

An Economic Study On Shrimp Farming, Land Utilization Pattern And Farmer's Perception In Coastal Belt In Bangladesh

Shuraya TASNOOVA¹ and Tomoyuki YUTAKA²

¹Faculty of Business Administration, Japan University of Economics,
Tokyo Shibuya Campus, 24-5 Sakuragaoka Town, Shibuya-ku, Tokyo 150-0031, Japan

²Dept of Agricultural Economics, Faculty of Agriculture, Kagoshima University,
1-21-24 Korimoto, Kagoshima 890 0065, Japan.

Abstract: Bangladesh is a Southeast Asian deltaic country highly vulnerable to the impacts of climate change, particularly sea-level rise and changes in runoff water. The coastal areas of the country are more vulnerable to a growing risk of pollution, floods, storm surges, wetland loss etc. The present study was carried out in the coastal areas of the Khulna region (Division) of Bangladesh. From 1990s commercial shrimp farming started in the coastal areas of the country and has become a valuable cash crop with earning of foreign currency through export. The shrimp farming industry has both positive and negative impacts on the coastal community. Due to salinity increase the agricultural crop production has reduced or destroyed in some places. Five hundred Household data were collected 13th sub-districts (Koyra, Dumuria, Fakirhat, Piakgacha, Mollahat, Satkira, Ashamuni, Dephata, Shamnager, fultola, Chitolmari, kaligong, Dakop) of Khulna, Berghat and Satkira districts in Khulna division in Bangladesh during July 2010 to December 2010 purposively. Farmer's perception and attitude on shrimp farming impacts in these regions were considered. In some cases, the small agricultural crop land owners were forced to lease their land to the influential shrimp farmers to construct big shrimp farms. Two species of shrimps are generally farmed: the giant freshwater shrimp, locally known as golda chingri (*Macrobrachium rosenbergii*) and the brackish and marine water species, the tiger shrimp, locally known as bagda chingri (*Penaeus monodon*). In the coastal areas the tiger shrimps are mostly farmed. The farming practice ranges from traditional to semi-intensive systems. Before the start of the shrimp farming the coastal lands were used only for agricultural crop farming, mainly rice and vegetables. In subsequent years they farmed shrimp in one season and agricultural crops in the other season, or shrimp and rice together. But over the decades the soil in the coastal shrimp farming areas has degraded due to saline water intrusion and the farmers' choices on agricultural crop farming has been reduced. The research findings indicate that the adoption of shrimp farming in the coastal belt of the Khulna region of Bangladesh has changed the cropping and land utilization patterns. Shrimp farming has become a profitable enterprise for most of the local people and improved their livelihood. Many interrelated enterprises have been established and employment opportunities created.

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Key words: Land utilization, Cropping pattern, Shrimp, Farming system

1. Introduction:

Contribution of fish farming is better in national development in Bangladesh. Many of the environmental and ecological problems associated with shrimp farming have been criticized. A large number of literatures argued that the shrimp farming has many negative environmental impacts including mangrove deforestation, salinisation of soil and water, depletion of wild shrimp and fish larvae stocks, coastal water pollution and lost of agricultural lands. Therefore, farmer's land utilization pattern and relation on product profit from each marketing channel are very important for sustainable agriculture development.

In Bangladesh, the crop rotation of food grain production, especially rice-based production system is apparently popular and this approach has appeared to be harmful in protecting the land productivity. At

present, rice covers about 75 percent of the cultivable land in Bangladesh. Area covers by other crops are as follows: pulses (4.64%), wheat (3.92%), oilseeds (3.77%), jute (3.71%), sugarcane (1.23%), potato (1.11%), fruits (0.84%) and vegetables (1.39%). The production system dominated by a single crop (i.e. rice) is neither scientific nor acceptable from the economic point of view. It is therefore, necessary to increase the cultivation and production of other crops. However, it considers the increasing demand for food grains and with a view to ensure food security. In order to increase crop production, supportive programs has been taken to rise per hectare yield through the use of modern technology and improved cultural practices along with the increased use of high yield variety (HYV) seeds. Agriculture is the main source of livelihood of two-third of the rural population; a

serious concern has arisen about the sustainability of agriculture in the face of deterioration of land quality, declining yield, and increased population. Being a land-scarce country, emphasis has been given to increase food production by intensifying the use of land, inorganic fertilizers, pesticides and water. Subsidies are provided on inorganic fertilizers, pesticides, and irrigation equipment to enable farmers to adopt these technologies for increasing crop yields. This has caused major changes in cropping patterns, use of agricultural inputs, and management of soil fertility. Likewise, cropping intensity and the area under irrigation and HYV paddy have all increased considerably. Use of inorganic fertilizers increased six times during 1970–90, and the use of pesticides increased about three fold in just one decade, during 1982–92.

