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Effects of Interest rates and Inflation Rates on Stock Price Volatility: A Granger Causality Approach

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Mohammad Jahangir Alam[**]

Abstract: This paper deals with the Granger Causality analysis to review the impact of U.S. interest rates and various inflation rates on the different companies' stock price volatilities and the explicit correlation between them. The interest rates are used as they are important indicator of volatility measurement and inflation rates are used to be a measure of implicit estimate of the stock price movement. After performing the test using R package the results make it essential to understand how the different interest rates and inflation rates behave over time especially granger causes each other. The data set that we used is extracted from the St. Louis Fed are all daily sector data over the period of June 2008 to December 2017 and the technique of autoregressive lag model (ARLM) are applied in investigating the trend behavior of the interest rates as well as the inflation rates over any influence on the stock indices. The result indicates that interest rate and the inflation rate Granger Causes each other quite significantly whereas inflation rates have not Granger causes the stock price volatility. However, interest rates establish a causal relationship among those stock price volatilities and the inflation rates.

Keywords: Granger Causality; Interest Rate; Inflation Rate; Stock Volatility

JEL classification: JEL: C22

1. Introduction

It is a debatable issue among the economists regarding theoretical as well as empirical relationship between the interest rate and inflation rate. According to Fisher effect under the quantity theory of money, an increase in real interest rate is necessarily causes a deflationary situation in the economy and vice-versa. This is on other hand causes the home country's currency to appreciate and thereby helps to avoid many adverse economic consequences. In general, when the interest rates are low, many people can borrow more money from the financial institutions. This causes a boom in the money supply of the economy where the consumers have more money to spend. This will cause expansionary pressure within the economy to grow and inflation to increase. The opposite holds true for an increase in nominal interest rates.

For several reasons, a high interest rate policy is thought to be important. First, it tells the market forces about the sharp exchange rate movement and the expectations of the market given the state of the economy and thereby reduce the inflationary pressure and prevent the vicious cycle of inflation and exchange rate depreciation. Secondly, by

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increasing the attractiveness of domestic financial assets, capital inflows are generated, thus limiting the depreciation of the exchange rate. Thirdly, the reduction of domestic demand results not only in an improvement in the balance of payments position, but also reduces imports.

Interest rate and inflation rate are two significant economic and financial indicators that affect not only the common stock value but also the capital accumulation and capital inflow or outflow situation of a country. On the other hand, financial analyst defines stock volatility as a measure of the relative rate at which the prices of a security move up and down. Volatility is found by calculating the annualized standard deviation of daily change in price. If the price of a stock moves up and down rapidly over short time periods we call it has high volatility. On the other hand, if the price almost never changes it has low volatility. In finance, volatility means as a measure for variation of price of a financial instrument over time that is how far, and fast stock prices can move.

Over the years, several market volatility indicators have been developed to track the status of broad market volatility and help investors decide when to buy or sell. These include the S&P 500 Volatility Index, the NASDAQ Volatility Index, and the Russell 2000 Volatility Index. Most of the time, stock prices move up and down, sometimes even trending in a positive or negative direction.

Interest rate, which reflects the price of money, has a clear and substantial effect on different indicator variables in money and capital market instruments. The interest rates indirectly affect the valuation of the stock prices and stock volatility directly creates a shift between the money market and capital market instruments. Inflation rate is another major source of macroeconomic uncertainty that directly and indirectly affects the stock volatility. High inflation rate influences the value of the stock since the future cash flows of the firm will change and hence affect their investment plan on stock or bond.

This paper takes the daily data on Chicago Board Options Exchange(CBOE)'s several companies stock volatility which are CBOE NASDAQ 100 Volatility Index, CBOE S&P 500 3-month volatility index, CBOE Gold ETF Volatility Index. Daily rates of three type of inflation rates have been taken these are 5-Year Breakeven Inflation Rate, 5-Year Forward Inflation Expectation Rate, and10-Year Breakeven Inflation Rate. Inflation expectation of these few influential rates are most connected with the United States business and exchange. For the interest rates four different types of daily rates such as Effective Federal Funds Rate, 3-Month Treasury Constant Maturity Rate, Bank Prime Loan Rate, and 3-Year Treasury Constant Maturity Rate are taken carefully through the R command. The findings show that interest rate and inflation rate Granger causes each other quite significantly but inflation rate has a minimal Granger causality impact on Stock price volatilities.

2. Ex-ante Discussion

The Granger testing procedure requires one set up and test two equations. In each equation, the current value of one variable (X_t or Y_t) is a function of the set of other variables and the function of its own level with the previous time periods or lagged values. The intuition behind the Granger test is that-if previous values of a variable X_t significantly affects the current values of the other variable Y_t, then it can be said that X

Causes *Y*. As mentioned earlier this paper takes three volatility indices of different measurement and therefore run the autoregressive distributed lag regression under the canned R command for to see whether the interest rate and the inflation rate has any Granger causality effects on the volatility indices. That is if interest rate or inflation rate causes any changes in volatility indices, then one can observe that changes in interest rate or inflation rate will cause a precede changes in stock volatility indices. The functional form of equations that are used in this process are follows:

$$\mathbf{Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \delta_1 X_{t-1} + \delta_2 X_{t-2} + \varepsilon_t}$$

$$\mathbf{X_t = \alpha_0 + \alpha_1 X_{t-1} + \alpha_2 X_{t-2} + \mu_1 Y_{t-1} + \mu_2 Y_{t-2} + \theta_t}$$

Due to the internationalization of the stock market, the liberalization of capital flows, and a large amount of foreign investment in the US stock market, stocks and all other major macroeconomic markets have become increasingly interdependent. Several financial and currency crises around the world, as well as the recent 2008-2009 fiscal year crisis in the US financial sector and different emerging markets around the world, prompted academicians and experts to re-examine the volatility spillover between stocks and different macroeconomic sectors.

Researchers have seen a large correlated movement resulting in market contamination (Mishra et al., 2007). It has been observed that interest rates have been used to explain the behavior of stock prices, assuming that company earnings tend to respond to any fluctuations in future forecasts and turning points (Kim, 2003). This paper uses three important inflation rates in the expectation to see how the 5-Year Breakeven Inflation Rate and 10-Year Breakeven Inflation Rate Granger causes stock volatility indices such as NASDAQ 100 Volatility Index or S&P 500 3-Month Volatility Index. From the past literature it can be discovered that the relationship between interest rate and stock volatility has been widely examined by the researchers. According to one of the studies, short- term interest rates and stock returns have a relationship with the level of market volatility. It was found that the nominal yield on one-month T-bills has a significant positive correlation with variance in the market, but it leads to negative correlation with future stock returns (Dimitrova, 2005).

A study conducted by Cifter and Ozun (2007) looked at how interest rate changes affect the closing values of the Istanbul Stock Exchange 100 index and the compounded interest rates on daily closing values to examine the causal effects of interest rate changes on stock returns. Accordingly, they concluded that the effect of interest rate on stock returns increases with increasing time scales. Their tests began with a nine-day time-scale effect of the ISE 100 index.

A similar study has been conducted by Salimullah (2016) in which the another uses the Granger Causality techniques on interest rate and exchange rate over the return behavior of the stock price volatilities. Using the daily sector data over the period of 2007-2012 and establishing a two-way causal relationship the study shows that there is strong statistical evidence between the stock volatility and the interest rate which exists only to some extent and, in some cases, demonstrates no relationship among them. However, the Granger Causality test was applied to the other two variables, exchange rates and stock volatility, which proved unidirectional causality running from interest rates to stock returns and from exchange rates to stock returns, but in the opposite cases the bi-directional effect did not support any significant results

3. Methodology

The methodology that is used in this paper is the Granger Causality approach that is applied through producing R-commands in which a special and systematic use of *F*-statistic has been formulized. Any time series trends or variables (i.e. daily, quarterly, monthly, or yearly data) are found suitable for this type of test. Usually most of the time series are non-stationary or produce a random walk. When a time series is found stationary, then the Granger test could be performed by using the level values of two (or more) variables. On the other hand, if the trend variables are found non-stationary, then the test is done only after by testing for a unit root (whether a series is stationary or non-stationary). The augmented Dickey-Fuller (ADF) test is used for detection of a unit root. The null hypothesis for ADF test is that the series is a non-stationary; if the p-value is low enough then we do reject the null hypothesis and accept the alternative views of the series is stationary. If the p-value is higher than any significance level (conventionally we use 1%, 5% or 10% level of significance) then we cannot reject but to accept the null hypothesis and trying to transform the series to a better one.

Typically, the first difference of a time series will be stationary. The number of lags included in an analysis will be determined with the help of information criterion, such as the Akaike information criterion (AIC) or the Schwarz information criterion. If any lag value of the variable is significant according to the t-test, it is retained in the regression, and according to the F-test, other lag values of the variable together add explanatory power to the model. The null hypothesis of no Granger causality will be created if and only if the lag value of the explanatory variable is not retained in the regression. In empirical techniques, it is very possible to find that neither of the two variables Granger-causes the other variable, or each of the two variables causes the other variable Granger-causes the other.

4. Data

This paper uses the data series from the Federal Reserve Bank of St. Louis namely as St. Louis Fed economic data. From the bunch of series at first, the researcher choses the variables that would be the best fit for the empirical model and then the author took the daily time point from June 2008 to December 2017. This restriction technique ends up with a total of **2,379** observations. The volatility indices that I have chosen are the most demonstrative financial indicators for the stock market under Chicago Board Options and Exchange (CBOE). These indices are based on the common stock prices of top publicly traded American companies stock and bond.

The choice variables for the stock volatilities are CBOE Gold ETF Volatility Index (Ticker-GVZCLS) measures the market's expectation of 30-day volatility of gold prices by applying the VIX methodology to options on SPDR Gold Shares. The other daily rates that have taken are CBOE NASDAQ 100 Volatility Index (Ticker-VXNCLS) and CBOE S&P 500 3-Month Volatility Index (Ticker-VXVCLS). VXNCLS is a key measure of market expectations of near-term volatility conveyed by NASDAQ-100 Index (NDX) option prices. While VXVCLS is designed to be a constant measure of 3-month implied volatility of the S&P 500® (SPX) Index options.

The interest rate variables that have been used in this research are the daily rates of Effective Federal Funds Rate (Ticker-DEF), 3-Month Treasury Constant Maturity Rate (Ticker- DGS3MO), 3-Year Treasury Constant Maturity Rate (Ticker-DGS3), and Bank Prime Loan Rate (Ticker-DPRIME). As the daily data are accepted for this study so that the other interest rates which are sounds predominant cannot be used as they have monthly or quarterly data. For the case of inflation rate I have chosen 5-Year Breakeven Inflation Rate (Ticker-T5YIE), 5-Year, 5-Year Forward Inflation Expectation Rate (Ticker-T5YIFR), and 10-Year Breakeven Inflation Rate (Ticker-T10YIE). The preliminary analysis of the data for all the series displays that interest rates and the stock volatilities are persistent with their respective mean values.

The mean or average values for the inflation rates are not consistent for three different rates. The mean for 10-Year Breakeven Inflation Rate is negative which is -0.00023 and has a lower standard deviation i.e. 0.0386. All three volatility indices have the higher level of implied volatility with mean around 21.167 and the standard deviation of 8.675 (almost 867%). The mean and the standard deviation for the interest rates are found much closer on average. The overall mean for the four interest rates is 1.261 and the standard deviation is 0.4283 (almost 42%). The other descriptive statistics for those variables are shown in the following Table 1.

Table 1: Summary Statistics

Variable Name	Mean	Standard Dev.	Median	Min	Max	Lags	P-value
GVZCLS	20.454	7.6847	18.54	10.16	64.53	22	0.020603
VXNCLS	21.481	9.6306	18.40	10.31	80.64	25	0.010000
VXVCLS	21.567	8.7124	18.99	11.85	69.24	17	0.023206
T5YIE	1.613	0.5309	1.710	-2.240	2.720	48	0.060523
T5YIFR	2.267	0.4063	2.330	0.430	3.050	33	0.010000
DFF	0.3169	0.4258	0.1500	0.0400	2.9700	46	0.010000
DGS3MO	0.249	0.3435	0.100	0.000	2.070	47	0.010000
DPRIME	3.442	0.4148	3.250	3.250	5.000	49	0.016054
DGS3	1.037	0.5291	0.980	0.280	3.380	16	0.033465
T10YIE	-0.0002271	0.0386	0.0000	-0.3600	0.3300	45	0.294031

Source: Author's own calculation

5. Results and Discussion

After running the standard statistical package R and modifying the necessary codes accordingly by including all of the observed variables and the related data set from the St. Louis Fed and using the R command install.Packages ("fImport") and library fImport, this paper comes up with the following results. To make the data set stationary this paper also performed the unit root test (R command adf.test). The entire Table 2 shows the first part of the Granger Causality result for all of the observed variables. In this following Table 2 the significance of the generated Granger causality test is accompanied by the

long run multiplier and its respective probability values. The null hypotheses and the alternative hypotheses for this test are:

H_0: variable X does not cause variable Y ($X \nRightarrow Y$).

H_a: variable X causes variable Y ($X \Rightarrow Y$)

Table 2 shows the outcomes of the estimation results. CBOE Gold ETF Volatility Index (GVZCLS) establishes positive Granger Causality on VXNCLS and VXVCLS but has negative Granger Causality on T5YIE, T5YIFR, T10YIE, DEF, and DGS3MO. But it has no causal relationship with DPRIME and DGS3. CBOE NASDAQ 100 volatility Index (VXNCLS) positively Granger causes GVZCLS, and VXVCLS. But it shows some negative Granger Causality over T5YIE, T5YIFR, T10YIE, and DGS3MO. However, VXNCLS shows zero Granger Causality over DEF, DPRIME and DGS3. CBOE S&P 500 3-Month Volatility Index (VXVCLS) generates negative Granger Causality over GVZCLS, VXNCLS, T5YIE, T5YIFR, T10YIE, and DGS3MO. VXVCLS produces zero causality over DEF, DPRIME, and DGS3. All of these causal relationship between the stock volatilities are found statistically significant by the value of the test statistic of long run multiplier with having a lower level of p-values. 5-Year Breakeven Inflation Rate (T5YIE) positively Granger causes GVZCLS, T5YIFR, T10YIE, and DGS3MO. However, it shows negative Granger Causality over VXNCLS, VXVCLS, DEF, DPRIME, and DGS3. 5-Year Forward Inflation Expectation Rate (T5YIFR) shows positive relation with GVZCLS, VXNCLS, VXVCLS, and T5YIE. But T5YIFR negatively Granger causes T10YIE, DEF, DGS3MO, DPRIME, and DGS3.

