A positive NR indicates profit, while a negative NR indicates loss. A comparison between the values of NR of shrimp and paddy production helps to understand the trend of conversion between shrimp and paddy production and hence the shrimp-paddy conflict in the study area. Similarly, BCR value also helps to explain the said conversion as well as the

conflict between shrimp and paddy production. A BCR value of greater than one indicates profit, while a BCR value of less than one indicates loss. Such NR and BCR values help to reach a logical conclusion regarding the study topic, conflict between shrimp and paddy production.

To extend the discussion beyond economic costs and returns associated with shrimp and paddy production, the environmental consequences of shrimp farming has been internalized in the calculation. An intensive literature survey identifies several environmental impacts of shrimp production. A careful consideration of such environmental impacts (i.e. indirect costs) of shrimp farming helps to internalize the adverse effects of shrimp cultivation, which ultimately helps to explain the conflict between shrimp and paddy production. It also helps to justify the new trend in the agricultural sector of the study area.

The main objective of this study is to compare the shrimp and paddy production to explain the conflict between these two in the study area. It collects farm-level data from randomly selected 60 farmers of Dacope upazilla² under Khulna district of Bangladesh. It follows a stratified random sampling procedure where shrimp and paddy farmers are the two strata. The surveyed sample farmers include 30 shrimp and 30 paddy cultivators. A structured questionnaire is used to collect primary data. Some secondary information is also used to address the study objectives.

3. Results and Discussion

3.1. Economic Cost of Production

Table 1 portrays the economic cost of shrimp and paddy production. The calculation considers land, labor, fry and feeding costs for shrimp production and land, labor, seed, fertilizer and insecticide costs for paddy production. According to field level data, cost of shrimp production increases over the time period. However, cost of paddy production remains almost same over the considered time period. The results also indicate that mean cost of shrimp production per acre is more than double of paddy production (Table 1).

Table 1. Economic cost of production.

Production cost (US\$/acre)	Year			Average
	2006	2007	2008	
Shrimp (N=30)	321	333	376	343
Paddy (N=30)	164	169	169	167

Source: Field Survey, 2012.

3.2. Economic Return from Production

The calculation of economic return from shrimp and paddy production requires data of price and corresponding quantity. This study considers average market price data and average production data collected from the field survey on the sample

¹ For land owner farmers, the lease cost of the adjacent land is considered as land cost.

² Total area of Dacope upazilla is around 991.58 sq. km having nine unions. Number of farmers in the upazilla is around 24,000.

farmers. According to Table 2, the return from shrimp production is lower in the year 2008 compared to that of year 2007. However, the return from paddy production is higher in the year 2008 compared to other two years. The mean return from shrimp production is about 2.5 times higher than that of paddy production.

Table 2. Economic return from production.

Items	Year			Average
	2006	2007	2008	
Average price of shrimp (US\$/kg)	4.51	4.51	5.15	4.72
Average price of paddy (US\$/kg)	0.26	0.26	0.27	0.26
Shrimp production (kg/acre)	123	131	111	122
Paddy production (kg/acre)	880	880	840	880
Shrimp production (US\$/acre)	552	592	573	572
Paddy production (US\$/acre)	225	227	231	228

Source: Field Survey, 2012.

N. B.: N=30 (Shrimp farmers), N=30 (Paddy farmers).

3.3. Benefit-Cost Ratio (Economic)

Calculation of the BCR of shrimp and paddy production includes Total Cost (in US\$/acre) and Gross Revenue (in US\$/acre). Table 3 illustrates the BCR and NR of shrimp and paddy production. According to the survey findings, both Gross Revenue (GR) and Total Cost (TC) of shrimp production are higher than that of paddy production. The NR from shrimp production is also higher than that of paddy production (Table 3). The calculated values of BCR for both the shrimp and paddy productions are greater than one and the value is comparatively higher for shrimp production than that for paddy production.

Table 3. Economic analysis of production.

Economic indicators	Unit	Shrimp	Paddy
Gross Revenue (GR)	US\$/acre/Year	572	228
Total Cost (TC)	US\$/acre/Year	343	167
Net Revenue (NR) = GR-TC	US\$/acre/Year	229	61
Benefit-Cost Ratio = GR/TC	Ratio	1.67	1.36

Source: Field Survey, 2012.