Farmer's point of view in Bangladesh, shrimp and other high value of agricultural export products farming are profitable because farmers get better price. But, high value of agricultural product's export quantity is very small. Domestic marketing systems have been a major constraint to Bangladesh agricultural growth and its potential to reduce poverty. Market is localized, price fluctuates frequently, market is control by market intermediaries, and input price is high in commodity markets. Markets are generally restricted by limited market infrastructure, transport and accessibility, better pricing mechanism, ineffective market institutions and system (channel, linkages and function), and disabling elements in the policy environment which indicate the market standard. This research project will try to find out a relationship between farmers marketing channel and land utilization pattern. Therefore, hypothesis of the study, shrimp farming is profitable because of good export system for farmers. Hence, shrimp production has increased. On the other hand, profit from existing marketing channel is small. Land use of rice production has decreased. This has negative impact for environment. If rice marketing system improves, rice farming would be profitable. Therefore, rice production would not decline. It may be environmentally friendly.

The broad objective of the proposed study is to find out the relationship between farmers' land utilization pattern and individual product market. Cost and return will be calculated for analyzing the profitability of different shrimp crop farming system.

Most of the literatures have been done on the reproductive behavior, strategies, embryonic development, soil degradation, agricultural technology adoption, impact of shrimp farming, impact of rice prawn farming, shrimp farming in Bangladesh as well as safety issues (Tasnova et al., 2015, Tasnova et al., 2014, Swapan and Gavin, 2011; Paul and Vogl, 2011; Ahmed, 2008; Akhand and Hasan, 1992; Ali, 2006;

Azad et al., 2005; Azad et al., 2007; Azam et al., 2010; Banks, 2003; Chanda, 1997; Deb, 1998; Hossain, et al., 2007; Hossain and Islam, 2007; Hossain et al., 2000; Giap and Lin CK, 2005; Hossain, 2001; Hossain and Islam, 2006; Islam, 2003; Islam, 2008; Ito, 2002; Ito, 2004; Ito, 2005; Ito, 2007; Ahmed et al., 2008; King, 1989; Nandeasha, 2003). However, in Bangladesh, a few study done on land utilization pattern, individual product market and profitability.

2. Methodology of the Study:

For this study, data and information were collected from both primary and secondary sources. Five hundred Household data were collected 13th sub-districts (Koyra, Dumuria, Fakirhat, Piakgacha, Mollahat, Satkira, Ashamuni, Dephata, Shamnager, fultola, Chitolmari, kaligong, Dakop) of Khulna, Berghat and Satkira districts in Khulna division in Bangladesh during July 2010 to December 2010 purposively. Farmer's perception and attitude on shrimp farming impacts in these regions were considered.

During the survey, three type of farming system have been found in this region.

- i. Only shrimp farming (OS) (70 households)
- ii. Rice shrimp farming (RS) (169 households)
- iii. Rice shrimp vegetables and fruits farming (RSVF) (261 households)

Semi-structured interviews were also conducted with personal of other stakeholder organizations. Besides, secondary data and information were collected from various organizations as well as from published and unpublished sources of government agencies and trade organizations in Bangladesh in the type of documents, reports, handouts, notifications, etc. having relevance with this study. The data and information from all these field surveys, were summarized which were used to write this paper.

After tabulation, necessary adjustments were made such as local unit like land area *bhiga* were converted in *hectare*. The converted data were summarized, and tabulated in accordance with the objective of the study. In Bangladesh the rural household activities and income are not generally recorded, it is difficult to estimate household income accurately, particularly for unpaid household activities. Therefore, the hired labors and paid money for machinery (tractors, water pump etc.) were considered as cost items. Most rural households have many expenditure and saving activities for family consumption such as rice, fish, vegetables, fruits, poultry, duck and livestock rearing, fishing nearby swamplands and canal etc. Therefore, only the selling quantities were considered as income and buying quantities were included in cost items. The present study has other limitations. In the study areas,

especially for rice shrimp farming (RS) and Rice shrimp vegetables and fruits farming (RSVF), farmers produced *Bagda* and *Golda* in separate pond or used same pond together. They don't have any record for separate for cost and return each pond/*gher*. They told total production quantity, cost and return for rice and shrimp farming per year. Some farmers were scared to give the proper information to unknown persons. The farmers may have thought that the researchers are government officers and came to collect tax. Therefore, the researchers didn't collect the information from these types of farmers. Only shrimp farming (OS), Rice shrimp farming (RS) and Rice shrimp vegetables and fruits farming (RSVF) are practiced only in southwest coastal belt in Bangladesh particularly in greater Khulna division. Khulna, Bagerhat and Satkhira districts are well-known and farmers are practicing those tree types of farming in these three districts in Khulna division. Farmers each product marketing information has been collected.