10-Year Breakeven Inflation Rate (T10YIE) has a negative causal relationship with T5YIE, T5YIFR, DEF and DGS3. However, T10YIE shows positive Granger Causality with all the volatility indices such as GVZCLS, VXNCLS, and VXVCLS. It also creates positive causal relationship with two interest rates namely, DGS3MO and DPRIME. However, some of these relationship are found insignificant as the value of the long run multiplier is lower than the critical value of this test statistic. Effective Federal Funds Rate (DEF) positively affects all the three stock price volatilities as expected. The probability values for GVZCLS, VXNCLS, and VXVCLS are found very low that confirms the statistical significance of their relationship with DEF. It also has a positive effect on T10YIE, DGS3MO and DPRIME. However, DEF has a negative Granger Causality with T5YIE, T5YIFR and DGS3.

3-Month Treasury Constant Maturity Rate (DGS3MO) has a positive causal relationship with CBOE Gold ETF Volatility Index, NASDAQ 100 Volatility Index, S&P 500 Volatility Index and 10-Year Breakeven Inflation Rate. But it shows negative causality with T5YIE, T5YIFR, DEF, DPRIME and DGS3. One of the major interest rates Bank Prime Loan Rate (DPRIME) shows positive causal relationship with GVZCLS, VXNCLS, VXVCLS, T10YIE, and DGS3MO. There is found some negative Granger Causality with T5YIE, T5YIFR, DEF, and DGS3. 3-Year Treasury Constant Maturity Rate (DGS3) constructs positive effect with T5YIE, T5YIFR, T10YIE, DEF, DGS3MO, and DPRIME. But in case of all three stock volatility indices i.e. GVZCLS, VXNCLS, and VXVCLS, 3-Year Treasury Constant Maturity Rate shows negative Granger Causality. The test statistic which is the value of the long run multiplier has the significant results with the lowest probability values.

Table 2: Two-way Granger Causality test results for the selected number of variables

Variable X	Variable Y	p-value	Long Run Multiplier	pvLRM	Label	Sign
GVZCLS	VXNCLS	0	0.00147	0.00026	H0: CBOE Gold ETF Volatility Index -/-> CBOE NASDAQ 100 Volatility Index	1
GVZCLS	VXVCLS	0	0.00191	0	H0: CBOE Gold ETF Volatility Index -/-> CBOES&P5003-MonthVolatilityIndex	1
GVZCLS	T5YIE	0	-1.00E-05	0.01116	H0: CBOE Gold ETF Volatility Index -/-> 5-Year Breakeven Inflation Rate	-1
GVZCLS	T5YIFR	0.00113	-1.00E-05	0.13307	H0: CBOE Gold ETF Volatility Index -/-> 5-Year,5-YearFrwrdInfltnExpcttnRt	-1
GVZCLS	T10YIE	0	-2.00E-05	0.00735	H0: CBOE Gold ETF Volatility Index -/-> 10-Year Breakeven Inflation Rate	-1
GVZCLS	DFF	0.00674	-1.00E-05	0.07516	H0: CBOE Gold ETF Volatility Index -/-> Effective Federal Funds Rate	-1
GVZCLS	DGS3MO	0	-1.00E-05	0.00429	H0: CBOE Gold ETF Volatility Index -/-> 3-MonthTreasuryConstantMaturityRt	-1
GVZCLS	DPRIME	0	0	0.26296	H0: CBOE Gold ETF Volatility Index -/-> Bank Prime Loan Rate	0
GVZCLS	DGS3	8.00E-05	0	0.39927	H0: CBOE Gold ETF Volatility Index -/-> 3-YearTreasuryConstantMaturityRat	0
VXNCLS	GVZCLS	0	0.00015	0.31509	H0: CBOE NASDAQ 100 Volatility Index -/-> CBOE Gold ETF Volatility Index	1
VXNCLS	VXVCLS	0	0.00401	0.01838	H0: CBOE NASDAQ 100 Volatility Index -/-> CBOES&P5003-MonthVolatilityIndex	1
VXNCLS	T5YIE	0	-1.00E-05	0.00748	H0: CBOE NASDAQ 100 Volatility Index -/-> 5-Year Breakeven Inflation Rate	-1
VXNCLS	T5YIFR	0	-1.00E-05	0.21021	H0: CBOE NASDAQ 100 Volatility Index -/-> 5-Year,5-YearFrwrdInfltnExpcttnRt	-1
VXNCLS	T10YIE	0	-1.00E-05	0	H0: CBOE NASDAQ 100 Volatility Index -/-> 10-Year Breakeven Inflation Rate	-1

Variable X	Variable Y	p-value	Long Run Multiplier	pvLRM	Label	Sign
VXNCLS	DFF	0.01628	0	0.05031	H0: CBOE NASDAQ 100 Volatility Index -/-> Effective Federal Funds Rate	0
VXNCLS	DGS3MO	0	-1.00E-05	NA	H0: CBOE NASDAQ 100 Volatility Index -/-> 3-MonthTreasuryConstantMaturityRt	-1
VXNCLS	DPRIME	0.00881	0	0.22344	H0: CBOE NASDAQ 100 Volatility Index -/-> Bank Prime Loan Rate	0
VXNCLS	DGS3	0.00071	0	0.47792	H0: CBOE NASDAQ 100 Volatility Index -/-> 3-YearTreasuryConstantMaturityRat	0
VXVCLS	GVZCLS	0	-1.00E-05	0.49374	H0: CBOES&P5003-MonthVolatilityIndex -/-> CBOE Gold ETF Volatility Index	-1
VXVCLS	VXNCLS	0	-0.00191	0.09826	H0: CBOES&P5003-MonthVolatilityIndex -/-> CBOE NASDAQ 100 Volatility Index	-1
VXVCLS	T5YIE	0	-1.00E-05	0.00522	H0: CBOES&P5003-MonthVolatilityIndex -/-> 5-Year Breakeven Inflation Rate	-1
VXVCLS	T5YIFR	0	-1.00E-05	0.34388	H0: CBOES&P5003-MonthVolatilityIndex -/-> 5-Year,5-YearFrwrdInfltnExpcttnRt	-1
VXVCLS	T10YIE	4.00E-05	-1.00E-05	1.00E-05	H0: CBOES&P5003-MonthVolatilityIndex -/-> 10-Year Breakeven Inflation Rate	-1
VXVCLS	DFF	0.01239	0	0.00352	H0: CBOES&P5003-MonthVolatilityIndex -/-> Effective Federal Funds Rate	0
VXVCLS	DGS3MO	0	-1.00E-05	0.01196	H0: CBOES&P5003-MonthVolatilityIndex -/-> 3-MonthTreasuryConstantMaturityRt	-1
VXVCLS	DPRIME	0.03714	0	0.11853	H0: CBOES&P5003-MonthVolatilityIndex -/-> Bank Prime Loan Rate	0
VXVCLS	DGS3	0.01807	0	0.33965	H0: CBOES&P5003-MonthVolatilityIndex -/-> 3-YearTreasuryConstantMaturityRat	0
T5YIE	GVZCLS	0.00013	0.00327	0.19517	H0: 5-Year Breakeven Inflation Rate -/-> CBOE Gold ETF Volatility Index	1
T5YIE	VXNCLS	0	-0.00011	0.49142	H0: 5-Year Breakeven Inflation Rate -/-> CBOE NASDAQ 100	-1

Variable X	Variable Y	p-value	Long Run Multiplier	pvLRM	Label	Sign
					Volatility Index	
T5YIE	VXVCLS	0	-0.00107	0.34407	H0: 5-Year Breakeven Inflation Rate -/-> CBOES&P5003-MonthVolatilityIndex	-1
T5YIE	T5YIFR	0	2.00E-04	0.24015	H0: 5-Year Breakeven Inflation Rate -/-> 5-Year,5-YearFrwrdInfltnExpcttnRt	1
T5YIE	T10YIE	0	0.00013	0.00172	H0: 5-Year Breakeven Inflation Rate -/-> 10-Year Breakeven Inflation Rate	1
T5YIE	DFF	0	-4.00E-05	0.16266	H0: 5-Year Breakeven Inflation Rate -/-> Effective Federal Funds Rate	-1
T5YIE	DGS3MO	0	5.00E-05	0.13362	H0: 5-Year Breakeven Inflation Rate -/-> 3-MonthTreasuryConstantMaturityRt	1
T5YIE	DPRIME	0	-4.00E-05	0.08581	H0: 5-Year Breakeven Inflation Rate -/-> Bank Prime Loan Rate	-1
T5YIE	DGS3	0	-0.00042	6.00E-05	H0: 5-Year Breakeven Inflation Rate -/-> 3-YearTreasuryConstantMaturityRat	-1
T5YIFR	GVZCLS	0.00549	0.00418	0.02652	H0: 5-Year,5-YearFrwrdInfltnExpcttnRt -/-> CBOE Gold ETF Volatility Index	1
T5YIFR	VXNCLS	0.03976	0.00339	0.266	H0: 5-Year,5-YearFrwrdInfltnExpcttnRt -/-> CBOE NASDAQ 100 Volatility Index	1
T5YIFR	VXVCLS	0.00038	0.00695	0.20705	H0: 5-Year,5-YearFrwrdInfltnExpcttnRt -/-> CBOES&P5003-MonthVolatilityIndex	1
T5YIFR	T5YIE	0	0.00025	0.04197	H0: 5-Year,5-YearFrwrdInfltnExpcttnRt -/-> 5-Year Breakeven Inflation Rate	1
T5YIFR	T10YIE	5.00E-05	-0.00013	0.08438	H0: 5-Year,5-YearFrwrdInfltnExpcttnRt -/-> 10-Year Breakeven Inflation Rate	-1
T5YIFR	DFF	0.00014	-0.00013	3.00E-05	H0: 5-Year,5-YearFrwrdInfltnExpcttnRt -/-> Effective Federal Funds Rate	-1
T5YIFR	DGS3MO	0	-6.00E-05	0.01665	H0: 5-Year,5-YearFrwrdInfltnExpcttnRt -/-> 3-MonthTreasuryConstantMaturityRt	-1

Variable X	Variable Y	p-value	Long Run Multiplier	pvLRM	Label	Sign
T5YIFR	DPRIME	0.00036	-0.00016	0.00401	H0: 5-Year,5-YearFrwrdInfltnExpcttnRt -/-> Bank Prime Loan Rate	-1
T5YIFR	DGS3	0	-0.00042	0.00971	H0: 5-Year,5-YearFrwrdInfltnExpcttnRt -/-> 3-YearTreasuryConstantMaturityRat	-1
T10YIE	GVZCLS	0	0.01339	0.01268	H0: 10-Year Breakeven Inflation Rate -/-> CBOE Gold ETF Volatility Index	1
T10YIE	VXNCLS	0	0.01038	0.00044	H0: 10-Year Breakeven Inflation Rate -/-> CBOE NASDAQ 100 Volatility Index	1
T10YIE	VXVCLS	0	0.00893	0.01211	H0: 10-Year Breakeven Inflation Rate -/-> CBOES&P5003-MonthVolatilityIndex	1
T10YIE	T5YIE	0	-0.00023	0.00029	H0: 10-Year Breakeven Inflation Rate -/-> 5-Year Breakeven Inflation Rate	-1
T10YIE	T5YIFR	0	-0.00025	2.00E-05	H0: 10-Year Breakeven Inflation Rate -/-> 5-Year,5-YearFrwrdInfltnExpcttnRt	-1
T10YIE	DFF	0	-0.00034	0.38239	H0: 10-Year Breakeven Inflation Rate -/-> Effective Federal Funds Rate	-1
T10YIE	DGS3MO	0	9.00E-04	NA	H0: 10-Year Breakeven Inflation Rate -/-> 3-MonthTreasuryConstantMaturityRt	1
T10YIE	DPRIME	0	5.00E-05	0.37514	H0: 10-Year Breakeven Inflation Rate -/-> Bank Prime Loan Rate	1
T10YIE	DGS3	0	-0.00035	0.10741	H0: 10-Year Breakeven Inflation Rate -/-> 3-YearTreasuryConstantMaturityRat	-1
DFF	GVZCLS	0	0.01073	0.02221	H0: Effective Federal Funds Rate -/-> CBOE Gold ETF Volatility Index	1
DFF	VXNCLS	0	0.00954	0.00333	H0: Effective Federal Funds Rate -/-> CBOE NASDAQ 100 Volatility Index	1
DFF	VXVCLS	0	0.00789	0.13542	H0: Effective Federal Funds Rate -/-> CBOES&P5003-MonthVolatilityIndex	1
DFF	T5YIE	0	-0.00027	0.01516	H0: Effective Federal Funds Rate -/-> 5-Year Breakeven Inflation	-1