N. B.: N=30 (Shrimp farmers), N=30 (Paddy farmers).

3.4. Social Benefit-Cost Ratio

In addition to production cost, there are many other unaccounted and unaddressed costs of shrimp production, which have negative impacts on soil productivity, human health, biodiversity, watersheds and society. For example, land degradation, mangrove destruction, biodiversity loss, health hazard and change in hydrology of watershed are notable in this regard. Among these, the costs of land degradation due to shrimp culture in Bangladesh are captured in this study. Introduction of shrimp culture in the paddy field hampers paddy production. Another cost of land degradation is restoration cost [3]. The restoration system requires some technology and cost of this technology is called reclamation cost of shrimp production. The main elements of the technology involve: a) installation of deep drains to lower the water table, b) leaching of salinized areas requiring the

application of non-saline water in amounts considerably in excess of the irrigation requirement and c) treatment of sodic soil with gypsum [3].

This study considers both primary and secondary information to calculate social BCR of shrimp production. Calculations of direct costs and benefits of shrimp production consider primary data collected from the field survey in 2012. For indirect cost of shrimp production, this study considers secondary data. The study [3] assumes that land degradation arising from salinity due to shrimp culture in Bangladesh is of moderate degree: 45 percent loss in production of paddy per acre. According to the field survey findings, the production of paddy is 880 kg per acre (Table 2). Assuming that the field survey and secondary information are true, production loss is 396 (=880*0.45) kg Aman paddy per acre. As the average market price of Aman paddy is 0.26 US\$ per kg (Table 2), the monetary value of this production loss is 102US\$ per acre. Moreover, the study [3] assumes that the reclamation or restoration cost for degraded land in shrimp cultivating area of Bangladesh (except Chittagong) would be 30 million US\$ and estimated shrimp cultivated area coverage (except Chittagong) is 116 (=145*0.80) thousand hectare. Therefore, the resulting reclamation or restoration cost is approximately 105US\$ per acre (Table 4).

Table 4. Social BCR of shrimp production.

Items	Unit	Value
Direct Costs of shrimp production		
Total Cost of production	US\$/acre	343
Indirect Costs of shrimp production		
Cost of production loss basis	US\$/acre	102
Restoration cost basis	US\$/acre	105
Total Cost (TC)	US\$/acre	550
Direct Benefits of shrimp production		
Gross Revenue (GR)	US\$/acre	572
Net Revenue (NR = GR - TC)	US\$/acre	22
Benefit-Cost Ratio (BCR = GR/TC)	Ratio	1.04

Source: Authors' Compilation.

Adding direct and indirect costs generate a higher cost value and accordingly a lower NR value (Table 4) which signals a lower profit from shrimp cultivation. The calculated social BCR of shrimp production is 1.04. Adding other indirect cost components, such as health cost, loss in livestock, mangrove destruction and loss of biodiversity (as described in [3]) might generate a negative NR and less than one BCR value indicating loss in shrimp cultivation.

4. Conclusions

Paddy production is the traditional means of livelihood for a majority of the farmers of Bangladesh [16]. In contrast, shrimp production is a comparatively new practice in the country which has started its journey since 1980s. It is a traditional aquaculture in south-west coastal Bangladesh [17]. A short-run lucrative profit of shrimp production attracts the attention of the farmers. They

initially ignored the decrease in paddy productivity due to shrimp production.

The economic cost and return analysis show that the BCR of shrimp production is 1.67 and the BCR of paddy production is 1.36 (Table 3). However, the BCR of shrimp production including the costs of land degradation due to shrimp culture in paddy field is 1.04 (Table 4) which is very close to one and might decrease to less than one [18] after considering other unaccounted indirect costs. The environmental impact of shrimp production on land is very much hazardous. Shrimp production has negative externality on society. The external social cost of shrimp production falls upon other party rather than the shrimp producer. So, by considering economic and external costs and benefits of shrimp culture, it can be concluded that, the costs of shrimp production might be higher as compared to the benefits from it. The benefits of shrimp production are limited within export earnings and employment generation, whereas the costs of shrimp production are multi-dimensional.

The farmers in the study area have identified a gradual declining trend of shrimp production over the time period against a comparatively stable paddy production. Moreover, some farmers have realized the external and indirect costs of shrimp farming which are mostly unobserved, invisible and ignored. As a result, the farmers are again attempting to shift towards paddy production. However, the shrimp expansion led salinity intrusion creates constraints in the said shift in some cases. The farmers are handling the constraints and gradually moving back towards the traditional paddy production in the south-west coastal region of Bangladesh. An active cooperation of government through limiting shrimp cultivation in some selected saline areas and through enforcing associated rules and regulations might be helpful for the farmers of the south-west coastal region to protect their livelihood and efficiently re-solve the shrimp-paddy conflict.

Acknowledgements

The authors acknowledge to the survey respondents for providing valuable information. Acknowledgements are also due to Economics Discipline, Khulna University, Bangladesh for granting permission to conduct the study as a partial fulfillment of BSS (Hons.) degree. However, the views expressed in this paper are those of the authors and do not necessarily reflect the views of the respondents or of the concerned organization.

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