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SOCIOECONOMIC ANALYSIS ON FACTORS CONTRIBUTING TO HOUSEHOLD INCOME OF THE STAKEHOLDERS INVOLVED IN SHRIMP INDUSTRY OF BANGLADESH

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ABSTRACT

The present study made an attempt to determine the impact of major factors contributing to household income of the stakeholders involved in shrimp industry of Bangladesh. For this purpose, eleven different stakeholders such as shrimp farmers, land lessors, hatchery owners, depot owners, shrimp seed collectors, shrimp farm labourers, processing plant workers, hatchery workers, feed mill workers, depot workers and shrimp traders (*faria*) who are involved in production, processing and marketing of shrimp were selected from Khulna and Cox's Bazar regions. In total 220 stakeholders were selected and data were collected for the year 2005. Results of the study showed that household income of the stakeholders depends mainly on income earned from shrimp industry and with the involvement in farm and non-farm activities. Apart from these, there are other factors that also influenced the household income and they are number of earning members engaged in productive works, education and training, and size of holding (farm-size) of respective stakeholders. Regression analysis was performed by using log linear model which indicated that almost all the included variables had some positive impacts on household income and increasing returns to scale was observed for three groups of stakeholders living in coastal areas of Bangladesh.

I. INTRODUCTION

Development of shrimp industry played a vital role in changing the socioeconomic condition and livelihood of stakeholders engaged in shrimp industry of Bangladesh. Usually, the shrimp industry consists of four distinct subsectors viz., shrimp farms/gher, shrimp hatcheries, feed mills and shrimp processing plants (Islam *et al*, 2004). Shrimp farms are the mainstay of the industry and the activities of the other sub sectors depend largely on the growth and sustainable development of shrimp farms in the country.

Under the shrimp industry, there are 6581 shrimp farms covering 140000 ha. of costal land, 49 shrimp hatcheries, 115 shrimp processing plants, 1700 depots and 20 feed mills in Bangladesh (Sharmin, 2006 and DoF, 2005). Moreover, shrimp industry contributes significantly to the national economy of Bangladesh. In 2003-04, Bangladesh earned Tk

23634.7 million by exporting 54141 mt. fish products of which shrimp alone contributes more than 80 percent (DoF, 2005).

Shrimp farming offers an excellent employment opportunity through a series of backward and forward linkage activities and accordingly, different group of people (stakeholders) are directly and indirectly involved in shrimp industry and they are shrimp farmers, shrimp farm labourers and workers and owners of shrimp related industries (feed mill, processing plant, depot and hatchery), shrimp seed collectors, land lessors and shrimp traders. Commercial shrimp culture has created a substantial economic and social transformation in the shrimp belt of Bangladesh (Hamid and Alauddin, 1996). A large number of big *gher* owners, urban and semi-urban stakeholders have made a quick fortune by producing and trading shrimps. The gains of the big farmers and traders are alleged to have been achieved at the expense of the small/marginal farmers and the fisherman community. Alauddin and Tisdell (1996) reported an uneven distribution of gains from shrimp culture between big *gher* owners and the small land owners who lease out lands to the *gher* owners for shrimp cultivation. However, among these stakeholders, there is a large variation of income level earned from different works of shrimp industry. Depending on the nature of work and occupation they are involved, some of them belong to upper income group and some are lower income group, and some of them are middle income group. Moreover, all of them depend mainly on different sub-sectors of shrimp industry.

Developing shrimp industry has also opened up the avenues of new employment pattern both for rural and urban women. The emergence of commercial shrimp farming and the related backward and forward linkage activities have created new dimension for women's involvement in many of the activities. Shrimp depots are the largest source of employment for women. Karim and Aftabuzzaman (1995) reported that women represented 40 percent of depot workers. They also estimated that 45 percent of workers in the shrimp processing plants were women. Shrimp fry collection is also an important source of employment for rural women. In this context, Islam and Wahab (2000) conducted study to assess the socioeconomic and environmental impact of shrimp farming in Bangladesh. Few studies (Islam *et al*, 2004 and Talukder, 2004) documented the socioeconomic profile of stakeholders involved in aquaculture and shrimp industry of Bangladesh. Jahan *et al*, (2002) and Islam (1995) examined the nature and extent of women's participation in aquaculture and processing factories while Rahman (2003) compared the economic returns of year-round golda shrimp and alternate golda shrimp-rice farming. However, the present study determined the impact of major factors contributing to household income of the stakeholders involved in shrimp industry of Bangladesh.