Why farming system were categorized in three types?

In Bangladesh, there are two types of shrimp that are cultivated.

- i. *Bagda* (Salt water shrimp) or (*Penaeus monodon*)
- ii. *Golda* (Freshwater shrimp) or (*Macrochium rosenbergii*)

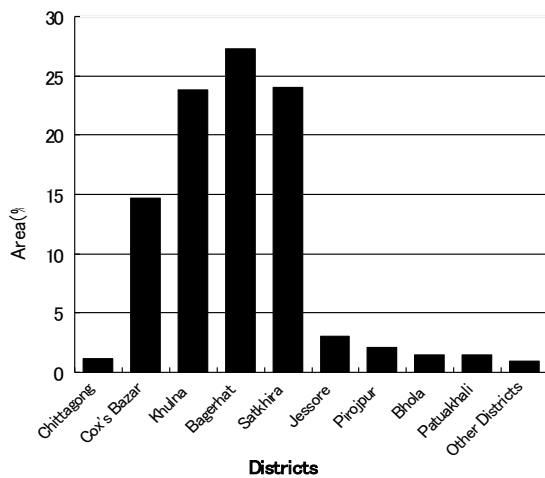


Fig. 1. Percentage of shrimp farming area in Bangladesh 2005-06

Source: Statistical Year Book Bangladesh 2008

Shrimp culture started in Bangladesh in the coastal district of Satkhira in 1960s. Gradually its culture expanded to the coastal belts of Khulna, Bagerhat, Cox's Bazar and Chittagong and now the area under shrimp culture has increased from 52,000 ha in 1982-83 to 270,000 ha in 2007-08 (Bangladesh Frozen Food Exporters Association, BFFEA, 2009).

About 90% shrimp land is located in the Khulna, Bagerhat, Satkhira and Cox's Bazar districts in the south-eastern region of the country which is shown in figure 1.

The *ghers* which are traditional earthen ponds or fields situated by riversides and impounded by dykes (Islam et al., 2005; Ahmed et al., 2008). For Aman rice, a *gher* is used to grow rice between the month of August and December/January, and shrimp culture is practiced during the month of February to July/August. For Boro rice, a *gher* is used to grow rice between the month of January and March/April, and shrimp culture is practiced during the rest of the months. The rapid growth of *gher* farming has negative environmental impact which is short term and long term impact such as land degradation and salt water intrusion, pollution, loss of capture fishery stock and seed supply, diseases and danger of imported fry and genetic alternation. Other problems have arisen (social, economical and institutional) with environmental problem. Therefore, some parts of coastal belt, farmer can only produce *Bagda* shrimp and some of them produce *Bagda* shrimp around the year. But 25 years ago in this land they could produce everything like all crops, rice, vegetable, shrimp and fruit and 12 years ago they could produce rice and *Bagda* shrimp. Now they can't produce anything but *Bagda* shrimp. *Gher* farming in those regions has expanded in late 1980s. Therefore, cropping pattern, land holding size, land tenant and farming system system have been changed. Before, shrimp (*Bagda* and *Golda*) were cultured separately. Recently, some farmers produce nothing except *Bagda* shrimp. Some of them are producing shrimp (*bagda*, *golda*) and rice together with the same land which was categorized as rice shrimp farming (RS). They produce *Bagda* and rice or *Golda* and rice or *Bagda*, *golda* and rice. Some of them are using their land more intensive. They are producing rice, shrimp (*bagda*, *golda*), vegetables and fruits in dyke of the *gher* or pond which was categorized as rice shrimp vegetables and fruits farming.

Cropping pattern of the study areas:

Table 1 shows Cropping pattern of the before and after shrimp farming in the coastal belt in Bangladesh. Before shrimp farming farmers produced all crops, jute, all vegetables and fruit. Now, farmers changed the producing products items. Firstly, they preferred to produce shrimp because high market value and price and secondly they also produce rice because of staple food in Bangladesh. Some farmers also utilizing their land very intensively and they were produced vegetables and fruits in the ponds/*ghers* dyke. They also used net to produce vegetables besides shrimp (*Bagda* and *golda*) farming. The following the cropping pattern has been found for rice shrimp farming (RS), Rice shrimp vegetables and fruits

farming (RSVF) and OS farming which are shown in Figure 2.