Variable X	Variable Y	p-value	Long Run Multiplier	pvLRM	Label	Sign
					Rate	
DFF	T5YIFR	0	-0.00011	0.04785	H0: Effective Federal Funds Rate -/-> 5-Year,5-YearFrwrdInfltnExpcttnRt	-1
DFF	T10YIE	0	0.00191	1.00E-04	H0: Effective Federal Funds Rate -/-> 10-Year Breakeven Inflation Rate	1
DFF	DGS3MO	0	0.00052	0.05941	H0: Effective Federal Funds Rate -/-> 3-MonthTreasuryConstantMaturityRt	1
DFF	DPRIME	0	2.00E-05	0.4382	H0: Effective Federal Funds Rate -/-> Bank Prime Loan Rate	1
DFF	DGS3	0	-0.00037	0.00739	H0: Effective Federal Funds Rate -/-> 3-YearTreasuryConstantMaturityRat	-1
DGS3MO	GVZCLS	0	0.01304	0.04944	H0: 3-MonthTreasuryConstantMaturityRt -/-> CBOE Gold ETF Volatility Index	1
DGS3MO	VXNCLS	0	0.01272	NA	H0: 3-MonthTreasuryConstantMaturityRt -/-> CBOE NASDAQ 100 Volatility Index	1
DGS3MO	VXVCLS	0	0.01259	NA	H0: 3-MonthTreasuryConstantMaturityRt -/-> CBOES&P5003-MonthVolatilityIndex	1
DGS3MO	T5YIE	0	-0.00025	1.00E-05	H0: 3-MonthTreasuryConstantMaturityRt -/-> 5-Year Breakeven Inflation Rate	-1
DGS3MO	T5YIFR	0	-0.00033	NA	H0: 3-MonthTreasuryConstantMaturityRt -/-> 5-Year,5-YearFrwrdInfltnExpcttnRt	-1
DGS3MO	T10YIE	0	0.00311	0.00025	H0: 3-MonthTreasuryConstantMaturityRt -/-> 10-Year Breakeven Inflation Rate	1
DGS3MO	DFF	0	-1.00E-05	0.4351	H0: 3-MonthTreasuryConstantMaturityRt -/-> Effective Federal Funds Rate	-1
DGS3MO	DPRIME	0.00042	-5.00E-05	0.38836	H0: 3-MonthTreasuryConstantMaturityRt	-1

Variable X	Variable Y	p-value	Long Run Multiplier	pvLRM	Label	Sign
					-/-> Bank Prime Loan Rate	
DGS3MO	DGS3	0	-0.00048	1.00E-05	H0: 3-MonthTreasuryConstantMaturityRt -/-> 3-YearTreasuryConstantMaturityRat	-1
DPRIME	GVZCLS	1.00E-05	0.00399	0.12957	H0: Bank Prime Loan Rate -/-> CBOE Gold ETF Volatility Index	1
DPRIME	VXNCLS	0	0.01038	0	H0: Bank Prime Loan Rate -/-> CBOE NASDAQ 100 Volatility Index	1
DPRIME	VXVCLS	0	0.01008	0.0188	H0: Bank Prime Loan Rate -/-> CBOES&P5003-MonthVolatilityIndex	1
DPRIME	T5YIE	0	-0.00026	0.00462	H0: Bank Prime Loan Rate -/-> 5-Year Breakeven Inflation Rate	-1
DPRIME	T5YIFR	0	-1.00E-04	0.05074	H0: Bank Prime Loan Rate -/-> 5-Year,5-YearFrwrdInfltnExpcttnRt	-1
DPRIME	T10YIE	0	4.00E-05	0.18915	H0: Bank Prime Loan Rate -/-> 10-Year Breakeven Inflation Rate	1
DPRIME	DFF	0	-1.00E-05	0.27615	H0: Bank Prime Loan Rate -/-> Effective Federal Funds Rate	-1
DPRIME	DGS3MO	0	3.00E-05	NA	H0: Bank Prime Loan Rate -/-> 3-MonthTreasuryConstantMaturityRt	1
DPRIME	DGS3	0	-0.00025	4.00E-05	H0: Bank Prime Loan Rate -/-> 3-YearTreasuryConstantMaturityRat	-1
DGS3	GVZCLS	0	-0.46865	0.00085	H0: 3-YearTreasuryConstantMaturityRat -/-> CBOE Gold ETF Volatility Index	-1
DGS3	VXNCLS	0.00292	-0.05389	0.37721	H0: 3-YearTreasuryConstantMaturityRat -/-> CBOE NASDAQ 100 Volatility Index	-1
DGS3	VXVCLS	2.00E-05	-0.15841	0.18522	H0: 3-YearTreasuryConstantMaturityRat -/-> CBOES&P5003-MonthVolatilityIndex	-1
DGS3	T5YIE	0	0.00704	0.1689	H0: 3-YearTreasuryConstantMaturityRat -/-> 5-Year Breakeven Inflation Rate	1

Variable X	Variable Y	p-value	Long Run Multiplier	pvLRM	Label	Sign
DGS3	T5YIFR	8.00E-05	0.00308	0.37859	H0: 3-YearTreasuryConstantMaturityRat -/-> 5-Year,5-YearFrwrdInfltnExpcttnRt	1
DGS3	T10YIE	0	0.00898	3.00E-05	H0: 3-YearTreasuryConstantMaturityRat -/-> 10-Year Breakeven Inflation Rate	1
DGS3	DFF	0.00309	0.0014	0.09863	H0: 3-YearTreasuryConstantMaturityRat -/-> Effective Federal Funds Rate	1
DGS3	DGS3MO	0	0.002	0.01388	H0: 3-YearTreasuryConstantMaturityRat -/-> 3-MonthTreasuryConstantMaturityRt	1
DGS3	DPRIME	0.00058	0.00393	0.07626	H0: 3-YearTreasuryConstantMaturityRat -/-> Bank Prime Loan Rate	1

6. Ex-Post Discussion

The results in Table 2 also produce a Flowchart using the R-command. This visual representation of the sequence of steps incorporating each of the variables with a node and each link establishes a causal relationship. This study shows some import illustrations from this flow chart. The ‘black’ color node shows positive Granger Causality and the ‘red’ color node represents negative Granger Causality. The 3-Year Treasury Constant Maturity Rate (DGS3) has shown three unique Granger causality with DEF, T5YIFR, T10YIE, and DGS3MO. 3-Month Treasury Constant Maturity Rate (DGS3MO) shows positive Granger causality to T5YIFR but in response T5YIFR has a negative Granger Causality with DGS3MO. 5-Year Forward Inflation Expectation Rate (T5YIFR) shows negative Granger Causality to Effective Federal Funds Rate (DEF) but in reply DEF shows positive causal effect on T5YIFR.

This T5YIFR shows positive causality with S&P 500 3-Month Volatility Index (VXVCLS) but in response VXVCLS has a negative Granger causality to T5YIFR. DEF and VXVCLS both negatively Granger causes each other which is established with that of the red color nodes. 5-Year Breakeven Inflation Rate (T5YIE) and Bank Prime Loan Rate (DPRIME) shows negative causal relationship with each other. However, T10YIE positively Granger causes GVZCLS but in opposite direction GVZCLS has a negative effect on T10YIE. Besides, no other inflation rates, interest rates, and stock volatility indices builds any form of strong granger causality between them as portrayed from the following flow chart.

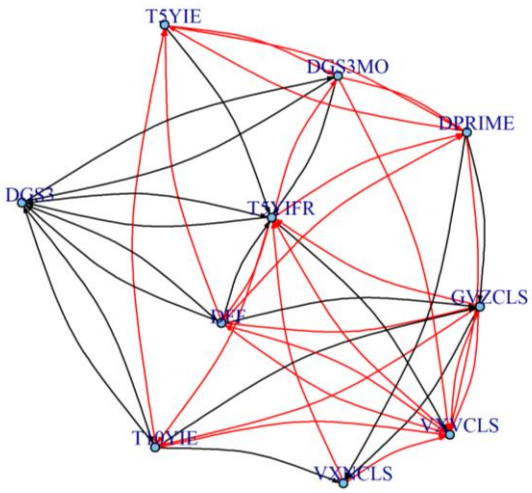


Figure 1: The Flow Chart

For example, VXNCLS has a negative Granger causality on VXVCLS but not the reverse is true. On the other hand, T10YIE do a positive granger causes on VXNCLS but there is zero causality in reverse. GVZCLS has a negative Granger Causality over DPRIME but the reverse causality is absent here in this diagram. Therefore, the study can make a decision that interest rate has a clear Granger causal effects on inflation rate and to some extent with stock volatilities. However, stock volatilities could not make any prominent causal effects on interest rates in reverse. This chart is therefore, in most cases establishes a negative causal relationship with the stock volatilities and the inflation rates but the reverse is not true always. Thus, the findings of this study therefore, verify that interest rate has the strong impact on inflation rate and vice-versa. Inflation rate although did not create any workable impact on volatilities but it creates in a shorter extent some negative impacts on stock price changes.

The interest rate however in a broad sense has significant effect on the stock volatilities. This result could be more interesting if a number of appropriate inflation rate (such as CPI) can be included and this will surely cause stock volatility, that's why I opened it up for further research and I welcome everyone to do similar type of research with more fitting inflation rates and interest rates and investigate the influence of them on stock price volatilities.

7. Conclusion

This paper empirically examines the Granger Causality test between the stock price volatilities, interest rates and inflation rates in tems of auto regressive and distributed lag effects. Daily data from June 2008 to December 2017 are used for the various interest rates and the major inflation rates to investigate the two-way causality under the Granger procedure between stock volatilities and among those indices. The probability value for the long run multiplier within that set range of time periods helps to identify the significant Granger causality test results. Considering the overall results, this study

therefore examines the causality sign to see how each of these variables affects the others within this procedure. The empirical findings from the causality tests therefore reveals that there is a strong statistical relationship between the interest rate and inflation rate and also there exists causality between interest rates and stock volatilities to some extent. It also shows, in many cases, there is no relationship among the stock volatilites and the inflation rates. Hence, the Granger Causality test proves unidirectional and bi-directional causality running from interest rates to inflation rates to stock returns and also from inflation rates to stock returns to interest rates. However, a different scenario could be established between them if the number of interest rates and inflation rates is no longer controlled.

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Value Chain Analysis of Mud Crab in the South-West Coastal Region of Bangladesh

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Abstract : Mud crab centric livelihood is one of the major provisionary services for mangrove adjacent poor community in the south-west coastal region of Bangladesh. The core objective of this research is to portray how the value adding activities are performed by multitudinous mud crab centric actors. In this regard the authors purposively choose total 93 actors related with mud crab centric activities and grouped them into seven main channels based on the information retrieved from field visit, KII and FGD. Analytical operations like percentile distribution and average calculation are executed in addition to generating flow-chart and tabular exhibitions for representing material flow, input and support service flow, money flow, involved stakeholders and stages, value adding activities and value addition. This study finds that in each of the main channels, crab catcher and depot are common. However, the fattener plays a dominant role for value addition of mud crab by nurturing and fattening them. Therefore, the paper recommends developing and expanding fattener-oriented chain so that the mud crab centric economic activities become more value additive. Two major actors, crab catcher and fattener are not getting proper price. They are trapped in the vicious circle of credit burden and supposed to sell crab at lower price to the middleman or depot owner. Therefore, alternative credit management is inevitable for the crab catchers at favorable terms and conditions.

Keywords: Mud Crab, Fattener, Sundarban, Value Chain

JEL Classification: Q57, Q22, Q23, D46

1. Introduction

Mud crab centric economic activities are mostly dependent on the direct catch from the nature by the crab catchers, while only a minor part of mud crab supply comes from crab fatteners(Alava et al., 2007). The ongoing fattening practice of mud crab in Bangladesh is related to farming large juvenile or small adult crab with soft shell or broken leg until it gains a commercially tradable size.

Wild mud crab is a popular seafood bearing rich nutritional value. Its' increasing market demand leads expansion of mud crab-oriented livelihood in the coastal region of Bangladesh. It is an export item of Bangladesh, which is playing an important role in boosting GDP of the country. Taiwan, Singapore, Hong Kong, Malaysia, Thailand, and the USA are the major mud crab export destinations of Bangladesh.

Mud crab-oriented economic activities are expanding rapidly because of its high economic value (Keenan, 1999). It generates direct and indirect employment opportunities to the people associated with its collection, fattening and marketing. This species provides livelihood support for millions of poor crab catchers, fatteners, fishers, traders, and transporters of the value chain (Azam et al., 1998).

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According to Woldesenbet (2013), value chain analysis (VCA) is a method for accounting and presenting the value of products and services, which is transformed from raw inputs to a final product consumed by the end users. VCA identifies the full set of economic cost along with the value chain and it determines where how much value is added and the relative importance of different actors (CYE Consult, 2009).

The chain for the mud crab begins from the crab catchers. The crab catchers collect crab from the mangrove and sell to the local traders i.e., agents of mud crab value chain (Hossain et al., 2018). The *foria*, fattener and the depot owner are the local traders of the mud crab value chain. Crab fattening practice in pond was introduced in Bangladesh in early 1990's (Kamal, 2002), while fattening and culture of mud crab in bamboo cages at experimental level started at early 2000's (Khatun, 2007). Therefore, the fatteners are newcomers in the crab value chain. Yet the number of crab fattener is increasing day by day. Rahman et al. (2015) state that more than 60 percent respondents in their study area consider crab fattening as their primary occupation.

The chain of the mud crab begins from the most disadvantaged section of coastal population, the crab catchers who collect crab from the forest and sell to the local traders, like *foria* or depot. *Foria* usually lend money to the collectors in the lean season in a condition that the later will sell their entire catch to the former at a certain price fixed earlier. Through such conditional trading, local collectors never get the actual price of their catch. According to the field visit, the local *foria* purchase crabs from the collectors in 2-4 grades, while the depot owners purchase crabs from the local *foria* in 8-10 grades. Depot *owners* also lend money in form of credit to the collectors in the lean season in a condition that the later will sell their entire catch to the former at a certain price fixed earlier. These forms of conditional credit hinder the local crab catchers to get the actual price of their catch (Zafar, 2004).

While exploring the production and marketing of mud crab in the south-west coastal region of Bangladesh, Das et al. (2012) finds that mud crab culture in the region is mostly concentrated on hardening and fattening of wild mud crab collected from the mangroves. Fattening and hardening of mud crab usually require 10 to 30 days. The market price of mud crab depends on season and grade which fluctuates frequently. During Chinese festival, the price of mud crab is high irrespective of grade. In addition, at off-season i.e., the ban period, the price of mud crab is high for all grades. However, the price of crab is low at peak season of crab catch. In fact, the price fluctuates depending on availability and international market demand.