This paper contains four sections. The first section is followed by section 2, which describes methodology and sources of data. Section 3 discussed the impact of major factors contributing to household income of stakeholders. Conclusions and policy recommendations are made in the last section.

II. METHODOLOGY

The study attempted to determine the impact of factors contributing to household income of stakeholders engaged in shrimp industry. However, considering the different activities performed and the section of people (stakeholders) engaged, the whole shrimp industry was divided into 11 sub-sectors where different categories of stakeholders were engaged as shown in Table 1.

Table 1. Sampling design and distribution of stakeholders involved in shrimp industry.

Stakeholders ¹ of shrimp industry	Sample households No.	Selected areas
Shrimp farmers	30	Satkhira and Teknaf
Land lessors	20	Teknaf and Paikgacha
Hatchery owners	15	Teknaf and Cox's Bazar
Depot owners	15	Teknaf and Paikgacha
Shrimp seed collectors	30	Teknaf and Cox's Bazar
Shrimp farm labourers	30	Teknaf and Paikgacha
Processing plants workers	20	Cox's Bazar
Hatchery workers	15	Cox's Bazar and Teknaf
Feed mill workers	15	Cox's Bazar
Depot workers	15	Teknaf and Paikgacha
Shrimp traders (<i>faria</i>)	15	Teknaf and Paikgacha
Total Sampled Stakeholders	220	-

Note : Upper income group : shrimp farmers, land lessors, hatchery owners and depot owners; middle income group: processing plant workers, hatchery workers and shrimp traders and lower income group : shrimp farm labourers, shrimp seed collectors, feed mill workers and depot workers.

Three study areas were purposively selected from Khulna, Satkhira and Cox's Bazar districts depending upon the concentration of shrimp farms and allied industry related to production, processing and distribution of shrimp products. The study areas included Paikgacha of Khulna, Shamnagar of Satkhira and Teknaf of Cox's Bazar district. From these districts, in total 220 stakeholders who are involved in different sub-sectors of shrimp industry were selected.

Data were collected through personal interviews with the selected stakeholders by field survey. Keeping the objectives in view, data and information were collected for the year 2005.

Stakeholders involved in different sub-sectors of shrimp industry were taken as the unit of analysis and they were classified into three groups depending on their level of income. The amount of income for upper income group stakeholders was higher (Tk. 138000-855000) followed by middle (Tk. 73000-99000) and lower income group (Tk. 35000-71000) (Sharmin, 2006). However, shrimp farmers, hatchery owners, shrimp farm labourers, hatchery workers and feed mill workers earned 70-84 percent of their income from shrimp related activities of shrimp industry. On the other hand, share of contribution of farm and non-farm

activities to household income was higher for land lessors, depot owners, shrimp seed collectors and depot workers.

The collected data were analyzed as per objective of the study and tabular analysis was used mainly based on average, percentage etc. However, functional analysis was used to reveal the quantitative relationships between dependent variables and set of explanatory variables. To determine the effects of the explanatory variables, linear and log linear models were initially estimated for household income. The log linear model was better in terms of expected signs and magnitudes of the coefficient, R^2 (adjusted) and F-values. So the parameter estimates obtained from log linear model were selected for interpretation. Many factors might affect household income of stakeholders but it is quite difficult to include all the variables in a model due to theoretical and economic considerations. So the important variables were included to keep the model as simple as possible. Care was taken to note that the included variables were not multi-collinear. To explore the relationship of household income, the selected variables were specified. Considering the household income and livelihood status of selected stakeholders and to make the analysis simple and meaningful, stakeholders were grouped and classified as upper income group, middle income group and lower income group (Table 1).

