

LIVELIHOOD AND FOOD SECURITY STATUS OF THE WORKING PEOPLE IN SAFARI PARKS OF BANGLADESH: A MULTIVARIATE REGRESSION ANALYSIS

Md. Sazzadur Rahman Sarker¹
 Sheikh Mohammad Sayem^{2*}
 Md. Akhtarul Alam²
 Khandaker Md. Mostafizur Rahman²

ABSTRACT

This study was designed to assess the role of Safari parks on livelihood pattern and food security status of the people linked with parks. A survey was conducted among the employees in two safari parks. Different descriptive and inferential statistics were applied to evaluate the socioeconomic characteristics of the respondents. Economic Security Index (ESI), Health Security Index (HSI), Food Security Index (FSI), Educational Security Index (EDUSI) and Livelihood Security Index (LSI) were constructed. Simultaneous equation system and Three Stage Least Square regression were used to detect the influential factors that affect livelihood and food security status of the people. The result shows that educational status and mode of employment were significantly associated ($p < 0.01$). The body mass indexes about 78% employees were normal. The findings of 3SLS are that the livelihood of the households was positively changed by their food security status where food security was significantly influenced by the mode of employment. For sustainable employment opportunities, the authorities should have to give priority on training and sufficient education to the employees. Different stakeholders can take initiatives to create a number of local jobs, namely shop keeping, hotel and restaurants, transportations, guides, daily laborers through Safari parks.

Keywords: Food security, Index, Livelihood, Multivariate analysis, Safari parks

I. INTRODUCTION

Safari Park is an ecotourism activity for recreation but it also plays a vital role to protect natural pristine with rich biological diversity. In Bangladesh, safari Park concept is considered as a revenue generating source for government and socio-economic benefits to the local communities. Most of the tourist attractions in Bangladesh comprise of hills, forests, wildlife, mangroves, sea-beaches, sea, river, lake, archaeological and historical relics, natural beauty, tribal lifestyle and the indigenous culture. Safari Park is a new horizon as a specialized protected area along with eco-park in Bangladesh except other three protected areas including national park, wildlife sanctuary and game reserve (Shaheed and Chowdhury, 2014).

According to the European Geo-parks Network (EGN) charter and Global Geo-park Network regulations, all Geo-parks have to be established in rural areas (Zouros et al., 2003). Safari and eco-parks, by increasing the number of tourists, play a major role in local economic development. When visitors or tourists move to a park, the money moves to the locality as if it is transferring something such as agricultural and local products to other places (Sue, 2006). Thus, geo-park and geo-tourism create opportunities for rural development, and they reduce the rate of unemployment and migration in rural areas. Tourism can support diversification of livelihood, which is

¹Krishi Gobeshona Foundation, Farmgate, Dhaka

²Department of Agricultural Statistics, Bangladesh Agricultural University, Mymensingh-2202

***Corresponding author:** Sheikh Mohammad Sayem, Department of Agricultural Statistics, Bangladesh Agricultural University, Mymensingh, Email: sayem383@yahoo.com

particularly important in rural areas as it is also labor-intensive, can grow with unspecialized labor and has low entry barriers (Holland et al., 2003).

In view with this, the study endeavors to detect the determinant and assesses the socio-economic condition of the people linked with two Safari parks i.e., Bangabandhu Sheikh Mujib Safari Park, Gazipur and Dulhazara Safari Park, Cox's Bazar. The two Safari parks have the most contribution in employment and income generation. People residing adjacent to the project area are directly getting involved as employers and employees. Different local enterprises are developing adjacent to the area depending on the visitors or tourists. Business prospects like hotel business, handicraft and small shops, transport businesses have been generated beside the project area. All these things affect the income and employment status of local people (Meyer and Meyer, 2016).

Generally, the livelihoods of the people residing near the forest area are remarkably influenced by the forest. However, it is crucial and widely acceptable to judge the food security condition while working on the poor. It is misleading to treat food security as independent of wider livelihood considerations. In addition to food, there are other interrelated dimensions of livelihood security such as economic, health, nutrition, education, environment, empowerment etc. It would be over-optimistic to achieve the objective of food security target without attention to other dimensions of livelihoods simultaneously. Therefore, the second objective of the study is to assess the livelihood pattern and food security status of adjacent community.