Ferdoushi et al. (2010) concentrate on the flow of mud crab as a product from catching to grading to final arrangement for exporting. The study finds that about two-third of the crab catchers sell their procured crabs to the *foria*. The rest one-third catchers sell the procured crab directly to the depot owner. In most of the cases, the catchers are bound to sell the procured crab to *foria* or depot owners at a lower price due to the agreed contractual agreement (in local language *dadon*). In contrast, such an agreement facilitates poor crab catchers to get access to required finance and necessary catching equipment.

Mud crab-oriented economic activities are versatile in nature. Sometimes, the crab catchers collect mud crab from mangrove and then directly sell to the depot owner. Another channel is associated with collection of immature mud crab from crab catcher

and depot owner and then nursing them and ultimately selling it to the depot owner after a certain period. The under-weight crabs rejected by the depot owners are purchased by the crab fatteners for further nursing for several days to more than one month. The fatteners sell the fattened crabs to the depot owner when the shell of the mud crab becomes hard. In some cases, the depot owners also play the role of crab fattener through nursing the juvenile crab in their pond until the shell becomes hard. The depot owners grade the collected mud crab according to size, weight, and gender for final export. These versatile mud crab-oriented practices added some sort of value to the product. Therefore, we are interested to investigate the nature, degree, and amount of value addition by the agents of mud crab value chain.

Accordingly, the main objective of the study is:

- To analyze the value chain of wild mud crab in the south-west costal region of Bangladesh

To address this objective, the study attempts to find out how much value is added at different stages of the chain. It mainly covers the stages of crab value chain i.e., mud crab collection, value addition at each stage, distribution of collected wild mud crab at different distribution channels, grading of crab according to weight and gender and so on.

This section depicts the background of the study. The next section explains the methodology of the research. Section 3 introduces the study results and section 4 discusses study findings compared to available knowledge. Finally, section 5 concludes by highlighting recommendations.

2. Methodology

Considering the gained information from literature, KII and field visit as benchmark, this study attempts to figure out the detailed value chain of mud crab in the south-west coastal region of Bangladesh. We tried to identify the value adding activities across the mud crab-based value chain performed by different stakeholders. We also concentrate on addressing the question about how and how much value is added in different channels/stages of mud crab flow in the value chain. The time duration required for value addition at various stages i.e., the period of holding crab at hand for value addition is considered in this study. The literature, KII and field visit endorse catching wild mud crab, storing, sorting, grading, feeding, preserving alive, shell hardening, and packaging are the main value adding activities along the mud crab value chain. This study tries to cross-check and complete such value adding activity list in addition to identifying about which value adding activities are performed at which stage by different actors. In addition, we also explore the volume contribution of each of the actors in the value chain. Such an attempt will help us to understand the relative share/contribution in value addition by various actors across the chain. In summary, we are keen to make a comprehensive investigation on mud crab centric value adding activities in the south-west coastal region of Bangladesh. We consider multiple dimensions such as material flow, input and support service flow, money flow, involved stakeholders and stages, value adding activities and value addition to fill in the gaps (question marks) of Table 1.

Table 1: Matrix for Value Chain Analysis

Agents / Stages / Stakeholders	Main Activities	Main Value Adding Activities	Rejection Rate	Value Addition (BDT)
Mud crab catcher	Mud crab catching	?	?	?
Middlemen	Crab purchase and sell	?	?	?
Nursery owner	Cultivation	?	?	?
Fattener	Fattening	?	?	?
Depot owner	Crab purchase, grading and sell	?	?	?
Transporter	Crab transportation	?	?	?
Exporter	Crab export	?	?	?

Source: Authors' compilation based on literature review, KII and Field visit

As illustrated in Table 1, the aim of this study is to trace out the stakeholders and stages; materials, input & money flow; value adding activities and value addition associated at each stage/stakeholder in the value chain. The prevailing and prospective forward and backward linkages associated with each stage of the value chain are also explored through FGDs. Accordingly, this study tried to sketch an updated, complete, composite, and comprehensive value chain for mud crab with a specific focus on the south-west region of Bangladesh.

For analysis of the mud crab-oriented value chain, data from crab catcher, *foria*, fattener, nursery operator, depot and sub-depot owner are collected through FGD and interview method. Here, we are keen to draw a complete overview of mud crab value chain by exploring how stakeholders' value addition activities contribute to every single stage.

Table 2 explains the sampling framework. In this case, we apply purposive sampling procedure. The enumerators go to the local bazaar and collect information from different actors associated with mud crab centric economic activities. The agents of the value chain are crab catcher, *foria*, fattener 1, fattener 2, sub-depot and depot owners. The purposively selected agents of the value chain are located in the three districts adjacent to the Sundarban - Khulna, Satkhira and Bagerhat. Table 2 depicts the specification of agent-wise and district-wise sample size.

Table 2: Sampling Framework for Value Chain Analysis

Agent	Number		District	Number
Catcher	18		Khulna	33
Foria	18		Satkhira	30
Fattener 1	18		Bagerhat	30
Fattener 2	15		**Total**	**93**
Sub-Depot	6			
Depot	18			
Total[1]	**93**			

N.B.: Fattener 1 – Who are engaged in fattening for shorter time period, up to one month; Fattener 2 – Who are engaged in fattening for a longer time period, more than one month

After data collection through an interview schedule, the trained enumerators have successfully accomplished the data entry task. Then the data is compiled, cleaned, and sorted for making those useable for further analysis.

3. Results

Wild mud crab is a valuable provisionary service provided by the Sundarban mangrove ecosystem. Based on literature review, field visit, KII, FGD, field interviewand expert consultation, we identify eight major agents of wild mud crab value chain, namely crab catcher, *foria*, fattener 1, fattener 2, sub-depot, depot, exporter, and importer. All these agents are engaged in mud crab centric various economic activities in the value chain. However, due to lack of access to the importer, we consider only the first seven agents in this study while analyzing the value chain.

3.1 Value Adding Activities

Table 3 lists agent-wise main value adding activities. Feeding crab, preserving them at a cool place, binding of leg, contact with other agents are the main value adding activities performed by the crab catchers. Similarly, feeding crab, preserving crab at a cool place, providing credit to the catcher, taking loan from depot owner, contact with other agents are the main value adding activities performed by the *foria*. Cutting rope of leg, feeding crab, fencing the pond, medicinal support, using cage, nursing, contact with other agents are performed by the fatteners. Collecting crab, weighting, grading, packaging, contact with other agents are the main value adding activities performed by the sub-depot and depot (Table 3).

[1] In addition, we collected data from four exporters at Dhaka to get exporters' value addition data.

Table 3: Value Adding Activities

Agent	Value Adding Activities
Catcher	Feed the crab Preserve (keep) crab at a cool place Binding of leg Loan for meeting operating and capital expenses Contact with other agents of the crab value chain
Foria	Feed to crab Preserving (keeping) crab at a cool place Provide credit to the catcher Take loan from depot owner for supplying crab Contact with other agents of the crab value chain
Fattener 1 & 2	Cutting rope of leg Feed to crab Change water of pond Fencing the pond Provide medicinal support Keep crab inside the cage Repair broken cage of crab Nursing until the shell become hard Catching crab from pond for sale Binding leg again after catching Contact with other agents of the crab value chain
Sub-depot	Collecting crab Weighting Grading Packaging Contact with other agents of the crab value chain
Depot	Weighting Grading Packaging Contact with other agents of the crab value chain Purchasing big box and other things for sending to exporter

Source: Authors' compilation

3.2 Channels of Value Chain

Multiple parties are involved as agents of mud crab-oriented value chain. Accordingly, there is a variation in nature of dealings among the agents as well as their value adding activities. We consider 93 individual channels for 93 agents and try to classify those into several broader channels. We find five major channels having 2-3 agents in each. The Catcher-Depot (C-D) channel comprises around 14 percent of the total considered 93 channels. Some other important channels are Catcher-Sub Depot-Depot (C-SD-D),

Catcher-*Foria*-Depot (C-F-D), Catcher-Fattener 1-Depot (C-F1-D) and Catcher-Fattener 2-Depot (C-F2-D). All these separately comprise around 10 percent or more of the total considered 93 channels. The rest channels are broadly classified into two broader subgroups – with vs. without the presence of sub-depot. The subgroup having sub-depot is Catcher-*Foria*/Fattener 1/Fattener 2/Sub Depot-Depot (C-F/F1/F2/SD-D) and the other is Catcher-*Foria*/Fattener 1/Fattener 2-Depot (C-F/F1/F2-D). All the channels in these two subgroups have at least four agents having catcher and depot as common and at least two other agents among *foria*, fattener 1, fattener 2 and sub-depot.

Catcher and depot are the most important agents across the value chain. We find the presence of both catcher and depot in all 93 channels. However, other agents like *foria*, fattener 1, fattener 2 and sub-depot are involved less as compared to catcher and depot in the channels of value chain. Hence, we can say that catcher and depot are the key actors of the value chain channels. Crab catcher is the first agent of the value chain who brings the crab in the flow of value chain and depot is the last agent from whom the crab reaches to the hand of importer via exporter. After catcher and depot, the third and fourth important agents in the channels are sub-depot and *foria* respectively from frequency of involvement perspective. We find least involvement of fattener 1 and 2 in the channels. However, they play dominant role to increase the value of crab by performing fattening activities.

3.3 Frequency of Contact across the Value Chain

Table 4 describes the frequency of contact of the catcher with *foria*, depot, sub-depot, fattener 1, fattener 2, forest officer and local market.

Table 4: Frequency of Contact

	Foria	Depot / Sub-depot	Fattener 1	Fattener 2	Forest officer	Local market
No	111	69	233	221	23	257
Very rarely	8	24	3	6	11	7
Rarely	2	20	5	7	13	3
Sometimes	38	41	11	13	124	15
Frequently	39	65	24	23	92	16
Very frequently	102	81	24	30	37	2
All	300	300	300	300	300	300

Source: Authors' compilation

The data of Table 4 claims that the crab catchers contact with *foria*, depot, and sub-depot very frequently. However, the reverse scenario is found in case of fattener 1, fattener 2 and local market where they have very minimum contact. The crab catchers also contact frequently with forest officer. It is mainly for getting entry permit of entering inside the forest.

3.4 Agent-wise Analysis in the Value Chain

Table 5 delineates that the same agent is doing multiple activities across the chain. For example, the crab catcher is working as *foria* or fattener 1, in some cases *foria* is working as fattener 1, fattener 2, sub-depot and depot owner.

Table 5: Multiple Activities by the Same Agent of Value Chain

	Catcher	*Foria*	Fattener 1	Fattener 2	Sub-Depot	Depot
Catcher	*******	*	*			
Foria		*******	**	*	*	*
Fattener 1			*******	**	*	
Fattener 2	*		***	*******		
Sub-Depot			*		******	
Depot			**	*		******

Source: Authors' compilation

N.B.: Star (*) refers to frequency of attachment, three or more agents for each star. Please proceed horizontally.

Table 6 represents the agent-wise information of crab value chain. It comprises different issues like rejection of the defective crab, buying price, selling price, value addition and duration of crab holding.

Table 6: Agent-wise Information of Crab Value Chain

Agent	Rejection rate (%)	Buying price (BDT/kg)	Selling price (BDT/kg)	Value addition (%)	Holding duration (Day)
Catcher	9	0	355	-	2
Foria	7	299	364	21	2
Fattener 1	12	268	494	85	18
Fattener 2	11	292	622	113	37
Sub-Depot	9	305	333	9	1
Depot	9	333	442	33	3
Exporter	-	577	807	47	1

Source: Authors' compilation

In Table 6 we find that the rejection rate in percentage is higher in the case of fattener 1 and fattener 2. It is 12 percent and 11 percent, respectively. We also find that fattener 2 has the highest value addition (113 percent) while compared with other agents of the value chain. The selling price for fattener 2 is the highest as compared with other agents. Hence, based on the primary data we can say that fattener is a particularly important agent in the crab value chain whose value addition, selling price and holding duration is the highest. After fattener, the second highest place form value addition perspective is hold by the exporters.

3.5 Channel-wise Analysis in the Value Chain

Table 7 depicts channel-wise information of the crab value chain. The data shows that highest rejection rate is prevailing in Catcher-Fattener 2-Depot (C-F2-D) channel, which is around 14 percent.

Table 7: Channel-wise Information of Crab Value Chain

Value Chain Channels	Rejection rate (%)	Buying price (BDT/kg)	Selling price (BDT/kg)	Value addition (%)	Holding duration (Day)
C-D	14	357	385	8	1
C-SD-D	9	311	310	15	1
C-F-D	8	296	428	45	2
C-F1-D	10	310	548	77	28
C-F2-D	14	292	669	129	37
C-F/F1/F2-D	4	248	459	85	29
C-F/F1/F2-SD-D	10	308	372	21	6

N.B.: C – Catcher, F – Foria, F1 – Fattener 1, F2 – Fattener 2, SD – Sub Depot, D – Depot.

Table 7 demonstrates that value addition is also the highest (129 percent) in this chain. The second chain that contributes value-adding activities with minimum rejection rate and maximum value addition is Catcher-*Foria*-Fattener 1-Fattener 2-Depot (C-F/F1/F2-D). The rejection rate is only 4 percent and value addition is 85 percent in this channel. The duration of holding crab is also higher in both the chains. Therefore, we need to develop and expand this chain so that the mud crab centric economic activities become more value additive.

3.6 Grade-wise Analysis in the Value Chain

According to literature review, KII and field visit, the value chain agents classify crab in multiple major grades based on weight and gender. Table 8 reports grade wise rejection rate and value addition.