On the basis of these assumed conditions, the multiple regression function was specified as follows: $Y = f(X_1, X_2, X_3, X_4, X_5)$

$$\text{Household income, } Y = aX_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} e^u$$

The equation may be alternatively expressed as log-linear form:

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + U_i$$

Where, Y = Total annual income per household, Tk per year

X_1 = Income earned from shrimp industry's activities, Tk per year

X_2 = Farm and non-farm income, Tk per year

X_3 = Earning member, No. per household

X_4 = Farm size, ha per household

X_5 = Year of schooling of respective stakeholders

a = Intercept;

b_1 ----- b_5 = Co-efficients of respective variables; and

U_i = Error term.

III. RESULTS AND DISCUSSIONS

Demographic Profile of the Stakeholders

The family size and its composition are related to occupation and income. Table 2 shows that the average family size was relatively larger (5.60 – 6.80) for higher income group stakeholders such as shrimp farmers, land lessors, hatchery owners and depot owners. On the other hand, stakeholders working as workers and labourers maintained relatively smaller family size (4.64 – 5.45). With the small size of land and low income, workers in recent years have become aware of the need for small family size compared to higher income group stakeholders who are able to feed if they have more family members which the resource poor

can not (Islam *et al.*, 2004). Secondly, most of the resource poor stakeholders, i.e., workers maintain disjoined family which reduced the number of family members. However, considering all categories of stakeholders household, the average family size was 5.43 which appeared to be higher than the national average size 4.84 (BBS, 2004).

Table 2. Socioeconomic profile of the stakeholders.

Sample respondents	Family members No.	18-60 years (Earning members)		Fisheries training %	Experience in respective occupation %	Farm size (ha)
		No.	% of Total			
Shrimp farmers	6.80	4.42	65	68	80	8.22
Land lessors	5.95	3.70	62	-	90	2.26
Hatchery owners	5.70	3.52	67	100	85	2.04
Depot owners	5.60	3.23	58	100	95	2.67
Shrimp seed collectors	5.30	3.18	60	-	100	0.07
Shrimp farm labourers	5.15	2.98	58	-	100	0.37
Processing plant workers	5.30	3.29	62	100	100	0.44
Hatchery workers	4.64	2.25	50	90	95	0.61
Feed mill workers	5.45	3.10	57	35	65	0.65
Depot workers	4.74	2.89	61	40	85	0.50
Shrimp traders (<i>Faria</i>)	5.10	3.36	66	15	90	0.80
All stakeholders	5.43	3.27	60	70	90	1.45

The number of earning member is very important to generate income and to contribute to household income. Other factors such as fisheries training and job experience also made the respective stakeholders skilled and efficient which helped them to earn more from their present occupation. It is evident from Table 2 that, number of earning member per household and level of fisheries training for respective stakeholders were higher for upper income group stakeholders followed by middle and lower income group.

Land is the most essential asset for farm household because farm families depend mainly on the land. Shrimp farmers, land lessors and to some extent, hatchery owners and depot owners owned relatively larger farm size compared to other stakeholders who are resource poor. Average farm size varied widely between resource rich group of stakeholders (shrimp farmers, land lessors, hatchery owners and depot owners) and resource poor group of stakeholders (workers and labourers). Again, regarding farm size, there was a large variation among the resource rich stakeholders (2.04-8.22ha) but this variation was smaller among the resource poor stakeholders (0.07-0.80 ha). On an average, the number of family members is found positively correlated with the farm size.

It is interesting to note that among the sample stakeholders most of them were under the age bracket of 30-50 years which is very active and potential age to work and for taking decision for better management. Other than shrimp seed collectors, more than 50 percent stakeholders were educated from primary to above secondary levels (Table 3). However, as the selected stakeholders are engaged in different sectors of shrimp industry, above 70 percent

of them had training on fisheries activities and that of 90 percent had work experience in respective works.