The previous studies dealt with the potentiality of ecotourism in different parks. Some studies (e.g. Vines, 1982; Stella and Velasquez, 1998; and Shaheed and Chowdhury, 2014) determine the necessity of conservation of natural sites; some other try to show that ecotourism sites can play a twofold role in conservation and income (Ashley and Roe, 2002; Holland et al, 2003; Mesozera and Janaki, 2004; and El Wartiti et al., 2009). Most of the above studies were confined with the development of ecotourism sites and the potentiality of income generation. However, there is no study related to the livelihood and the socioeconomic status of the employees of these ecotourism sites and the community's people who are involved with business outside the sites. Therefore, this study is designed to assess different socioeconomic variables of the stakeholders to increase knowledge about their livelihood and food security status.

II. METHODOLOGY

Data

Both the primary and secondary data were used for this study. Simple random sampling technique was applied for collecting primary data from Bangabandhu Sheikh Mujib Safari Park, Gazipur and Bangabandhu Sheikh Mujib Safari Park, Cox's Bazaar. The sampling units were the employee of the Safari parks and also the people who were the beneficiaries of the parks. The data were collected from the respondents using structured questionnaire where the sample size is as follows-

$$n = \frac{z^2 pq}{d^2} \approx 81 \quad (1)$$

Here, $p = 0.429$ represents proportion of permanent employees from pilot survey, $q = 0.571$, d means margin of error and $Z = 1.96$ at 5% level of significance.

Secondary data about land area and year of establishment of Safari parks were also collected from the Safari park office, forest office, Ban Bhaban. National level secondary information (e.g. per

capita calorie intake, BMI) was collected from statistical reports of Bangladesh Bureau of Statistics, World Bank and newspapers.

Analytical techniques

In this study different socio-economic variables namely age, education, income, employment status, expenditure, activities and BMI (a ratio of body weight to body height and expressed as kg/m²) of the respondents were analyzed through univariate analysis (average, standard deviation and coefficient of variations) to evaluate their current status. Inferential statistics such as t-test and χ^2 -test were used to reach conclusion regarding the hypotheses that have made. A combined index named Livelihood Security Index (LSI) was constructed using four component index to assess the livelihood pattern and food security status of the adjacent community. This proposed combined index is a balanced weighted average approach with a large number of indicators, where each indicator contributes equally to the overall index. The indicators were grouped into different domains representing security areas such as food, health, economic and education. Since each indicator was measured on a different scale, different standardized indicators were needed to use for generating each index. The approach was adopted from the paper of Lindenberg (2002) which was also used by CARE India. A standardized value of the indicator j is given by –

$$StdInd_j = \frac{indicator_j - minvalue_j}{maxvalue_j - minvalue_j} \quad (2)$$

Where, minvalue and maxvalue represents the minimum and maximum value of the indicator within all the sample households. The relevant security index is constructed by averaging the standardized value of a particular domain. The index value of a particular domain can be shown as follows –

$$SI_i = \frac{\sum_{j=1}^J StdInd_j}{J} \quad (3)$$

Where, J is the number of standardized index and is used to calculate the ith index and SI represents the index value of respective domain.

The formula for the overall Livelihood security index is-

$$LSI_i = \frac{\sum_{i=1}^n SI_i}{n} \quad (4)$$

Where, SI represents security index and i stands for representing ith security domain.

The functional form of the different security indexes for different security domain is given below.

$$Food\ Security\ Index\ (mFSI) = \frac{zFG + zMSPD + zFcon + zCalIn}{J} \quad (5)$$

$$Health\ Security\ Index\ (HSI) = \frac{zNDia + zNOther + zFdoc + zUWS + zBMI}{J} \quad (6)$$

$$\text{Economic Security Index (ESI)} = \frac{zHHIn + zLand + zLive}{J} \quad (7)$$

$$\begin{aligned} \text{Educational Security Index (EDUSI)} \\ = \frac{zLit7plus + zLit15plus + z15to24 + zEnroll}{J} \end{aligned} \quad (8)$$

Here J indicates the number of indicator used in each domain for an individual. The description of the indicators of different security indices are given in Appendix-1.