Table 8: Grade-wise Information of Crab Value Chain

Grade	Rejection rate (%)	Buying price (BDT/kg)	Selling price (BDT/kg)	Value addition (%)
M_XXL	3	677	790	17
M_XL	4	572	673	18
M_L	7	428	536	25
M_M	4	278	357	28
M_SM	22	217	276	27
M_SSM	22	155	171	11

Grade	Rejection rate (%)	Buying price (BDT/kg)	Selling price (BDT/kg)	Value addition (%)
M_P	21	68	100	46
M_PD	7	281	418	46
F_FF1	6	576	727	26
F_F1	8	309	400	29
F_F2	14	218	262	20
F_F3	2	56	184	226
F_P	0	300	750	150
F_PD	8	222	359	66
Male	11	335	415	27
Female	6	280	447	86
Grade	9	349	438	43
Non-grade	9	218	407	77

Source: Authors' compilation

The buying and selling price of large-sized crab is higher compared to small-sized crab for both male and female. However, the value addition as well as the rejection rate for female crab is higher than that of male crab. In Table 8 the highest rate of value addition is noticed from F3 grade female mud crab and the second highest rate of value addition is generated from female piece crab. The data also provide the evidence that female crab has higher percentage of value addition than that of male crab. It also signals that the value addition is more in non-graded crab than that of graded crab. The main reason behind this is that the graded crabs are sold in the market directly for export. In contrast, the crabs that are not yet eligible to be considered as a graded product instantly are purchased by the fattener 1 and fattener 2 for further nursing. When they are matured and eligible for categorized in any grade, they are caught by the fattener 1 and 2 and sold. Sometimes the depot owners have their own pond for fattening crab as they know that non-graded crab will gain value if they are nursed properly.

3.7 Mud Crab Value Chain in Brief

Figure 1 describes the mud crab value chain briefly. It includes six main agents of the value chain: crab catcher, *foria*, fattener 1, fattener 2, sub-depot and depot. It also describes five main channels: Catcher-Depot (C-D), Catcher-Sub Depot-Depot (C-SD-D), Catcher-*Foria*-Depot (C-F-D), Catcher-Fattener 1-Depot (C-F1-D) and Catcher-Fattener 2-Depot (C-F2-D). All other channels are included in Catcher-*Foria*/Fattener 1/Fattener 2/Sub Depot-Depot (C-F/F1/F2/SD-D). Here, 'N' refers to a channel's existence in total number of considered channels (in %) in the value chain, 'VA' refers to value addition in percentage, 'D' refers to crab holding duration (in days) in a channel, 'R' refers to crab rejection rate in a channel and 'V' refers to value addition per day in percentage.

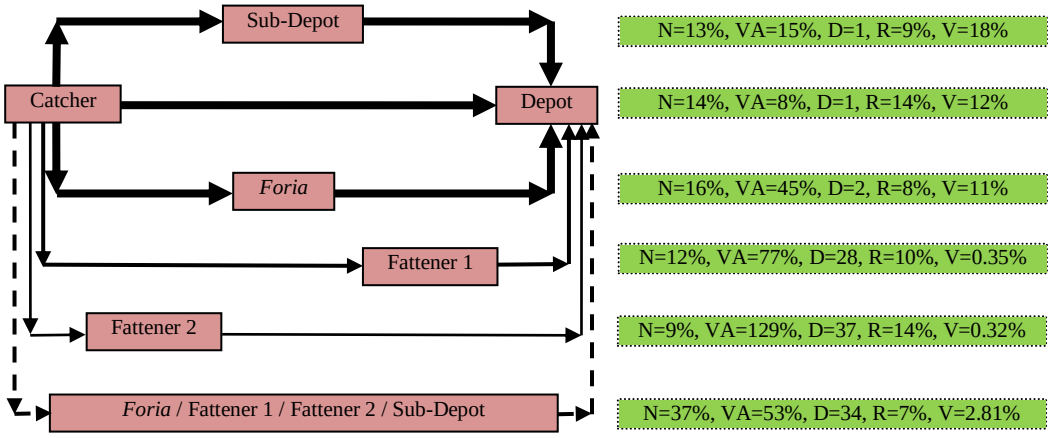


Figure 1: Mud Crab Value Chain

N.B.: N = A channel's existence in total number of considered channels (in %) in the value chain; VA = Value addition in percentage; D = Crab holding duration in a channel; R = Crab rejection rate in a channel; V = Value addition per day in percentage.

It seems that in Figure 1 the value addition is the highest when the crab passes through fattener 2 followed by fattener 1. However, a completely different and reverse scenario is observed if we consider value addition per day instead of total value addition. For example, per day value addition is the highest (18 percent) when the crab passes through C-SD-D channel. It is 12 percent for C-D and 11 percent for C-F-D channel, respectively. Hence, it is evident that the depot, sub-depot and *foria* are capturing the major amount of the added value. Furthermore, if werun the similar exercise of per day value addition for value chain agents, we find that it is the highest for the exporters, 47 percent followed by 11 percent for both *foria* and depot and 9 percent for sub-depot, whereas it is only 3-5 percent for fatteners. Hence, we find that the exporters, *foria*, depot and sub-depot are capturing the major amount of the added value.

Fatteners are doing the real value adding activities through fattening and nursing the crab, but they are getting very insignificant amount of added value, though they have to incur higher cost for accomplishing the value adding activities. According to the collected data, the direct cost incurred (in addition to buying price and office maintenance cost) by the fattener 1 and 2 are 46 BDT and 72 BDT per kg respectively on average. In contrast, the role of sub-depot, depot and *foria* is just to collect and buy crab from the catchers and supply it to the agents of forward linkage with very minimum value adding activities and minimum cost, only 5 and 8 BDT per kg. However, they are capturing a major share of the added value. The root cause behind the said discrepancy is the vicious cycle of informal credit. Most of the catchers depend on the loan taken from depot, sub-depot and *foria* to continue the mud crab collection activities from the mangrove ecosystem. Our data indicates that mean credit amount for the crab catchers is around 10,000 BDT per head. Such a scenario facilitates the credit providers i.e., the depot, sub-depot and *foria* to capture the major share of the added value in the mud crab value chain.

Another interesting finding is the change in crab grading by the exporters. The exporters usually buy as per the local grades such as **XXL(W**≥500), **XL(**500>**W**≥400),

L(400>**W**≥300), **M(**300>**W**≥250), **SM(**250>**W**≥200) and **SSM(**200>**W**≥150) as grades for male crab and **FF1(W**≥200), **F1(**200>**W**≥180), **F2(**180>**W**≥150) and **F3(**150>**W**≥120) as grades for female crab. However, they redefine the grades as 4XL, 3XL, XXL, XL, L, M and SM for male crab and 5F, 4F, 3F and 2F for female crabs. Such re-grading activities facilitate the exporters to grab a handsome amount of price margin and added value.

4. Discussion

Mud crab centric value adding activities are mostly confined to a certain cluster of stakeholders. The crab catcher and the depot owner remain present in every possible chain of the observed 93 patterns of value additive channels in the study area. These channels are rearranged into seven broader channels. The crab catchers have a high frequency of contact with *foria*, depot, and sub-depot than other actors in the chain. This finding is consistent with Bhuiyanet al. (2021) who endorsed the active presence of crab collector in each of the five distinct channels of crab value chain.

This study observed that the patterns of grading crabs vary in the domestic and international markets. Firstly, crabs are graded in the local market according to gender, size, and weight. After receiving the product, importers themselves re-grade the crabs as per the international market standard. Mahmud and Mamun (2013), Ferdousi et al. (2010), and Haque (2010) also endorse the grading pattern of mud crab on the same ground.

Internationally graded crabs are sold at a higher price than that of domestically graded mud crab. Bhuiyanet al. (2021) has also found price discrimination in the domestic and international markets. Hossain et al. (2018) also revealed that the price gap between crab catchers and the exporters is quite far from the added value at different intermediate steps.

This study finds that the price of female crab is higher than male crab because of the variation of meat, tenderness, and taste. The data also demonstrates that the fattener 2 contributes the highest percentage of value addition (113 percent). Fattener is an important agent in the crab value chain whose value addition, selling price, and holding duration are the highest. This study suggests developing and expanding fattener-oriented chain following Rahman et al. (2020) so that the mud crab centric economic activities become more value additive, which will ultimately facilitate more parties involved in the value addition process.

We find that the exporter, depot, sub-depot, and *foria* are capturing the major benefit of value addition. The fatteners are doing the real value adding activities through fattening and nursing the crab, but they are getting a very insignificant financial reward for their contributions. However, they incur a higher cost for accomplishing the mentioned value adding activities. The root cause behind the said discrepancy is the vicious cycle of informal credit provided by the depot, sub-depot, and *foria* to the crab catchers and fatteners. This finding is consistent with Zafar and Ahsan (2006). They argued that the crab collectors did not get the actual price due to the rent-seeking behavior of brokers and the burden of loans. They are supposed to sell crabs at a minimum price to the specified brokers or wholesalers who lend them money in their lean period. Sujan et al. (2021) also prioritized capital inadequacy as the second ranked constraint faced by the crab farmers.

5. Conclusion

This study tries to draw a composite picture of the value chain of mud crab. There are seven major actors in this value chain process. The actorsof the chain are performing multiple activities across the chain. However, the contribution of fattener-1and fattener-2 is dominant under the ground even though the reward in the form of money is trivial. Besides, the crab catchers are the lowest receiver of monetary benefit. Informal credit arrangements of the depot, *foria*, and middleman are the main culprit behind the discrepancies. Therefore, it is important to initiate credit accessibility at easy terms and conditions to the crab catchers from alternative sources. It might help the crab catcher and fattener to dissociate their bindings of selling products to those specific loan providers i.e., depot, *foria*, and middleman. Besides, it boosts the bargaining capabilities of the crab catchers and fatteners in the perfectly competitive market for a fair price. It will create an avenue for the mud crab value chain centric stakeholders to claim their own bite in the value addition cake. In addition, the grading of mud crab is different in the domestic and international markets. The price of internationally graded crab is higher than domestically graded crab. Therefore, depot and sub-depot owners should follow the internationally recognized grading system. It will accelerate more financial inflow in the crab value chain.

This paper addresses agent-wise, channel-wise, and grade-wise mud crab centric value adding activities which are the unique contributions of the paper. Future studies on this topic might be able to think of it as a baseline study for further exploring the issue. In addition, how financial inclusion at easy terms can benefit all the actors related to mud crab catch can be explored further by others.

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The Gibson Paradox: An Empirical Examination for the Bangladesh Economy

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Abstract: The subject matter of this article is to pursue the existence of positive dependency between inflation and interest rate, known as "Gibson Paradox" which is in conflict to our traditional theory where a negative association ship between interest rate and inflation exists. Suitable ARDL technique is used to check the dynamics among variables with a view to confirming long run relationship between variables. Unit root test with various diagnostic tests empirically reveals Gibson Paradox is not valid for Bangladesh for short run and long-run both but they provides negative relationship with long term dependency by supporting the traditional theory. ECM shows about 42.26% is corrected each year form short-divergence to long-term equilibrium. It will contribute to the existing literature by using modern econometric techniques between inflation rate and interest rate during period 1986-2019.

Keywords: Gibson Paradox, Interest rate, Inflation, Unit root test, ARDL

1. Introduction

By studying over two hundred years of UK data Gibson in 1923 able to present pragmatic evidence that shows a positive association between price level and interest rates but this same results without empirical evidence was first presented by Tooke in 1844.This finding challenges and rejects the classical macroeconomic theory which predicts rate of interest is determined independently without affecting price level. Keynes strongly believed that the term "Gibson's paradoxes" was long-term interest rates and general price level changes. Since this relationship has no strong theoretical foundation this phenomenon becomes a controversial subject for further study. But Friedman and Schwartz (1982) rejected Fisher's findings because the distributed lags were estimated to be too long. John Maynard Keynes (1930) asserted that if demand for loans increased that could results to increase interest rate with a higher level of aggregate prices. Friedman and Schwartz (1982) had used data by covering Gold standard era and provide empirical evidence in the light of Gibson paradox and concluded that this was a paradox following the gold standard period. In 1980s, however, Dwyer (1984) concluded that Gibson Paradox may not hold over the time period throughout countries. Corbae and Ouliaris (1989) study found spurious results of Gibson paradox by examining the data of US and UK for the period 1920-1987. This disputed Gibson Paradox was rejected at the prior of 1990s, as it doesn't satisfy the time series properties. Recent empirical studies on this subject, however, continue to produce mixed results. In the last four decades, Klein (1995) discovered evidence to back up the Gibson paradox.

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The correlation suggested by monetary theorist should have been changes in the rate of interest and inflation that is the level of price. Central banks set monetary policy on this basis, and now that the gold standard is no longer in use, people who have studied the dilemma are likely to conclude that it is no longer relevant. There is no such link, according to empirical studies that is, instead of resolving Gibson's paradox, the Neo-Keynesian and monetarist schools have chosen to disregard it and 90s econometric techniques also rejected the Gibson paradox as data produced failed to satisfy the properties hold in time series. This appears to be a plausible explanation for today's lack of interest in the subject, which many expert economists are ignorant of.

Gibson's paradox is based on 200 years of long-run empirical evidence, from 1730 to 1930, when Arthur Gibson found that fluctuations in the yield on British Government Consols 2.5 percent Stock were positively connected with wholesale price levels. The Gibson paradox has not been investigated previously in Bangladesh as far as our knowledge. Validity of Gibson Paradox checking after fifty years of independence in Bangladesh is necessary since it may yield crucial insights for policymakers when they enact or design policies that will benefit the country. If this relationship continues, we will be able to claim supply-side dominance for our country. This paper therefore addresses the research gap of no previous study in Bangladesh with a view to contributing existing literature.