Table 1: Cropping pattern of the before and after shrimp farming

Item	RS Farming		RSVF farming		OSF farming	
	B.S Farming	Presently	B.S Farming	Presently	B.S Farming	Presently
Cultivated product	Rice and other crops, jute vegetables, fruits	shrimp (<i>Bagda</i> , <i>Golda</i>), Rice,	Rice and other crops, jute vegetables, fruit	shrimp (<i>Bagda</i> , <i>Golda</i>), Rice, vegetables, fruit	Rice and other crops vegetables, fruits	Only shrimp Bagda
Selling place	Local market	For shrimp, local market and farm gate But for rice only local market	Local market	For shrimp, local market and farm. For others only local market	Local market	For shrimp, local market and farm gate

Source: Field survey, 2010

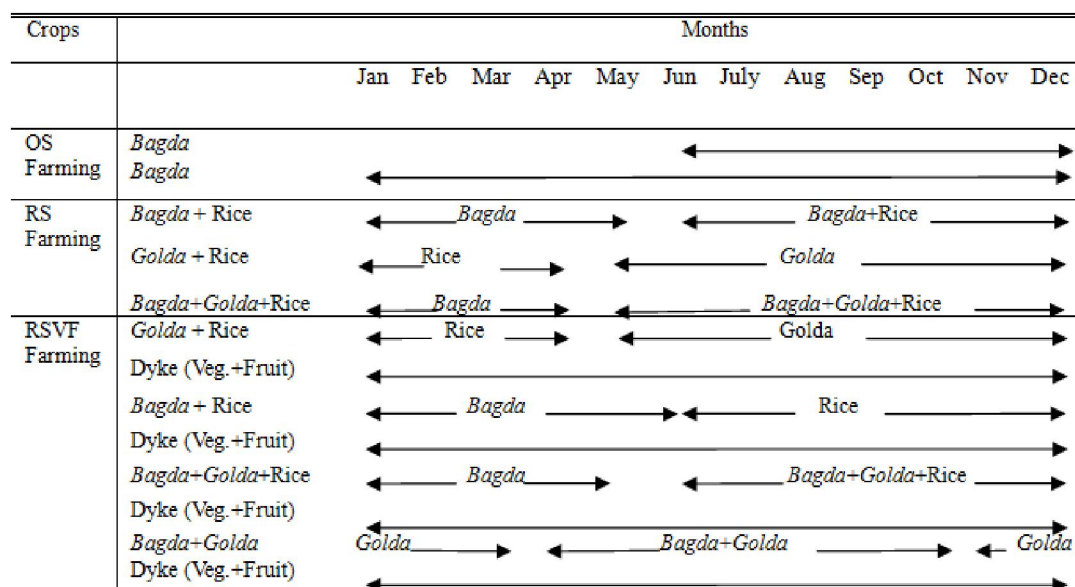


Figure 2: Recent cropping pattern of the shrimp farming

Source: Field survey, 2010

3. Result and Discussion:

Land area (ha) for respondents before and after shrimp farming:

Table 2 shows land area for respondents before and after shrimp farming. Farmers were categorized according to their present cropping patterns and land utilization patterns and location of land. OS farming land is closer to coastal belt and low lying areas. Before and after shrimp farming total land area was higher (3.71 and 10.10 ha) for OS farming. Before shrimp farming their own and lease in land area was 3.81 and 1.32 ha respectively. Rich farmers/land lords started shrimp farming in 1980s in their low lying areas in coastal belts in Bangladesh due to higher market price, demand and higher profit from shrimp framing. Initially, that time farmers were produced all crops besides shrimp (*Bagda*) farming. After observing their profit, other farmers started shrimp farming in these regions. Their own and lease in land area was increased

(7.09 and 2.93 ha). Now some part of these coastal belt people can't grow anything except shrimp because of environmental problems (such as water logging, restricted floodplain inundation with associated reductions in soil fertility, subsidence of land within polders, siltation of rivers and canals and increased saline intrusion) which created by long time culture of shrimp farming and construction of embankments and polders during 1960s. Before, farmers produced shrimp (*Bagda* and *Golda*) separately, now farmers used same pond or separate pond for producing two types of shrimp beside rice.

RS farming and RSHVF farming land are not as low as OS farming land. RS farming farmer's farm size was not so big which was 0.88 ha and 1.72 ha before and after shrimp farming respectively. Their own land area was increased (0.84 ha to 1.51 ha) because of good return from shrimp farming.