The relationships among the socioeconomic variables are not one-dimensional. Hence, multivariate approaches are more appropriate because socioeconomic variables are very much correlated. Then, simultaneous equation system was used in this study. The five equations with endogenous variables are given below –

$$LSI = \alpha_0 + \alpha_1 FSI + \alpha_2 HSI + \alpha_3 ESI + \alpha_4 \text{WRITE_READ}(D) + u_1 \quad (9)$$

$$ESI = \beta_0 + \beta_1 \text{TOTAL_IN} + \beta_2 \text{TO59} + \beta_3 \text{FARM_INPP} + u_2 \quad (10)$$

$$\text{TOTAL_IN} = \gamma_0 + \gamma_1 \text{P_INCOME} + \gamma_2 \text{EDUSI} + u_3 \quad (11)$$

$$\text{EDUSI} = \rho_0 + \rho_1 \text{ADULT10} + \rho_2 \text{WRITE_READ}(D) + u_4 \quad (12)$$

$$FSI = \tau_0 + \tau_1 \text{CAL} + \tau_2 \text{MODE}(D) + u_5 \quad (13)$$

Where, $\alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4, \beta_0, \beta_1, \beta_2, \beta_3, \gamma_0, \gamma_1, \gamma_2, \rho_0, \rho_1, \rho_2, \tau_0, \tau_1$ and τ_2 are unknown parameters and u_1, u_2, u_3, u_4 and u_5 are the stochastic disturbance terms. LSI, ESI, TOTAL_IN, EDUSI and FSI are endogenous variables and HSI, WRITE_READ (D), TO59, FARM_INPP, P_INCOME, ADULT10, CAL and MODE(D) are exogenous variables. The endogenous and exogenous variables jointly influence the target interest in the simultaneous equation system (Matel and Angelescu, 2010). The descriptions of the variables are given in Appendix-2. The Ordinary Least Squares (OLS) procedure could not be directly used where probable endogeneity was occurred among the variables. Therefore, the method of Three-Stage Least Squares (3SLS) regression was used to estimate the parameters of different structural equations.

III. RESULTS AND DISCUSSION

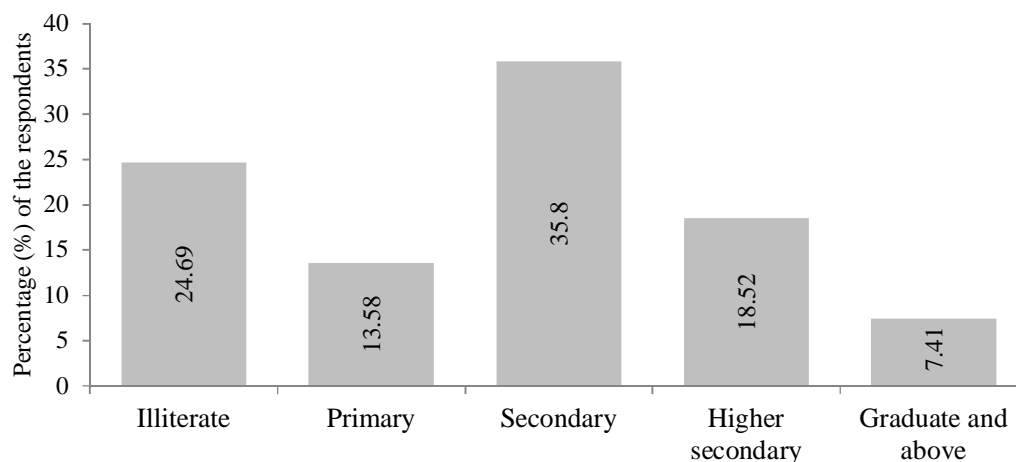
Socio-economic characteristic of the respondents

The study focused on socio-economic characteristics of the respondents such as age, education, employment status, calorie intake and BMI. As the respondents were the employees of the park aged of at least 15 years, they all are belonging to the economically active group (World Bank, 2010). It was found that out of the total sample employees, the three age groups 15-25, 26-35, and 26-35 cover 92.6 percent of the total. From the age distribution of the respondents (Table 1), it revealed that there is a potentiality of the young and active people to work here.

Table 1: Age distribution of the respondents

Age group	Frequency	Percent	Cumulative percent
15-25	15	18.5	18.5
26-35	33	40.7	59.3
36-45	27	33.3	92.6
46-55	4	4.9	97.5
Above 55	2	2.5	100.0
Total	81	100.0	

Educated people can identify different opportunities to make best use of their resources. The study revealed that most of the respondents (35.8%) had secondary education whereas 7.41% are at least graduates. The distribution of the employees according to their education level (Figure 1) represents that there is an opportunity of people with different level of education for being employed within the Safari park.