Changing Socioeconomic Condition

Working age, level of education and the types of occupation of the respective categories of stakeholders are very important factors to generate income. Table 3 shows that most of the selected stakeholders belong to the age bracket of 30-50 years which is considered as most potential and active age. Secondly, except shrimp seed collectors, most of the stakeholders, to some extent, were educated and many of them had education from primary to S.S.C. level. Thus this study confirms that the level of education is positively correlated with household income.

Working in different sub- sectors of shrimp industry are the main sources of employment for the selected stakeholders. Earlier most of the sample stakeholders were associated with crop farming or integrated farming and it was their main source of household income. Occupation of shrimp farmers and other stakeholders who were involved in shrimp related activities are presented in Table 3. It is evident from Table 3 that, 15-80 percent stakeholders have chosen shrimp farming and shrimp related activities as their main occupation. Petty trading was preferred most by land lessors, depot owners and shrimp traders (30-45 percent). About 70 percent shrimp farm labourers worked mainly in the shrimp farms. On the other hand, shrimp seed collectors collect seed to earn income to maintain their livelihoods. Shrimp seed production and post-harvest processing of shrimp were the main occupation for the hatchery workers and processing plant workers, and depot workers and labouring was the main occupation for feed mill workers. Land lessors depend mainly on crop farming (55 percent) and they leased out small amount of land for shrimp farming. The study shows that except shrimp seed collectors, 40-100 percent stakeholders are educated in different levels.

As a main source of income, shrimp farming was the principal occupation for shrimp farmers. Usually the shrimp farm owners spent their time mainly in shrimp farming and some of them had opportunity to be engaged in crop (or salt) farming, petty trading and other nonfarm activities. Land lessors, shrimp farm labourers, shrimp seed collectors and depot workers were also involved in their respective jobs but their secondary occupation was earth working, rickshaw pulling and day labourer.

Table 3. Demographic profile and principal occupation of stakeholders involved in the shrimp industry.

Stakeholders of shrimp industry	Age (Ave. years)	Education level %	Principal Occupation %				Labourers /Service
			Shrimp related activities	Agricultural crop farming	Petty trading	Rickshaw/Van/Earth work	
Shrimp farmers	48	100	80	5	5		10
Land lessors	42	90	15	55	20	-	10
Hatchery owners	53	100	80	5	-	-	15
Depot owners	47	85	55	10	30	-	5
Shrimp seed collectors	32	15	60	-	15	25	-
Shrimp farm labourers	37	40	70	-	10	20	-
Processing plant workers	31	100	75	5	15	5	-
Hatchery workers	30	55	55	-	20	25	-
Feed mill workers	35	80	45	10	10	15	20
Depot workers	33	55	65	-	10	25	-
Shrimp traders	34	55	50	-	30	20	-
Average	38	70	59	8	15	12	5

Income and Consumption Pattern of Stakeholders

The average annual income of different groups of stakeholders involved in shrimp industry are shown in Table 4. Level of income of sample households varied in a wide range among different categories of stakeholders households. Average income of shrimp farmers, and depot and hatchery owners was several times higher than those of other categories of households. However, household income of shrimp seed collectors was substantially lower compared to land lessors and workers of processing plants.

Level of household income depends mainly on income earned from shrimp industry, and income from other farm and non-farm activities. In case of shrimp farmers and shrimp farm labourers, shrimp farming/industry contributed more than 80 percent of their total income while for other group of people, it contributed 30-50 percent to their total income.

Table 4. Annual income and heads of expenditure of stakeholders of the shrimp industry.