Table 2: Land area (ha) for respondents before and after shrimp farming

Item	RS Farming (169)		RSVF farming (261)		OS farming (70)	
	B.S Farming	Presently	B.S Farming	Presently	B.S Farming	Presently
Total land	0.88	1.72	0.76	1.57	3.71	10.10
Own	0.84	1.51	0.73	1.30	3.81	7.09
Lease in	0.82	0.25	0.37	0.25	1.32	2.93
Lease out	0.09	0.08	0.25	0.02	1.10	0.00

Source: Field survey, 2010

RSVF farming farmer's farm size was not also so big which was 0.76 ha and 1.57 ha before and after shrimp farming. Their own land area was also increased (0.73 ha to 1.30 ha) and their lease in (0.37 ha to 0.25 ha) and lease out land (0.25 to 0.02 ha) were declined.

Net return for rice shrimp farming in Bangladesh per ha/yr:

Table 3 shows net return from different farming systems in Bangladesh. Net return was the lowest for OS farming farmers (Tk.109,764) per ha/year. For the environmental problems, farmers weren't produced any other agricultural crops except shrimp (*Bagda*). Some

of the OS farming farmers were produced *Bagda* shrimp June to December and rest of them tried to produce *Bagda* shrimp around the year.

For RS farming and RSVF farming farmer's net return were Tk.185,287 and Tk. 236,089 respectively and their net return was two times higher than OS farming farmers. Both farming systems, farmers were cultured Shrimp (*Bagda*, *Golda*) together or separately and they were used the same field for producing rice. But RSVF farming farmers used their land more intensively and they were produced diversify vegetables and fruits in their ponds/*ghers* dykes or using the net for vegetable farming.

Table 3: Net return from different farming systems in Bangladesh ha/yr

Item	RS Farming (169)	RSVF farming (261)	OS farming (70)
Return for shrimp			
<i>Bagda</i>	122,266	120,360	128,286
<i>Golda</i>	103,454	160,435	0
Others	13,977	9,093	9,065
Vegetables	0	1,036	0
Fruit	0	456	0
Total Return from shrimp (A)	239,717	291,380	137,351
Return from rice (B)	23,098	34,696	0
Total return for rice shrimp C= (A+B)	262,815	326,076	137,351
Total cost for shrimp farming (D)	68,096	73,458	27,587
Total cost for rice farming (E)	9,432	16,529	0
Total cost for rice shrimp farming F=(D+E)	77,528	89,987	0
Net return for rice shrimp farming G= C-F	185,287	236,089	109,764

Source: Field survey, 2010

Though, the net return was very few from vegetables and fruits. Net return was higher for the RSVF farming farmers than RS farming farmers because input cost was higher for RSVF farming farmers. Now, table 4 and table 5 were shown the cost and return for different farming systems.

Table 4 shows the cost and return for rice for RS and RSVF farming systems.

For both farming systems, the highest cost for rice was human labor cost which was Tk.5,442 for RS farming and Tk.6,831 for RSVF farming farmers. For RS farming farmers, second highest cost was for seedling (Tk.1,046). For RSVF farming farmers, second highest cost was for urea (TK. 2,621) and they

were used higher input for rice farming than RS farming farmers. The total cost (TK.16,529) for RSVF farming farmers was about two times higher than RS farming farmers cost (TK. 9,432). Therefore, total (TK.34,696) and net return (TK.18,167) for RSVF farming farmers were higher than RS farming farmers total (TK.23,098) and net return (TK.13,667) respectively.

Table 5 shows the cost and return for shrimp for RS, RSVF OS farming systems. To examine the cost and return for shrimp for RS, RSVF OS farming systems, the total cost was highest for the RSVF farming farmers (TK.73,458) than RS (TK. 68,096) and OS farming farmers (TK. 27,587) per ha per year.

To compare the average cost, RS and RSVF farming farmers cost were more than two times higher than OS farming farmers cost.

The total return was also highest for the RSVF farming farmers (TK.291,380) than RS (TK. 239,717) and OS farming farmers (TK. 137,351) per ha per year.

To compare the average total return, RSVF farming farmer's total return was more than two times higher than OS farming farmer's total return and for RS farming farmer's total return was more around two times higher than OS farming farmers total return.