**Figure 1: Percentage (%) of respondents in different educational status**

Major portions of the respondents (40.74%) were permanently employed in the Safari park (Table 2). This is indicating that the establishment of Safari park could generate permanent and stable source of income.

Table 2: Distribution of employment pattern of the respondents

Profession	Frequency	Percent
Permanent	33	40.74
Part time	4	4.94
Wage basis	18	22.22
Contractual	11	13.58
Employee of contractor	8	9.88
Non-permanent	3	3.70
Business outside	3	3.70
Total	81	100

Education is a very important variable that influences employment status of the people. Higher education is a major platform for increasing human skill of the tourism industry (Biswakarma, 2016). Most of the permanent employees (54.50%) had a good educational status. A good number of employees (77.80%) worked on a wage basis and most of them are illiterate (Table 3). The χ^2 test proves that there is a significant relationship ($p < 0.01$) between educational status and mode of employment. To ensure the sustainable generation of employment opportunities, the authorities have to give proper training and sufficient education (Nee, 2011).

Table 3: Association among mode of employment and the educational status

Mode of employment	Illiterate	Primary	Secondary	HSC & Graduate	Total	χ^2 statistic
Permanent		1 (3.0)	14 (42.4)	18 (54.50)	33 (40.7)	70.44***
Part time	1 (20.0)	1 (20.0)	3 (60.0)		5 (6.2)	
Wage basis	14 (77.8)	4 (22.2)			18 (22.2)	
Contractual	4 (36.4)	1 (9.1)	6 (20.7)		11 (13.6)	
Employee of contractor		3 (37.5)	3 (37.5)	2 (25.00)	8 (9.9)	
Non-permanent			2 (66.7)	1 (33.30)	3 (3.7)	
Self employed	1 (33.3)	1 (33.3)	1 (33.3)		3 (3.7)	
Total	20 (24.7)	11(13.6)	29(35.8)	21 (25.9)	81(100)	

Note: The figures within the parentheses indicates the percentages and *** denotes 1% level of significance

Per capita calorie intake is a good measure of food security. It indicates the amount of calorie a person consumes in a day. Table 4 shows that the per capita calorie intake was highest (2865.71 kcal) for the part time worker because they had alternative source of income. Per capita calorie intake for non-permanent employees was lowest (2186.43) and this may be due to the non-stability of their income. It ascertains that average calorie intake 2441.27 kcal per day for all categories was significantly greater than 2122 kcal (p -value of one sample t statistic is less than 1% level of significance). So according to calorie intake, the employees of the parks were food secured.

The BMI is one of a good indicator of health. The BMI is defined as the body mass (in kilograms) divided by the square of the body height (in meters) and is universally expressed in units of kg/m^2 (Ferrara, 2006). The accepted BMI ranges are underweight (under 18.5 kg/m^2), normal weight (18.5 to 25), overweight (25 to 30), and obese (over 30) for categorization of a person as underweight, normal weight, overweight, or obese (Malcolm, 2015). It gives an idea about the health condition of the respondents which can affect the household income and other socio economic condition. From the Table 5 it is found that most of the respondents (84%) had good health condition. The congenial working environment and a regular income flow had a positive impact on their health condition.

Table 4: Per capita calorie intake of different categories of employees

Mode of employment	Frequency	Food expenditure		
		Mean	Standard deviation	Coefficient of variation (%)
Permanent	33	2417.97	533.65	22.07
Part time	5	2865.72	493.42	17.22
Wage basis	18	2596.21	604.49	23.28
Contractual	11	2235.41	670.61	29.99
Employee of contractor	8	2267.19	520.24	22.95
Non-permanent	3	2186.43	506.22	23.15
Self employed	3	2534.33	734.14	28.97
Total	81	2441.27***	576.21	23.60

Table 5: Distribution of the respondents according to BMI (Body Mass Index)

Status	Frequency	Percentage	Cumulative percentage
Under weight (16-18.5 kg/m ²)	5	6.2	6.2
Normal (healthy) weight (18.5-25 kg/m ²)	63	77.8	84.0
Over weight(25-30 kg/m ²)	13	16.0	100.0
Total	81	100.0	
Average BMI	22.301 kg/m ² ***		

*** denotes 1% level of significance

On the other hand, the average BMI of the 81 sampled respondents was 22.301 kg/m², which were significantly higher than the national average at 1% level of significance.