2. Literature Review

Friedman and Schwartz showed in 1982 that the relationship between Gibson paradox in the United States in their monetary trends which are unequivocally and clearly established for the period 1880-1914 during the operation time of Gold Standard.By investigating their work, Lee and Petruzzi (1986) by using the data for Great Britain (1800–1981) and the United States (1730–1980) supported the inference; the study again carried out when gold standard was in effect which did not lead to any definte conclusions. Further study carried out by Benjamin Klein (1975), Barsky and Summers (1988), Mills (2008) and Dowd and Harrison (2000) provide documentation that, with the end of the gold era, the statistical correlation of prices to nominal rates changes substantially. Chung, Chen, Jevons and Lee (1990) confirmed the evidence of the dynamic structural shift of their associationshipresulting from a shift of monetary standard. Ibrahim and Williams (1978), Benjamin Klein (1975) and Dwyer (1984) demonstrated significant changed resulted in nominal yields and price levels following the end of the gold standard. Chung, Chen, Jevons, and Lee discovered the dynamic relationship between structural changes in prices and interest rates resulting from monetary standard changes in 1990.Shiller & Siegel (1977) tried to investigate this correlation between prices and interest rates, which has been a Gibson Paradox (GP) for the last quarter of a millennium. Spectral methods used to confirm the correlation of prices and long-term rate of interest rate(the Gibson Paradox)for very long-term swings, but suggested a substantial short-term correlation of interest rates alone, which we referred to as the Kitchin phenomenon. Previous clarifications of these interactions also neglected to differentiate between interest rate and cycle times. Their findings deny Irving Fisher's explanations of "price expectation" and the velocity of money explanations from Sargent-Wickseell. H. Summers & Barsky (1988) contribute a new aspect of learning to grasp the Gibson paradox (GP), which decreases the equilibrium

relative price of gold caused by real rate of return in the economy with the nominal price of gold anchored by the government, forcing the price level to rise. The system attempted to balance gold allocation between monetary and nonmonetary purposes. Dowd and Sampson (1993) used the Johansen cointegration technique to analyze the impact of gold reserves and interest rates on the gold standard price. It concludes that there are two balanced relationships between gold stock, price level, and interest rate, and that conventional Gibson's paradoxical conclusions are mis-specified. Based on fresh data from Chinese monetary history Cheng, G. Kesselring, and Brown (2013) concluded that the Gibson paradox (GP) existed throughout China's silver-cored metallic standard period. Abdullah (2013)attempted to establish empirical correlations among gold prices, IR and commodities prices. He claimed that the value and purchasing power of US dollar and UK pound. Theirfindings about purchasing power are the associations to its real interest rate and exchange rate so that changes in prices are the result and not the cause. Caporale & Škare, (2014) adopts a non-linear multivariate system to analyze the paradox of Gibson in the Netherlands over the period 1800-2012. In specific, the methods used are SSA (singular spectrum) and MSSA (multichannel singular spectrum). In the Netherlands over the past 200 years, it is demonstrated that gold price fluctuations or shifts in monetary policy regimes cannot consider for the actions of the prices of government bonds and yields. Ogbonna (2014) examines the presence of a substantial long-term relationship between price levels and nominal interest rates and examines the potential causal correlation between interest variables for the periods from 1970 to 2012, by using quarterly data on Nigeria. To evaluate the number of co-integrating vectors and to check the existence and direction of causality between price levels and nominal interest rates in Nigeria, the co-integration method proposed by Granger causality and Johansen (1988, 1991) that lends credence to the Gibson Paradox in Nigeria, which suggests that price levels and nominal interest rates are trending in the same direction over time and in a positive direction. When the ADL models were used to quantify the degree of long and short-term causality between interest variables, the results showed that they have a very strong causal relationship in the long run. Suggesting supply side dominates the CPI in Nigeria, rather than demand side. So, Policy attempts to reduce inflation while retaining a high nominal interest rate may therefore prove ineffective in Nigeria as both shares a significant positive correlation.

3. Methodology of this study

Source and Description of Data

We will use yearly time series data generated by the World Bank Development Indicator (WBDI) for the period 1986-2019 to investigate the Gibson paradox for Bangladesh. We'll use the lending interest rate (percentage) or IR, and the consumer price index (CPI) to measure inflation. If there are positive correlations between IN and IR, which is the objective of this research, we may conclude that the Gibson paradox (GP) is valid for Bangladesh, but if it doesn’t hold, it indicates the support of traditional validity in the context of Bangladesh. If we convert all of the variables to log form, we can estimate elasticities that is a more convenient way to explain the model. For econometric analysis, we will use the statistical packages of EViews 9.0.

The nature of the variables is given below.

Table 1: Variables Description

Variables	Nature
LIR	Natural log of Interest rate
LIN	Natural log of Inflation rate

Source: WDI

Nelson and Ploser (1982) showed that time series produced spurious results which is misleading to our objective if there exist unit root problems. So, before running ARDL, it is necessary to check the unit root problem to analyze the validity of the model. Numerous tests are used to find the unit root problem among them widely used approach is Augmented Dickey-Fuller (ADF) test. The cointegration of variables can be tested using a variety of approaches, but the ARDL bounds test is a popular choice because it allows for the combination of I (0) and I (1) series.

4. Results and Discussions

The stationarity of variables will be checked using the ADF unit root test, and the results will be presented in Table 1. Table 1 shows that they are stationarity at the first difference but not at the level, indicating that they are integrated of order I(1) in nature.

Table 2: Results of Unit root test

Variables	H_0 = Time series is non-stationary					
	In level form			In first difference form		
	Test Statistic	Prob*	Result	Test statistic	Prob*	Result
LIR	-1.5425	0.4997	Do not reject	-4.5751	0.0009	Reject
LIN	0.4857	0.9836	Do not reject	-4.2498	0.0022	Reject
Decision	Nonstationary			Stationary		

Source: Software output by using Eviews 9.0

We apply the ARDL bounds test technique to find out the cointegration between LRI and LIN in the context of Bangladesh. The F-statistic is compared to the upper and lower bound to test the cointegration. The F-statistic of the bounds test in table 4 is 7.969346 which is much larger than the 1% critical value of the upper bound of Pesaran et al. (2001) 7.84 so that it can be concluded that LRI and LIN are cointegrated. It can be concluded that the variables under this study are cointegrated, and they have long-term convergence.

Table 3: Results of ARDL Model

Dependent Variable: LRI Selected Model: ARDL(2, 4)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LRI(-1)	0.939498	0.178624	5.259645	0.0000
LRI(-2)	-0.362152	0.168370	-2.150932	0.0427
LIN	0.139344	0.442186	0.315125	0.7556
LIN(-1)	0.825843	0.728555	1.133536	0.2692
LIN(-2)	-0.653826	0.738428	-0.885430	0.3855
LIN(-3)	0.559041	0.728492	0.767395	0.4510
LIN(-4)	-0.961587	0.462619	-2.078571	0.0495
C	1.292019	0.347821	3.714608	0.0012

Source: Software output by using Eviews 9.0

Table 4: ARDL Bounds Test

Significance	F-statistic= 7.969346	
	I(0)	I(1)
10%	4.04	4.78
5%	4.94	5.73
1%	6.84	7.84

Source: Software output by using Eviews 9.0

In the short run, both LRI &LIN are significant at 5% level of significance. The negative value of ECM (-1) with statistically significant model are indicated to show the short-term deviation to long-run deviation, which is about 42.26% that is corrected each year form short divergence to long -term equilibrium which leads to 2.5 years to correct the equilibrium.

Table 5: Short Run Model

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LRI(-1))	0.362152	0.154158	2.349229	0.0282
D(LIN)	0.139344	0.423470	0.329052	0.7452
D(LIN(-1))	1.056372	0.447528	2.360459	0.0275
D(LIN(-2))	0.402546	0.458191	0.878555	0.3891
D(LIN(-3))	0.961587	0.452412	2.125466	0.0450
C	1.292019	0.334537	3.862111	0.0008
ECM(-1)	-0.422654	0.103540	-4.082056	0.0005
ECM = LRI - (-0.2157*LIN)				

Source: Software output by using Eviews 9.0

As LRI and LIN are cointegrated, then we can construct the long-term association ship. Here, LRI is the dependent variable and the explanatory variable is LIN. The LR outcomes are as follows in Table 6. Here the explanatory variable LIN is significant at the given level of significance. The results shows a 1% rise in inflation rate will cause to decrease the interest rate by 0.21%.

Table 6: Long Run elasticities

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIN	-0.215744	0.045619	-4.729308	0.0001

Source: Software output by using Eviews 9.0

Diagnostic Test

It is essential to perform the model diagnoses which includes normality test, serial correlation, heteroscedasticity, stability test etc. For the normality test, it is assumed that if the probability value is greater than 5%, in this case 69% that rejects the null hypothesis thus the residuals are normally distributed. Figure-1 shows the normality plot which is shown below.

The diagnosis in the ARDL model includingnormality tests, serial correlation test, heteroscedasticity test and finally stability test etc. should be monitored. For the normality test, it is assumed that if the probability value is greater than 5% In this case, 69 percent, which rejects the null hypothesis that means that residues are normally distributed. The normality plot below appears in Figure 1by using Eviews.

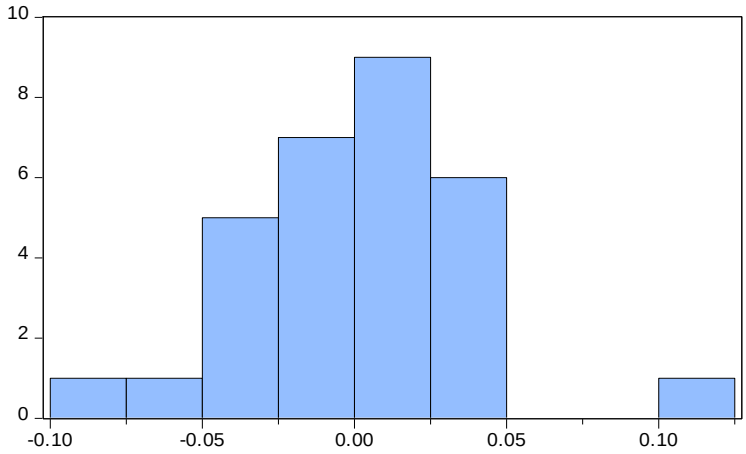


Figure 1: Normality Test

The results of several diagnostic tests are listed in the tables below, from where it is clear that the residuals are not serially correlated (null hypothesis of “no serial correlation” is not rejected at 5% significance level which is 22%), there is no heteroskedasticity problem (null hypothesis of homoscedasticity is not rejected at 5% significance level which is35%). Moreover, the model is correctly specified (null hypothesis of correct specification is not rejected at 5% significance level which is 25%).

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	1.633499	Prob. F(2,20)	0.2202
Obs*R-squared	4.212402	Prob. Chi-Square(2)	0.1217

Source: Software output by using Eviews 9.0

Ramsey RESET Test			
	Value	df	Probability
t-statistic	1.177143	21	0.2523
F-statistic	1.385666	(1, 21)	0.2523

Source: Software output by using Eviews 9.0

Heteroskedasticity Test: ARCH			
F-statistic	0.901860	Prob. F(1,27)	0.3507
Obs*R-squared	0.937354	Prob. Chi-Square(1)	0.3330

Source: Software output by using Eviews 9.0

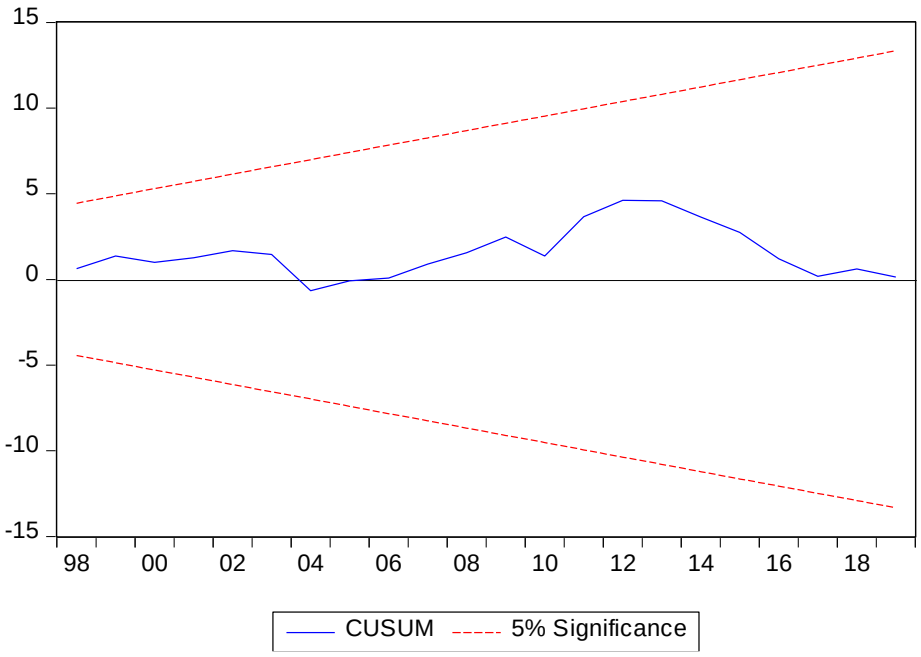


Figure : CUSUM Stability test

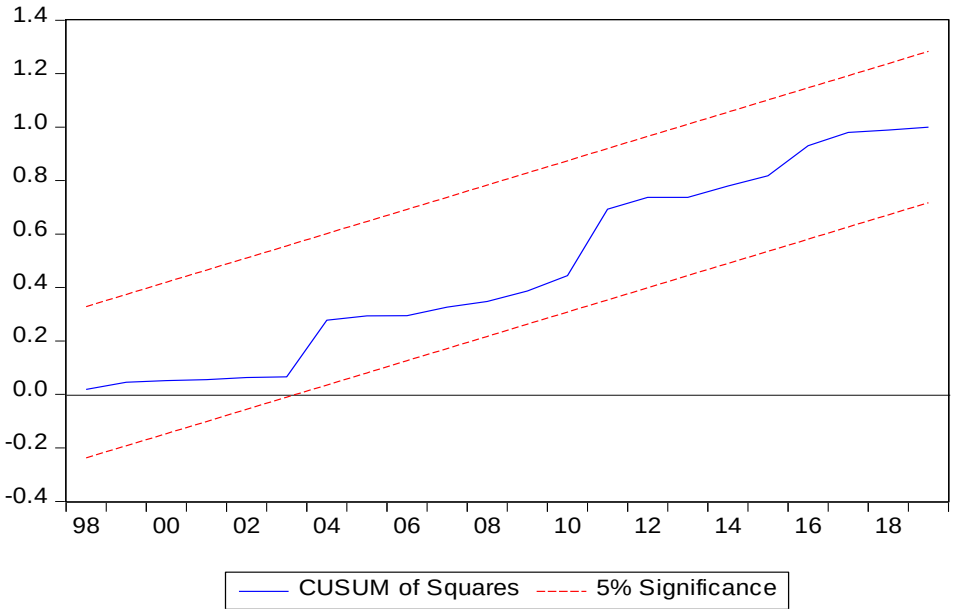


Figure : CUSUM Square Test

5. Conclusions

The study of the relationship between inflation and interest rates for emerging economies, is an endemic feature of today's society which will help the policy makers to formulate their policy in their interest. In an applicability for Bangladesh econometric study found Gibson paradox (GP)is not valid but it supports the traditional relationship which tells us interest rate and inflation rate are negatively related. Empirical results show a 1% rise in inflation rate will cause to decrease the interest rate by 0.21%. ECM shows the speed of adjustment which is 42.22 percent. So, it takes almost 2.4 years to correct the short-run deviations from long-run equilibrium. In the long-run, there exists a negative relations between inflation rate (IN)&and interest rate (IR)which rejects the validity of the Gibson Paradox in the context of Bangladesh. It's worth noting that Covid-19 provides a fresh perspective to our investigation. The Covid-19 event demonstrates how delicate our accomplishment is! Gibson's paradox is especially relevant since it links important policy variables when various policies are considered.Various research show that Covid-19 has the ability to undo all of humanity's advances over the last few decades. As a result of the strong negative connection between CPI or inflation and lending interest, policy attempts to cut inflation while keeping the lending interest rate high may be effective in Bangladesh. As a result, policymakers should consider the Gibson paradox's relevance to Bangladesh when making important decisions.