Table 4: Cost and Return for rice for rice shrimp farming in Bangladesh ha/yr

Item	RS Farming (169)	RSVF farming (261)	OS farming (70)
Total Return from rice	23098	34,696	0
Cost items			
Seedling	1,046	2,445	0
Human labor	5,442	6,831	0
Power tiller	385	492	0
Urea	399	2,621	0
TSP	429	650	0
MP	632	2,073	0
Cow dung	92	311	0
Irrigation	697	873	0
Insecticide	310	233	0
Total cost (B)	9,432	16,529	0
Net return= (A-B)	13,667	18,167	0

Source: Field survey, 2010

Table 5: Cost and Return for shrimp for rice shrimp farming in Bangladesh ha/yr

Item	RS Farming (169)	RSVF farming (261)	OS farming (70)
Total return from shrimp	239,717	291,380	137,351
Cost items			
Fingerling			
<i>Bagda</i>	4,889	3,767	3,304
<i>Golda</i>	3,679	4,680	0
Others	2,371	1,011	1,119
Human labor	13,792	20,022	8,251
Urea	150	252	104
TSP	127	215	28
MP	65	211	6
Cow dung	153	408	2
Fish meal	8,631	3,774	918
Rice bran	1,694	1,967	3,031
Formulated feed	5,418	6,443	0
Snail	499	212	0
Lime	752	1,144	28
Lease in	25,876	29,120	10,796
Vegetable cost	0	147	0
Fruit	0	85	0
Total cost (B)	68,096	73,458	27,587
Net return= (A-B)	171,621	217,522	109,764

Source: Field survey, 2010

To compare the average net return, the net return was highest for the RSVF farming farmers (TK.217,522) than RS (TK. 171,621) and OS farming farmers (TK. 109,764) per ha per year. RS and RSVF farming farmer's net return were more than two times

higher than OS farming farmer's net return.

4. Farmer's perception and attitude on shrimp farming impacts in these regions:

According to the perception and attitude on shrimp farming impacts, positive and negative impacts

were found in these regions. Four types of impacts were considered for shrimp farming which were as follows:

1. Environmental impact
2. Social impact
3. Economical impact and
4. Institutional impact

Those four types of impacts were shown in table 6, Table 7, table 8 and table 9. Table 6 shows different farmer's perception and attitude on shrimp farming

impact (environmental impact) in these regions. RS and RSFV farming is still okay for farmers but 100 percent OS farmers were suffered bad environmental impact. Large numbers of RS, RSFV and OS farming farmers weren't known what kind of bad impact occurred for shrimp farming in these regions such as land degradation, water logging, ecological problems etc. For the sustainability of shrimp farming environmental awareness is very important in these regions.

Table 6: Different farmer's perception and attitude on shrimp farming impact (environmental impact) in these regions

Items	RS Farming (169) (%)			RSFV farming (261) (%)			OS farming (70) (%)		
	1	2	3	1	2	3	1	2	3
Environmental impact:									
Is shrimp farming hampering mangrove ecosystem?	59	18	23	76	8	16	86	7	7
Is shrimp farming creating land degradation?	30	18	52	29	4	67	57	14	29
Is shrimp farming has sedimentation?	30	18	50	27	6	67	47	17	36
Is shrimp farming creating pollution	35	15	50	31	19	50	64	7	29
Is shrimp farming creating water logging problems	24	24	52	19	15	66	100	0	0
Is shrimp farming creating natural seed crisis	100	0	0	100	0	0	100	0	0
Loss of capture fishery stock	28	20	52	29	17	54	70	1	29
Is salt water intrusion creating for shrimp farming?	24	18	58	27	23	50	86	3	11
Do the imported fry and genetic alternation danger for environment?	30	18	52	23	17	60	43	43	14
Does shrimp farming has diseases risk?	100	0	0	100	0	0	100	0	0
In <i>gher</i> farming, are applications of agrochemical, antibiotics and disinfect creating environmental problems?	30	18	52	25	16	59	14	14	72
Do you think, shrimp farming zone can protect the future more environmental threat?	30	0	70	17	23	60	50	11	39
Do you think, you should more concern about the environmental impact of shrimp farming?	100	0	0	100	0	0	100	0	0
Are you facing bad impact of shrimp farming?	0	100	0	0	100	0	100	0	0

1= Yes, 2= No and 3= I don't know/sometimes

Source: Field survey, 2010

Table 7: Different farmer's perception and attitude on shrimp farming impact (social impact) in these regions

Items	RS Farming (169) (%)			RSFV farming (261) (%)			OS farming (70) (%)		
	1	2	3	1	2	3	1	2	3
Social impact:									
Is shrimp farming creating social problems	12	18	70	15	19	66	89	11	0
Is shrimp farming creating land conflicts in these regions?	100	0	0	100	0	0	100	0	0
Is shrimp farming creating water sharing problems?	35	59	6	19	58	23	72	14	14
Is it improving the livelihood condition?	100	0	0	100	0	0	100	0	0
Is it improving children education?	100	0	0	100	0	0	100	0	0
Is it improving housing status?	100	0	0	100	0	0	100	0	0
Is it improving the infrastructure development?	100	0	0	100	0	0	100	0	0
Is it alleviating poverty in these regions?	100	0	0	100	0	0	43	43	14