Assessment of the Livelihood Pattern and Food Security

This study measured livelihood security in selected Safari parks in Bangladesh. Four security areas such as food, health, economic and education were chosen and indices were computed based on a number of components.

Table 6: Summary statistics of different socio-economic indicators

Socio-economic indicators	Average	Standard deviation
Livelihood Security Index (LSI)	0.338	0.085
Food Security Index (FSI)	0.553	0.144
Healthy Security Index (HSI)	0.237	0.091
Economic Security Index (ESI)	0.132	0.090
Educational Security Index (EDUSI)	0.326	0.194
Total household income in Taka (TOTAL_IN)	24123.99	16507.492
Farm Income Per Person in Taka (FARM_INPP)	6955.302	12736.659

Tourism industry provides revenue to the park authority and income of the local people (Tapan and Abdullah, 2006). Table 6 indicates, among all the indices, food security index was

contributing maximum towards the improvement of overall livelihood security; while economic security index was contributing least to the overall improvement of livelihood security in the study area.

The equations 9 to 13 have been estimated simultaneously using Three Stage Least Square (3SLS) regression methods. All of the variables have been log-transformed to achieve the normality assumption.

Table 7: Estimated values of coefficients and related statistics of three stage least squares (3SLS) regression

Variables	Coefficient	Standard Error	Z-test		R^2	χ^2 -test	
			Statistic	p-value		Statistic	p-value
lnLSI							
lnFSI	0.266	0.100	2.65***	0.008	0.5171	115.68***	0.000
lnHSI	0.231	0.035	6.52***	0.000			
lnESI	0.162	0.037	4.35***	0.000			
WRITE_READ(D)	0.081	0.037	2.19**	0.028			
Constant	-0.302	0.102	-2.96	0.003			
lnESI							
Intotal_in	0.639	0.130	4.91***	0.000	0.6254	132.97***	0.000
Into59	0.655	0.133	4.91***	0.000			
lnFarm_InPP	0.0312	0.010	3.03***	0.002			
Constant	-8.405	1.274	-6.59	0.000			
Intotal_in							
lnP_income	0.282	0.093	3.02***	0.003	0.4459	68.11***	0.000
lnEDUsi	2.542	0.344	7.4***	0.000			
Constant	6.580	0.877	7.5	0.000			
lnEDUSI							
lnAdult10	0.511	0.055	9.28***	0.000	0.6467	153.8***	0.000
Write_read(D)	0.094	0.019	4.7***	0.000			
Constant	0.120	0.017	7.06	0.000			
lnFSI							
lnCal	0.707	0.093	7.64***	0.000	0.2738	62.72***	0.000
mode(D)	0.125	0.042	3***	0.003			
Constant	-6.175	0.722	-8.55	0.000			

Note: ln indicates the natural logarithm and D indicates dummy. * denotes 5% level of significance and ** denotes 1% level of significance.

From the Table 7, the high enough R^2 values and the p-value of χ^2 statistic for the goodness of fit ascertain that all the models were significant at 1% level of significance. So the model fitted the data reasonably well. In final equation FSI, HSI, ESI were significant at 1% level and WRITE_READ (D) was significant at 5% level of significance. The estimated value of the

coefficients was 0.266, 0.231, 0.162 which indicates that 1 percent increase in the value of Food Security Index, Health Security Index, Economic Security Index would increase Livelihood Security Index by 0.261, 0.231, 0.162 percent respectively. In addition, the value of the coefficient of the dummy variable WRITE_READ (D) was 0.081, which indicates that if the household head could read and write, then the value of Livelihood Security Index would be 0.081 percent higher as compared to those who could not. FSI and ESI were endogenous variables in the final equation, which are proven through endogeneity test (Appendix-3). The ESI equation reveals that Economic Security Index was significantly influenced by total household income, ratio of the family members aged between 15 to 59 year and per person farm income. The value of the coefficients indicates that any 1 percent increase in total income, ratio of the family members aged between 15 to 59 year and per person farm income would increase the value of Economic Security Index by 0.639, 0.655 and 0.031 percent respectively.

Total income was an endogenous variable and positively affected by income of the respondent from park and educational index. Both of the variables were significant at 1% level of significance (p-value <0.01). One percent increase in income of the respondent from Safari park, the average total family income of the respondent's household would be increased by 0.281 percent. The value of the coefficients 2.542 means that one percent increase of educational security index, total family income of the respondent's household would be increased by 2.542 percent.