Stakeholders of shrimp industry	Household income (Tk/Year) ²			Total household expenditure (Tk/Year)	% spent on basic items 1	Investment in Shrimp/crop farming and other options
	Shrimp related activities	Farm and non- farm activities	Total household income			
Shrimp farmers	785295 (78)	215365 (22)	1000660	885210	17.15	82.85
Land lessors	48530 (24)	150255 (76)	198785	130475	64.50	35.50
Hatchery owners	980240 (84)	180956 (16)	1161196	832570	27.15	72.85
Depot owners	130750 (46)	155360 (54)	286110	210450	57.50	42.50
Shrimp seed collectors	16780 (41)	24265 (59)	41045	34920	97.20	2.80
Shrimp farm labourers	45175 (75)	15345 (25)	60520	50370	95.75	4.25
Processing plant workers	56785 (54)	49175 (46)	105960	88250	96.50	3.50
Hatchery workers	62360 (70)	26470 (30)	88830	80875	94.87	5.13
Feed mill workers	57585 (78)	16340 (22)	73925	65125	98.70	1.30
Depot workers	21300 (37)	35850 (63)	57150	51250	96.00	4.00
Shrimp traders (faria)	50300 (65)	27360 (35)	77660	68345	96.05	3.95

Figures within parenthesis indicate percentage of total income

Note : 'Food, clothing, health care, education and housing, ^{2US}\$ 1= TK 71.

Table 4 also shows annual expenditure of stakeholders of shrimp industry. Since household income of shrimp farm labourers and shrimp seed collectors are very low, they spent more than 80 percent of their income on basic items. Shrimp farmers and depot owners spent 82.85 percent and 42.50 percent of their income for farming business whereas land lessors used about 35.50 percent of their total expenditure for crop production. On the other hand, other stakeholder groups invest small amount of money on capital items, which was not considered in annual expenditure. It may be noted that hatchery owners invested about 73 percent of their income on developing shrimp hatchery.

Determinants of Household Income

The econometric model concerning the determinants of household income showed that income earned from shrimp industry and farm (cropping) and non-farm activities, earning member engaged in productive works, farm size and year of schooling of stakeholders were the major factors. As stated earlier that, to make the results meaningful, all selected stakeholders were categorized into three groups depending on their level of household

income. Accordingly, regression analysis was done for each of the three stakeholders groups and combining all groups together. The estimated values of coefficients and related statistics of these stakeholders groups were presented in Table 5, which indicate the relationship between explanatory and dependent variables.

Table 5. Estimated values of coefficients and related statistics of household income.

Independent Variables	Upper income group stakeholders ¹	Middle income group stakeholders ²	Lower income group stakeholders ³	All three groups/All stakeholders
Intercept	5.565 (0.338)	0.714* (0.146)	1.893* (0.554)	1.153* (0.154)
Income earned from shrimp industry (X1)	0.809* (0.028)	0.577* (0.048)	0.873* (0.051)	0.539* (0.21)
Farm and non-farm income (X2)	0.027 (0.027)	0.442* (0.034)	0.101** (0.050)	0.414* (0.015)
Earning member (X ₃)	0.283* (0.085)	-0.013 (0.057)	-0.046 (0.255)	-0.002 (0.069)
Farm size (X4)	-0.240* (0.023)	-0.019 (0.028)	-0.048 (0.064)	0.093* (0.017)
Year of schooling (X5)	0.238* (0.026)	0.020 (0.033)	0.233* (0.104)	0.009* (0.004)
Adjusted R ²	0.946	0.984	0.918	0.993
Return to scale ($\sum b_i$)	1.117	1.007	1.113	1.053
F-values	103.064*	615.979*	61.727*	3148.580*

Figures within parentheses indicate standard error

* Significant at 1 percent level of confidence

** Significant at 5 percent level of confidence

Note:

1. Shrimp farmers, land lessors, hatchery owners and depot owners
2. Processing plant workers, hatchery workers and shrimp traders
3. Shrimp farm labourers, shrimp seed collectors, feed mill workers and depot workers

The coefficient of multiple determination, R² for three different groups of stakeholders were 95, 98 and 92 respectively which indicated that all included variables in the model explained 92 to 98 percent variation in household income for three different groups of stakeholders. In case of lower income group, the explanatory power of the model was relatively weak.

The F-values of all individual log linear equations for respective three groups of stakeholders were highly significant (at 1 percent level) which implied that inclusion of these variables in explaining the variation of household income was reasonably accurate. Therefore, t-values of individual coefficients should be expected to be significant.