1= Yes, 2= No and 3= I don't know/sometimes

Source: Field survey, 2010

Table 7 shows different farmer's perception and attitude on shrimp farming impact (social impact) in these regions. RS and RSFV farming farmers were

faced less social problems for shrimp farming, but 89 percent OS farmers were agreed that shrimp farming created social problems (land conflicts, water sharing

problems) in these regions. One hundred percent RS, RSFV and OS farming farmers were also agreed that shrimp farming were improved the livelihood condition, children education, housing status of the respondents and infrastructure development in these regions as well as hundred percent RS and RSFV farming farmers and forty-three percent OS farming farmers agreed that shrimp farming were contributed alleviating poverty in these regions. Therefore, RS and RSFV farming were still more sustainable than OS shrimp farming in these regions.

Table 8 shows different farmer's perception and attitude on shrimp farming impact (economical impact) in these regions. Hundred percent RS, RSFV and OS

farming farmers agreed that shrimp farming were changed the land utilization patter and cropping patterns in these regions. One hundred percent RS, RSFV and OS farming farmers also answered yes that shrimp farming were profitable. Hundred percent RS and RSFV farming farmers answered yes that present cropping pattern were profitable than before. But hundred percent OS shrimp farming were answered no because of negative impact of producing others crops (rice, vegetables, fruits) and livelihood (pure drinking water and bad impact of livestock and poultry). Therefore, RS and RSFV farming were still more sustainable than OS shrimp farming in these regions.

Table 8: Different farmer's perception and attitude on shrimp farming impact (economical impact) in these regions

Items	RS Farming (169) (%)			RSFV farming (261) (%)			OS farming (70) (%)		
	1	2	3	1	2	3	1	2	3
Economical impact:									
Does shrimp farming change the land utilization and cropping patterns in these regions?	100	0	0	100	0	0	100	0	0
Are Present cropping pattern profitable than before?	100	0	0	100	0	0	0	100	0
Is shrimp farming profitable?	100	0	0	100	0	0	100	0	0
Is shrimp farming creating employment opportunities?	100	0	0	100	0	0	100	0	0
Is shrimp farming creating income generating opportunities?	100	0	0	100	0	0	100	0	0
Is shrimp farming creating other linkage industries?	100	0	0	100	0	0	100	0	0
Does shrimp farming has negative impact on livestock and poultry?	0	100	0	0	76	24	72	4	24
Does shrimp farming has negative impact on paddy production?	0	100	0	0	100	0	100	0	0
Does shrimp farming has negative impact on vegetables production?	52	30	18	0	100	0	100	0	0
Does shrimp farming has negative impact on fruits production?	52	30	18	0	100	0	100	0	0
Do you think, shrimp farming have sustainability in these regions?	100	0	0	100	0	0	100	0	0
Do you think, shrimp farming can contribute for food security these regions?	100	0	0	100	0	0	50	26	24

1= Yes, 2= No and 3= I don't know/sometimes

Source: Field survey, 2010

Table 9 shows different farmer's perception and attitude on shrimp farming impact (institutional impact) in these regions. Hundred percent RS, RSFV and OS farming farmers answer was yes on institutional need for shrimp farming in these regions. Only twelve percent RS, eleven percent RSFV and twenty-nine percent OS farming farmers answer were yes for getting institutional help (credit, training and support on farming systems and managements from extension officers, rules and regulation etc) in these regions for shrimp farming. A better institution can

make better rules and regulations and proper implementation of the better rules and regulations improve the efficiency of any aspect and provide sustainability. Hundred percent RS, RSFV and OS farming farmers agreed that shrimp farming has high risks and they also believed that farm insurance reduces risk of shrimp farming and better work of law enforcement institute can reduce the social and institutional problems for shrimp farming in these regions. Most of them were no idea of shrimp producing zone in these regions.