The value of the Educational Security Index was positively affected by number of household member having 10+ years of schooling and a dummy variable (household head can read and write). Both of the variables were significant at 1% level of significance. If the number of family member having more than 10 years education increases by 1 percent then the value of the education index would be increased by 0.511 percent. The value of the Educational Security Index would be 0.093 percent higher for the household head who can read or write (value of dummy variable equals 1) than those who cannot.

It reveals from the equation 13 that food security of the household significantly affected by per capita calorie intake and mode of employment (permanent or non-permanent) in the Safari park. Per capita calorie intake and mode of employment both were significant at 1% level of significance. Therefore, one percent increase in per capita calorie intake would increase the value of Food Security Index by 0.707 percent. Again, the food security status of the employee was 0.125 percent higher for the permanent employee compared to the non-permanent employee.

IV. CONCLUSION AND RECOMMENDATIONS

In sum, the study is a modest attempt to evaluate the current socio-economic condition and to assess the livelihood pattern and food security status of adjacent community of two Safari parks (Bangabandhu Sheikh Mujib Safari Park, Gazipur and Bangabandhu Sheikh Mujib Safari Park, Cox's Bazar), as number of employees of these parks was higher than other conservational parks. This paper reveals that there is a potentiality of the young and active people to work here and there is also an opportunity of people with different level of education being employed within the Safari parks. Major portion of the respondents were permanently employed in the Safari parks, which generated permanent and stable source of income. The average calorie intake per day and average BMI of the respondents was significantly higher than the national level. So, the employees of the parks were food secured and most of the respondents enjoyed good health. Four

component indices such as Economic Security Index (ESI), Health Security Index (HSI), Food Security Index (FSI) and Educational Security Index (EDUSI) were constructed to assess the livelihood pattern and food security status of adjacent community. Three-Stage Least Squares (3SLS) regression estimated the overall Livelihood Security Index (LSI). The study disclosed that these four indices significantly influenced the overall Livelihood Security Index (LSI). One percent increase in the value of Food Security Index, Health Security Index and Economic Security Index would increase Livelihood Security Index by 0.266, 0.231, and 0.162 percent respectively. These results suggest that employment opportunity within and also outside of the park was being generated which ultimately improves the livelihood of the local people.

A number of recommendations are given regarding the improvement of the socio-economic condition and livelihood pattern of the people linked with Safari park.

- a) It was observed that a large number of the respondents were illiterate. So, improving their literacy level is essential and it could be achieved through adult education program.
- b) Since food security status is higher for the permanent employees compared to the temporary employees, different income-generating tourist facilities should be increased for increasing the permanent employee. A sufficient number of employees should be appointed from the local community people so that local participation is assured and hence service facility will be improved.
- c) To ensure the sustainable generation of employment opportunities, the authorities have to give proper training and sufficient education. It will make communication easier and make the cultural environment more friendly and relaxing.
- d) Development of tourism facilities will improve the livelihood status of local household who directly participate in this sector. The local authority must take actions to create curiosity among visitors about the culture of the local community. Souvenirs, advertising and local cultural icons should be presented in a decent and attractive way for the purpose of cultural sharing.

REFERENCES

- Ashley, C. and Roe, D. (2002) Making Tourism Work for the Poor: Strategies and challenges in Southern Africa. *Development Southern Africa*, 19(1):61-82. DOI: 10.1080/03768350220123855
- Biswakarma, G. (2016) Relation of tourism academic, employability abilities & skills and human resource development in Nepalese tourism industry. *International Journal of Research in Business Studies and Management*, 3(2):20-25.
- El Wartiti, M., Malaki, A., Zahraoui, M., Di Gregorio, F. and De Waele, J. (2009) Geosites and touristic development of the Northwestern tabular middle atlas of Morocco. In: Desertification and risk analysis using high and medium resolution satellite data. Springer Netherlands, 143-156.
- Ferrera, L.A. (2006) *Focus on Body Mass Index and Health Research*. New York: Nova Science.
- Holland, J., Burian, M. and Dixey, L. (2003) Tourism in poor rural areas: Diversifying the product and expanding the benefits in rural Uganda and the Czech Republic. PPT Working Paper 12, London: Pro Poor Tourism Partnership.
- Lindenberg, M. (2002) Measuring household livelihood security at the family and community level in the developing world. *World development*, 30(2): 301-318.