The selected household income functions had sufficient degrees of freedom for testing statistical significance and were stable with respect to the sign of their regression. The levels of significance used were 1 and 5 percent.

Since the aim of this section was to determine the scale and magnitude of contribution of variable factors on household income of different income groups of stakeholders, the estimated co-efficient of individual equation would focus it. The range of the estimated coefficients of different equations for three groups of stakeholders was -0.24 to 0.87 while considering all groups of stakeholders, it varied from -0.002 to 0.54 .

The coefficient for shrimp related income was statistically significant at 0.01 level for three groups of stakeholders and also for all stakeholders. In fact, the value of the coefficient was the highest (0.81 to 0.87) and significant for all three groups of stakeholders. Considering all stakeholders, coefficient of shrimp related income was found also highest (0.54) which indicated that if the shrimp related income would increase by 1 percent keeping other factors constant, household income would increase by 0.54 percent.

As explanatory variable, farm (cropping) and non-farm income of the respective groups of stakeholders had positive effect on household income but it was not significant in case of upper income group. Considering all stakeholders, the value of its coefficient was 0.41 . However, the result indicated that farm and non-farm income earned from supplementary occupation had greater impact on increasing household income of the stakeholders except upper income group. Besides, income earned from shrimp industry, almost every stakeholder was engaged in farm and non-farm business activities and also earned income to supplement their household income.

The coefficient of farm size (0.093) was positive and significant in case of all stakeholders but it was negative in case of upper income group which was expected. It may be noted that upper income group stakeholders especially shrimp farmers owned large size of farm which was unmanageable and less productive and the results implied that with the increase of farm size by 1 percent, household income of this group of stakeholders would decrease by 0.03 percent. But considering all stakeholders, this factor would have positive effect by increasing 0.093 percent on household income.

The regression coefficient of year of schooling of stakeholders was from 0.020 to 0.24 for three groups of stakeholders and it was statistically significant for upper and lower income group, and for all stakeholders. However, the results indicated that each 1 percent increase in the years of education keeping other factors constant, would increase household income by 0.24 percent and 0.23 percent for upper and lower income groups respectively, and that for all stakeholders, it was by 0.009 percent.

Returns to scale ($\sum b_i$) were found increasing in case of all three groups of stakeholders and for all stakeholders and its range was from 1.007 to 1.117 . The highest return to scale was found in upper income group (1.117) and it was the lowest in case of lower income group stakeholders (1.007). Returns to scale were obtained as the sum of the coefficient of variable factors used in the model. However, the results indicated that the increased use of these variable factors would lead to more household income for all three groups of stakeholders.

IV. CONCLUDING REMARKS

The present study was undertaken to determine the effect of major contributing factors to increase household income of the stakeholders involved in shrimp industry of Bangladesh. The results of the study showed that there are some important sources of income and factors on which household income of the stakeholders depend. Among all the sources, income earned from shrimp (industry) related activities, and farm and non-farm activities are very important which contribute about 60 and 30 percent of total household income respectively. The amount of income for upper income group stakeholders was higher (Tk. 138000-855000) followed by middle (Tk. 73000-99000) and lower income group (35000-71000). However, shrimp farmers, hatchery owners, shrimp farm labourers, hatchery workers and feed mill workers earned about 70-84 percent of their income from shrimp related activities of shrimp industry. On the other hand, share of contribution of farm and non-farm activities to household income was higher for land lessors, depot owners, shrimp seed collectors and depot workers.

Through regression analysis, it was found that among the determinants of household income earned from shrimp related activities, and farm (cropping) and non-farm income contributed significantly to the household income of selected stakeholders. Other included explanatory variables were number of earning member, level of education and year of schooling of stakeholders. Size of holding, to some extent, also contributed to increase household income of middle and lower income group of stakeholders. Thus, the findings of the study imply that policy makers should take all possible steps and measures to improve the skillness and efficiency of selected stakeholders which might have effect to increase their household income.

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