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Effect of the Retirement Policy in Degeneration of Employment Opportunities in Bangladesh

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Abstract : Bangladesh's unemployment crisis is a key source of concern. This study examines the role of early retirement on Bangladesh's unemployment crisis using both primary and secondary data. Primary data is gathered through field surveys, and secondary data is compiled from the government's Management Information System (MIS) department, the human resource departments of Sonali Bank, Janata Bank, Rupali Bank, Agrani Bank, and the administrative departments of the naval force, air force, and armed force. The World Bank (WB) and the Bangladesh Bureau of Statistics provided secondary data on population growth rates and industrialization (BBS).According to the study, retirement is expected to have a substantial impact on employment in Bangladesh. Industrialization, on the other hand, has little effect on employment. The population growth rate has a detrimental impact on employment. Furthermore, this study reveals that the tendency to engage in business is strong among retired personnel from the defense sector, at 75%, but only 30% in the banking sector and only 12.50 percent in the education sector. In the defense sector every year, a large number of people get employment with a high rate of retirement. But in the education and banking sector, there is no stability in the case of employment and retirement. These two sectors have high employment levels in some years, but low employment levels in the majority of years due to the low retirement rate. However, there is a positive association between employment and retirement in all of the sectors studied. The regression result reveals a positive association between employment and retirement, indicating that if retirement is increased by one unit, employment will increase by.929 units.

Introduction

Unemployment refers to a situation, when persons of working age i.e., belong to the workforce, are seeking but not getting any work at prevailing market wage during a specified period. This concept of unemployment in Bangladesh is supplemented by the concepts of visible and invisible underemployment. The total civilian labor force of the country in 2009-2010 is 53.7million; of which 2.7 million are unemployed (BBS report 2010). Unemployment among educated youths is one of Bangladesh's significant issues. Bangladesh is the world's eighth most populous country (Bangladesh Economic Review 2011), but there aren't enough work opportunities to meet demand. Bangladesh, like other developing countries, suffers from large-scale disguised unemployment in the sense that a considerable portion of the population engaged in agriculture could be eliminated without hurting agricultural productivity if agricultural techniques remained unaltered. Hidden unemployment exists in huge industries, offices, and organizations, particularly in the public sector, in addition to agriculture.

In Bangladesh, unemployment is a major concern. Hundreds of thousands of students graduate from college and university every year. Despite the fact that providing work for

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the young generation is one of the government's key obligations, the government has failed to meet the demand for jobs among the large population. Different government institutions and private organizations manage only a small portion of the total unemployed, while the majority stay unemployed. For a long time, British government was the primary source of this issue. When the British arrived in the Subcontinent (India, Pakistan, and Bangladesh) they began to do commerce and exploit the region. Despite the fact that certain industries were founded, they were all located in Indian Territory. As a result, the British disregarded the Bangladesh region. Pakistan adopted the same role after the end of British control in 1947, establishing all types of industry in West Pakistan rather than East Pakistan. East Pakistani faced a freedom fighting war in 1971 as a result of Pakistani monopoly rule, and after nine months of continuous struggle, Bangladesh became an independent state. However, Bangladesh has been mired in a political crisis since 1971. As a result, no government will be able to take a long-term, major action to address the grave unemployment crisis.

No nation can expect a robust economic base or a solution to the unemployment crisis without Industrialization. However, for an economy to industrialize, it must have a large amount of savings and investment. However, according to Bangladesh's 2011 economic report, per capita income is only $818 (BBS 2011), and most households cannot satisfy their daily necessities with this money. As a result, Bangladesh's savings and investment are low. There is now another alternative for Bangladesh's industrialization called as foreign direct investment. But in order to attract foreign direct investment, Bangladesh needs to assure political stability and developed a transport and communication system and other related facilities. But as a developing country, it is not possible to satisfy all the matters within a few years. Furthermore, due to a lack of liquidity in the bank, every growth initiative must rely on foreign loans and aid, which come with stringent terms and conditions that are detrimental to Bangladesh's economy. It is noteworthy that the world is currently experiencing a severe economic downturn, and industrialized countries are unable to invest in our country.

Bangladesh must adopt a new policy to address the unemployment problem in a chronological manner. Among the several policy alternatives, early retirement is the most pressing concern. The retirement age for government employees in Bangladesh is 59 years (index Mundi 2011), whereas the autonomous body retirement age varies from institution to institution, ranging from 60 to 65 years (Statistical pocket yearbook 2009). Bangladesh's armed forces have a separate retirement age system. According to the 2011 Bangladeshi population data, the average life expectancy is only 65.8 years, and those who work after the age of 60 become physically handicapped (field survey 2011) and are unable to conduct work spontaneously.

A younger person, on the other hand, can provide better service than an older person. Furthermore, if the retirement age is 55, a person who retires at that age can work elsewhere and use his retirement advantages, such as money and a pension. This will assist Bangladesh in regenerating its currency. However, the retirement age has been raised from 57 to 59 years, owing to the fact that Bangladesh's average lifespan has climbed to 67.2 years (Bangladesh economic survey 2011). There is a reality gap here. Infant mortality and maternal mortality rates are, in fact, the most powerful causes of increased longevity. This does not imply that the old employee's strength has been increased. Rather, this expansion of the elderly's service has obstructed the entry of

educated youth into the labor market. If the old employees are fathers, and the educated and uneducated youths are sons and daughters, it can be said that the aged father is happily breathing in the fresh air under the open sky while sitting and blocking the exit of the vicious circle of unemployment within which his son is suffocating in the poisonous gas and agony of unemployment. The father will benefit from the job opportunity for only a few years, but his son's service age will have passed, and he will no longer have the possibility to work. Now is the moment to consider what is good and what is terrible from both an economic and humanitarian standpoint. In the current situation, there is no other good and quick way to tackle Bangladesh's unemployment crisis but to implement an early retirement system. It's also possible that the idea of early retirement provides a ray of hope for Bangladesh's severe unemployment situation.

Background of the study

Study objectives

Bangladesh's unemployment problem is a major issue. It is to blame for the emergence of other serious issues in Bangladesh, such as social instability, inflation, reliance on foreign aid, and so on. Bangladesh's significant challenge is the creation of job opportunities. However, when the economy does not support the emergence of new jobs through industrialization or other initiatives, early retirement plans might benefit the economy by providing job opportunities for the unemployed labor force.

General Objective

The overall goal of this research is to look into the impact of early retirement in Bangladesh's unemployment problem. Following specific objectives is critical for achieving the overall goal.

Specific Objectives

The specific objectives of this research provided are many folds:

To reveal the recent unemployment status of Bangladesh.

To examine the correlation between employment and retirement.

To disclose the effect of age on employment generation and money regeneration.

To derive policy recommendations for enhancing early retirement schemes in the economy by removing the problems associated with it.

Here, early retirement does not indicate retirement at the age of 45 years or 50 years. Mainly here early retirement indicates retirement at the age of 55 years when a person can work in another place or has an enthusiasm to take the risk by investing money in another sector. But if a person is retired at the age of 60 years or 65 years he or she becomes physically disable. So, a large amount of money he or she gets at the time of retirement remains in the bank idly or is utilized for household purposes. As a result, the economy does not get any benefit. But if he uses the money for productive purposes then the economy can gather benefit in two ways firstly total productivity of the economy is increased; secondly the employment opportunity is created in the economy. Such as if that money is utilized in establishing a firm at those times some people are employed at that job.

In Bangladesh, the retirement age has been increased from 57 years to 59 years (The Daily Jugantor, 27 December 2011). Here government argues that the average longevity of life has been increased from 50 years to 65 years (The Daily Jugantor, 27 December 2011). But if the retirement age is increased then few numbers of people will be retired in these two years. As a result, the young section of the society whose age has been 28 years, will not get a chance of getting a government job so his life will fall into a depression. Here it can be mentioned that every year thousands of students are passing from public, private, and national universities. All the students are talented and they have the right to get a suitable job. But when they enter the job market, they face a different environment. Here for one post thousands of students compete. So only a few students get a chance to avail themselves of the job. Moreover, when there are few posts, there is a high possibility of corruption. Here it can be seen that only the candidates who have the capability of giving bribes can get the job. But we know that most of the students of our country come from middle-class and lower middle-class families. So, they cannot get the job. As a result, their family has to fall into a problem and they have to lead a miserable life. So, with the increase of unemployment, if an employment opportunity is not created at that time mismanagement will be created. But as Bangladesh is a developing country so it is not possible to create job opportunities for all the unemployed persons. So, in this case, early retirement is very important to decrease the excessive pressure of unemployment.

If a person is engaged in more time in a job, he becomes efficient at that job. But it is not true for all the persons. Some people become physically disabled. On the other hand, some people think that he is the senior person in his sector, so no one will complain against him. As a result, he will give less service than a younger employee. But if there is a contractual employment system in the sense that one person who will give more service will be employed after his retirement otherwise, he will be bound to retire from his job. At that time the person will competitively give more service. As a result, the GDP growth rate of Bangladesh will increase.

Maybe that by late retirement government becomes beneficial because when retirement age is increased government has not to bear excessive pension or other facilities that have to be paid to the retired person. But the government does not count that how much loss he has to face for late retirement. Such as if a person is retired a new person will be employed in that job and he can give more service than the oldest person. This can remove the unemployment problem of a country. Moreover, if the government makes a rule that pension will be given in three installments at that time the government will not have to bear excessive pressure. On the other hand, it is known to all that, there is a budget for every employee. So, if the person is retired government can give him a pension from that budget.

When a person remains in a profession for a long period, he becomes experienced about how to happens corruption. So, if the retirement age is increased, the service holder can get more opportunities for corruption because his experience may make him cunning and greedy to commit greater corruption. But it is very difficult for a new employee who had been employed a few years ago. Moreover, the new employee will give more service than the older.

When there is early retirement in a country at that time the opportunity of getting rank is increased for the assistant employees. As a result, the work efficiency of the people increases. On the other hand, for retirement, more employment opportunities will be created for the unemployed person. If this happens at that time father will get the opportunity of taking leisure and the unemployed son will get the opportunity of work in his age bindings.

In Bangladesh, there are a large number of an educated unemployed people. So, if the retirement age is late at that time this educated unemployed person will not get a job within their age bindings. So, they will not marry at a specific age. This will create depression, generation gap, crime, etc. But if there is early retirement, then these unemployed persons will get a job and social stability will be established.

In the reduction of corruption early retirement keeps a great role. When more vacancy is created more people will get the opportunity in entering the job. But when posts are few, at that time without money no person can get a job. In this case, the general people cannot come forward.

In removing income inequality early retirement can keep a great role. The mass student of our country has come from a middle-class family. So, when he does not get a job, he becomes poor. Because of the lack of collateral, he does not get any loan from the bank. Moreover, for the lack of money, he cannot give bribes. So, he does not get a job. But the people who remain in the job become rich day by day. This increases social inequality.

After 2012 Bangladesh will get the highest number of productivity and a smaller number of dependent persons. This type of opportunity gets a nation for one time. This time is called bonus time of population i.e., most of the people age is between the age of 15 years to 64 years. The number of people within this age is 59.26% which is the highest in the history of Bangladesh. Now it is the highest time to utilize this population. But if this time is over then the country will not be developed with expectation. It is said here that India is covering the middle time of utilizing efficient labor (Daily ittefaq, 28 December 2011).

The unemployed problem is solved when the private sector is developed. But for the development of the private sector private investment is very important. But there is a liquidity problem for the bank. The government takes more loans to meet the cost and use the money in the unproductive sector, which makes the liquidity problem more. But if the government uses the money in the productive sector employment opportunity can be created. For liquidity problems, the private investor does not get money for investment. At present interest rate for the productive loan is 18%, which is too high. For the high rate of interest private investor or does not come forward to invest money. Moreover, for using more money in the unproductive sector inflation is increasing day by day. Now inflation rate is 11.42%. To remove inflation Bangladesh bank is taking the step of contractionary monetary policy. But for contractionary monetary policy, if the central bank takes 100 TK from the market, it creates the effect of 453 tk (The Daily Ittefaq 5 December 2011). Now import is more than he exports. To meet the excessive import demand foreign reserve ratio is decreasing day by day. Moreover, the value of money is falling day by day against the dollar. On the other hand, for the international instability, foreign remittance is decreasing day by day. It creates a great problem for the country.