- Malcolm, K. (2015) Why being 'overweight' means you live longer: The way scientists twist the facts. <https://www.independent.co.uk>.
- Matel, A. and Anghelescu, S. (2010) Models with simultaneous equations for local development. *Theoretical and Applied Economics*, XVII (542): 27-48.
- Mesozera, M.K. and Alavalapati, J.R.R. (2004) Forest Dependency and its implications for Protected Areas Management: A case study from the Nyangwe Forest Reserve, Rwanda. *Scandinavian Journal of Forest Research*, 19 (4):85-92.
- Nee, A.Y.H. (2011) Training and employment for a sustainable hospitality and tourism in Malaysia. *International Journal of Business and Technopreneurship*, 1(2):283-295.
- Meyer, N. and Meyer, D. (2016) The relationship between the tourism sector and local economic development (LED): The case of the Vaal Triangle Region, South Africa. *Journal of Environmental Management and Tourism*, 7.3(15):466-472.
- Shaheed, M. and Chowdhury, H. (2014) Forest Conservation in Protected Areas of Bangladesh. Springer International Publishing Switzerland, DOI: 10.1007/978-3-319-08147-2.
- Stella, L. and Velasquez, B. (1998) Agenda 21; a form of joint environmental management in Manizales, Colombia. *Environment and Urbanization*, 10(2): 9-36. <https://doi.org/10.1177/095624789801000218>.
- Sue, B. (2006) Community Development through Tourism, CSIRO Publishing, Australia, Pp.191-215.
- Tapan, K.N. and Abdullah, M. (2006) Sitakunda Botanical Garden and Eco-park, Chittagong, Bangladesh: Its Impact on a Rural Community. *International Journal of Biodiversity Science and Management*, 2:1-11.
- Vines, G. (1982) Safari parks, after the honeymoon. *New Scientist*, 96(1334): 554-555.
- Zouros, N., Martini, G. and Frey, M.L. (2003) 2nd European Geoparks Network Meeting, Proceed. International Symposium Geological Heritage Protection and Local Development, Lesvos Island, Greece, Pp. 3-7.
- World Bank (2010) World Development Indicators. 69-70, Green press initiative, USA.

Appendix-1: Description of indicator of different security indices

Indicator name	Description
<i>Food security indicators</i>	
zFG*	Dietary diversity: number of food groups consumed per day
zMSPD	Food frequency: meals and snacks per day
zFcon	Number of food convenient months in the year
zCalIn	Per capita calorie intake
<i>Economic Security indicators</i>	
zHHIn	Household income
zLand	Per person land (cultivable land/housing/pond in decimal)
zLive	Per person livestock (TK)
<i>Health security indicators</i>	
zNDia	Incidence of diarrhea among household member in one year
zNOther	Incidence of other diseases among household member in one year
zFdoc	Frequency of doctor's consultation by household member in one year
zUWS	Number of days household head unable to work due to sickness
zBMI	Body Mass Index of the household head
<i>Educational Security indicators</i>	
zLit7plus	Number of 7 to 14 aged population read and write (Literacy)
zLit15plus	Number of 15+ aged population read and write (Literacy)
z15to24	Number of 15-24 years member in household enrolled
zEnroll	Number of 6-10 years children enrolled

* z indicates the standardized value of the indicator.

Appendix-2: Variable description

Variable name	Description of the variable
LSI	Livelihood Security Index
ESI	Economic Security Index
FSI	Food Security Index
HSI	Health Security Index
WRITE_READ(D)	Household head can read and write
TOTAL_IN	Total household income (Taka per month)
TO59	Ratio of the family member aged between 15 to 59
FARM_INPP	Farm income per person (Taka per month)
EDUSI	Educational Security Index
P_INCOME	Income from park (Taka per month)
ADULT10	Adult household member have ten plus years of schooling
CAL	Per capita calorie intake
MODE(D)	Mode of employment in the park

Note: D within parenthesis indicates the dummy variable

Appendix-3: Hausman endogeneity test

Tests of endogeneity

Ho: variables are exogenous

Durbin (score) $\chi^2(2)$ = 25.6109 (p = 0.0000)

Wu-Hausman $F(2,74)$ = 17.1081 (p = 0.0000)