Table 9: Different farmer's perception and attitude on shrimp farming impact (institutional impact) in these regions

Items	RS Farming (169) (%)			RSVF farming (261) (%)			OS farming (70) (%)		
	1	2	3	1	2	3	1	2	3
Institutional impact:									
Do you need institutional help for shrimp farming?	100	0	0	100	0	0	100	0	0
Do you get institutional help for shrimp farming?	12	77	11	11	80	9	29	64	7
Are training is available for shrimp and rice shrimp farming from agriculture and fisheries office?	0	100	0	0	100	0	0	100	0
Is institutional credit available for shrimp and rice shrimp farming?	0	100	0	0	100	0	0	100	0
Do you know the all rules and regulations for shrimp farming?	48	28	24	50	50	0	50	50	0
Do you follow the all rules and regulations for shrimp farming?	12	48	40	50	50	0	50	50	0
Do you think agriculture and fisheries extension officers are available for farmers?	0	100	0	0	100	0	0	100	0
Do you think shrimp farming has high risk?	100	0	0	100	0	0	100	0	0
Major risks for shrimp farming (virus diseases, flood, cyclone and theft)	100	0	0	100	0	0	100	0	0
Do you think, farm insurance is good way to reduce the risk?	50	0	50	50	0	50	100	0	0
Do you think, better work of law enforcement institute can reduce the social and institutional problems for shrimp farming?	100	0	0	100	0	0	100	0	0
Do you know about, the idea of shrimp producing zone?	6	94	0	4	96	0	10	90	0

1= Yes, 2= No and 3= I don't know/sometimes

Source: Field survey, 2010

5. Conclusion:

From the above discussions the following conclusion can be drawn

1. After, adopting shrimp farming land utilization patterns and cropping patterns has changed in both ways positively and negatively. Among the three (RS, RSFV and OS) farming systems, RS and RSFV farming farmers have positive change. Before shrimp farming RS and RSFV farming farmers have produced all crops in these region and still they can produce all crop. RSFV farming farmers have diversified their farm and utilized their land more intensively. But, OS farming farmers have lost their crop production diversification which is the negative impact of shrimp farming.

2. Before and after shrimp farming, there was no change on crop (rice, vegetables and fruits) marketing system and still they are selling their crops in local markets. But after shrimp farming, only for shrimp (*Bagda* and *Golda*) farmers sells their product at farm gate/ local markets.

3. Among the three (RS, RSFV and OS) farming systems, RS and RSFV farming farmers average farm size was smaller than OS farming farmers

land size. After shrimp farming all farming systems farmer's average total and own land area have increased.

4. Three (RS, RSFV and OS) farming systems were profitable. For shrimp, among the three (RS, RSFV and OS) farming systems, RSFV farming system is more profitable than RS farming system because of higher input cost. Here, human labor cost, Urea, TSP, MP, cow dung, formulated feed and lime cost were higher than RS and OS farming which increased the productivity of shrimp. Lease cost was higher for the RSFV farming than RS and OS farming. Though, the profit from vegetables and fruits were very low in RSFV farming, but farmers were tried used their fallow dyke intensive. RSFV and RS farming may consider as improve extensive farming system. The lowest profit was come from OS farming system as well as their input cost was also lowest. They were produced only *Bagda* shrimp and it may consider as extensive farming system.

5. Comparison between RS and RSFV farming systems, rice framing was less capital intensive than shrimp farming. Per hectare total cost for rice and shrimp was higher for RSFV than RS farming farmers.

Here, the seedling cost, human labor cost and TSP cost were much higher for RSVF farming than RS farming. RSVF farming farmers used Urea and MP six times higher and more than three times higher than RS farming. Therefore, production was higher as well as net return for rice was higher for RSVF than RS farming farmers.

6. Among the three (RS, RSVF and OS) farming systems, RS and RSVF farming systems are more sustainable than OS farming system.

7. According to the farmers' perceptions and attitude on different aspect of impacts of shrimp farming, economically shrimp farming has big contribution on food security, employment opportunity, income generating opportunity, creating other linkage industries which is interrelated to social impact.

8. Though shrimp farming created some social problems. It also provided social advantages such as improvement livelihood, children education, housing status, infrastructure development and contributing alleviating poverty which are very important for sustainable development.

9. Considering institutional impact, all farmers had mixed opinions good and bad. Better institutional policy and proper implementation on these policies can make sustain shrimp farming systems in coastal belt in Bangladesh which government should care to make and implementing any policy for sustainable shrimp farming in coastal belt in Bangladesh.

There was no changed and improvement in rice, vegetables and fruits marketing channel. For rice, its price was very low. If it compares for RS farming, shrimp farming was more than twelve times profitable than rice farming and if it compares for RSVF farming, shrimp farming was around twelve times profitable than rice farming. If farmers use their land three times for production of rice, though wouldn't be profitable than shrimp farming. Therefore, high value export product shrimp (*Bagda* and *Golda*) were more profitable than rice farming. RS and RSVF farming are still environmentally friendly. OS farming is also profitable though it has environmental problems. Marketing problems are still as it is.

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