Now the government should take another policy such as an early retirement scheme to solve the unemployment problem of Bangladesh. If the government does not create job opportunities for the unemployed person, at that time the nation will be suffered from many problems. In the case of foreign investment, the same case has happened last year foreign investment was 21crore 64 lac, but this year it is only 8 crore 54 thousand dollars (The daily Ittefaq8 December 2011). So, in this, there is no opportunity to create more employment. So, to solve unemployment early retirement is very important which can solve the unemployment problem to some extent.

For the development of a county, technological development is very important. But in this case, it can be seen that the present generation are technologically more efficient than the eldest person. So, if a country emphasizes early retirement in that case more enthusiastic person will come in the job. At that time more GDP will be increased and ultimately unemployment problem will be solved to a great extent.

Literature review

The literature support provided by secondary sources was not adequate and even in some cases irrelevant with this study. Very few publications were found containing specific chapters and discussions about early retirement. However, some secondary sources such as various reports, working papers, discussion papers, articles were carefully gone through for this purpose. Some of the glimpses are furnished in the following paragraphs for the orientation on the issue.

- Arie et al. (2010) found in their study that early retirement can be considered as a win-win solution. The older people who had worked hard during the reconstruction period after World War II could take up a well-deserved early retirement pension, while the young who were at risk of becoming a “lost generation” could take their places in the labor market. So the desire for an early retirement scheme was to create and preserve job opportunities for the young at that period. Burkhauser (1979), Gordon and Blinder (1980), Mitchell and Fields (1982), Burtless (1986), Gustman and Steinmeier (1986) pointed out an important prediction from their research that if both public or private sector old-age benefits are increased, early retirement will be more attractive for the individual. Moreover, when retirement is delayed present value of lifetime pension benefits falls. Blöndal and Scarpetta (1998) and Duval (2003) confirmed that early retirement is more prevalent in those countries where early retirement regulations are more generous. The two indicators used for the generosity of early retirement provisions are the old-age pension replacement rate which measures the expected pension income as a fraction of the earnings just before retirement and the decrease in accumulated pension wealth accrual when postponing retirement.• Gruber and Wise (1999) showed that for various countries retirement tends to take place around the age when early retirement benefits can be claimed. While it is typically assumed that generous public early retirement provisions increase the incidence of early retirement because more workers choose to retire early ('voluntary' early retirement). • Patrick Purcell (2009) found in his research that labor force participation among persons aged 55 is influenced by general economic conditions, eligibility for Social Security benefits, the availability of health insurance, and the prevalence and design of employer-sponsored pensions. For example, labor

force participation among people 55 and older may increase due to the trend away from defined benefit pension plans that offer a monthly annuity for life. The health insurance also may result in more people continuing to work until they are eligible for Medicare at 65.

- Romain Duval (2009) confirmed that old-age pension systems and other social transfer programmers are high in most Continental European Countries, compared with Japan, Korea, English-speaking, and Nordic countries. There is also a wide dispersion in implicit tax rates across the OECD countries. Simple cross-country correlations suggest that such taxes induce older male workers to anticipate their retirement decision. This indicates that old-age pension and other retirement schemes have a major impact on the retirement decision.
- Conde-Ruiz & Galasso (2004) told that early retirement has negative, long-lasting effects on the growth of the economy and it increases the tax bill of all future workers. If more people retire early, there are fewer people to pay the bill. As a result, there is a steep increase in taxes to pay for this retirement which can have devastating effects on the economy. This may create distorting effects on incentives to work and lowered available income for consumption. They argued that providing early retirement schemes reduces the incentives to accumulate human capital and shifts part of the increase in the tax burden on future generations. This leads to lower economic growth both now and in the future.
- Hakola and Uusitalo (2005) confirmed that firms react to public early retirement provisions by encouraging retirement. But after the pension reform was introduced which eliminated the subsidization of workforce reduction, early exits of older workers significantly decreased.
- Hutchens (1999) illustrated this idea with an implicit contract model of early retirement where a risk-neutral firm contracts with a risk-averse worker. The worker's risk aversion and the desire for consumption smoothing assure that the firm will enter into a three-period contract with the worker and thereby raising its profits. Under the contract, the worker is employed in the first period, either employed or early retired in the second period, and unemployed in the third period. Employment status is hence only uncertain in the second period where an early retirement can take place.
- Lazear (1979), Sala-I-Martin (1996) found that pensions could be beneficial for economic growth based on certain assumptions. The most important assumption is to remove a less productive workforce with more productive workers.
- Lazear (1979) found that the presence of a diversity of productivity depends on the diversity of talent. Different levels of productivity can be found in all cohorts. If this is the case, one could potentially make the economy more efficient by removing the least efficient from the workforce before mandatory retirement age. For instance, through an early retirement scheme. Combined with the findings of Bratberg et al. (2004) and Røed& Haugen (2003) who claimed that half and two-thirds of the retirees respectively would have stayed in full employment until age 67, this could be a negative force on economic growth.
- Ahituv&Zeira (2000) showed older workers may face problems due to entering new technology in the market. But technological development is often used as a black-box

term for explaining continuous economic growth. In growth models, it is often just set as a parameter, without any further explanation. However, for development purposes, this technological development has a very concrete significance. But for entering new technology a country needs more efficient machines, computerization of processes, and access to advanced tools requiring a high degree of training.

- Lindbeck (2003) argued that the generous welfare state cannot afford to maintain a costly pension scheme through unfavorable shocks such as demographic changes or slower productivity growth. A widening of the pension base and a shrinking of the tax base may have a degrading effect on economic growth.
- James & Brooks (2003) argued that the political compromises, a government has to make to come to or stay in power and is directly linked with the willingness to promote pension reforms. The political body takes incentives to change the past system and reforms the pension system. But they do not think whether it is good for the economy or not.
- Thus, there is a gap in the literature on the linkage between early retirement and employment generation and the determination of the effect of early retirement on employment generation. In the literature, there is also a gap in the determination of the effect of age on money regeneration. Such analysis becomes particularly important in the current context where the rate of employment needs to be accelerated and all possible means need to be found to make the economy of Bangladesh free from the unemployment problem. The primary motivation behind the present paper is to contribute to filling the gap in the literature mentioned above by analyzing the phenomenon of late retirement of some selected sectors of the economy.

Methodology

This research is mainly based on primary and secondary surveys. Thus, it is survey-based exploratory as well as explanatory research. To conduct the primary survey a two-stage sampling technique was applied. In the first stage, out of seven divisions of Bangladesh Khulna division was selected purposively. At the second stage from the whole Khulna division, one hundred and twenty persons who have been retired from the selected three sectors were selected purposively. The secondary data used for this study are mainly time-series data from 2001 to 2010 and have been collected from the Management Information System (MIS) department of government primary and secondary school, human resource department of Sonali bank, Janata bank, Rupali Bank, and Agrani bank and administrative department of naval force, air force and armed force. Secondary data such as population growth rate and rate of industrialization from 2001 to 2010 of Bangladesh also have been collected from the World Bank (WB) and Bangladesh Bureau of Statistics (BBS). The primary data used for this study have been collected from a field survey.

Data were collected from primary and secondary sources. The primary data were collected by using a questionnaire. The questionnaire was pretested before finalizing. The

questionnaire was fulfilled by each respondent. Multistage, purposive, and random sampling techniques were applied to collect both qualitative and quantitative data. To address the stated objectives both descriptive and econometric techniques are employed. The empirical model used in this study is-

$$E = f(Re, PGr, In) \quad \text{..... (1)}$$

Where E = Employment generation

Re=Retirement

PGr=Population growth rate

In=Industrialization

Econometric estimation of the linkage among employment generation and retirement, Population growth rate, Industrialization can be explained with the help of a multiple linear regression model. The above mathematical model can be postulated as:

$$E = bo + b1\ Re + b2PGr + b3\ In + ui \quad \text{..…….. (2)}$$

Where, E = Employment generation

Re=Retirement

ui = Stochastic error term

Validation of the structural equations of the model is tested individually by the goodness of fit (R2), individual significance of variables (t-values).

In this study, the relationship between employment and retirement is shown through graphs. Here for three sectors, three graphs are drawn. Average consumption, precautionary savings, asset building, and bank savings of the retired person of Education, banking, and defense sector is shown through a table in this study. After this, the respondent's involvement in business is described by a figure where the percentage of respondent's involvement in business is shown. In this study respondents' view towards early retirement is described through a matrix table where three views of the respondents are considered such as in favor, disfavor, and neutral view.

Hypothesis of the Study

- The study will examine the following hypothesis:
- H_0: μ = Retirement does not significantly influence employment of Bangladesh.

Overview on employment and unemployment condition of Bangladesh

Measurement of unemployment and real unemployment

- New liberalism supported by World Bank and IMF has not reduced the unemployment problem of Bangladesh rather than after introducing these reform activities the unemployment problem of Bangladesh has been increased. There are a large number of arguments about the counting system of unemployment in Bangladesh. Here in case of enumerating unemployment, it is asked that whether he

has done any work in the last month for earning money, if not whether he wants to do work in the current wage rate, or is he searching any job, if he would search, he will be counted as an unemployed (The Daily Ittefaq 5 December 2011).

- Mainly this concept is appropriate for developed countries but not for third world countries like Bangladesh. In many industrialized countries there is an allowance for the unemployed labor force. But like other underdeveloped countries, there is no unemployed allowance in Bangladesh. As a result, the active person does various unsuitable works or shares the household work among the household members. For this reason, a large number of workers remain unutilized but they are not included in the unemployed labor force.
- In the underdeveloped country though there is a large number of the unemployed labor force as the labor market is not organized so they do not search for work by following any hard and fast rule. As a result, it can be seen that by doing work one day, two days, or one week they are not being included in the unemployed labor force list. For this reason, there may not be a single unemployed person in a village. In rural areas, labor forces are employed temporarily. As a result, they get a chance to do work for some days in a month. But this does not mean that they are not unemployed. But at the time of unemployment enumeration, these persons are not being counted.
- Like other underdeveloped countries, Bangladesh also has to face a great problem in the case of measuring unemployment among women. In this case, it can be seen that most of the adult women do the household work. Since they are engaged in household work so they are not included in the unemployed labor force. But who can say that if they get suitable facilities, they will not want to do work? The men and women who work in various offices also do household work. So, by deducting a large portion of the unemployed population from the unemployed labor force list, the real picture of unemployment cannot be found.
- Despite following the incorrect method of measuring unemployment, the unemployment rate of Bangladesh is increasing day by day. In table 1, it can be seen that in 1961 where the unemployment rate was 0.5%, after introducing new liberalized reform in 1983-1984 unemployment rate was increased to 1.8%. In 1999-2000, the unemployment rate was increased to 4.3% and up to the last labor force survey introduced in 2005-06, this rate remained constant. But if the population is considered from 1961-2011, it is seen that the population of Bangladesh has been doubled but the unemployment rate has been increased to near at five times despite following the incorrect method of enumeration. On the other hand, if the correct method is followed unemployment rate will be increased.

Table 1: Unemployment rate among the active person of 15 years or more in various times in Bangladesh

Year	Unemployment rate (%)
1961	0.5
1983-1984	1.8
1990-1991	1.9
1995-1996	3.5
1999-2000	4.3
2002-2003	4.3
2005-2006	4.3

Source: Compiled data from BBS,2010

The number of the disguised unemployment rate is increasing which means the people who work less than 35 hours in a week. In table 2, it can be seen that the present unemployment rate is 24.53%. In 1999-2000 this rate was 16.6%. This unemployment rate will be increased if household labor is considered.

Table 2: Partial unemployment rate among 15 years or more persons in various times in Bangladesh (In percentage)

Year	Partial unemployment rate(working time less than 35 hours in a week)
1989	43.4%
1990-91	42.8%
1999-2000	16.6%
2002-2003	34.2%
2005-2006	24.53%

Source: Compiled data from BBS,2010

In order to know the employment opportunity by introducing new liberalized economic reform activities in Bangladesh we have to consider those people who are being considered as employed in different occupations. In this case a disappointed picture can be found from the table-3.

Table 3: Employed persons 15 years and over by status (in percentage)

Status in Employment	1983-84	1990-91	1995-96	1999-2000	2002-2003	2005-06
Paid employee	17.4	11.7	11.9	12.6	13.7	13.87
Employer	-	11.4	0.3	0.2	0.4	0.27
Self	38.8	15.4	32.2	35.1	44.8	41.9

Status in Employment	1983-84	1990-91	1995-96	1999-2000	2002-2003	2005-06
employed						
Domestic worker	15.9	47.2	37.7	33.8	18.4	21.68
Day labor	27	13.9	17.9	18.3	20	18.19

Source: Compiled data from BBS, 2010

From the table-3, it can be seen that among the total population the number of populations is engaged in an institutional job is too low. Here the number of self-employed populations is high. This rate was 39% in 1983-84 but this rate has been increased to 41.9% in 2005-06. But those who are employed in work do not get any salary and they will be considered as unemployed. This rate has increased from 16% in 1983-84 to 22% in 2005-06. Another portion of workers is day labor which rate has also been increased from 13.9% to 18.19% in 2006.

It will be more reasonable if institutional sectors are considered for the measurement of the unemployment problem in Bangladesh because employment does not mean only earning money but also the environment, security, various social and economic facilities, status, etc. also related to it. If any person gets this type of facility from any job at that time that employment level gets its fulfillment. This type of facility can be got only from the institutional job. But after introducing new liberalized reform activities employment opportunities in the institutional sector have been reduced at an alarming rate. In 1983-84 employment in the institutional sector was near about 18% but this rate decreased to 12% in 1995-96. But in 2005-06 this rate decreased to 14% in table -3.

On the other hand, a large portion of people among the self-employed and day labor are mainly unemployed who work less than 35 hours. Most of them are economically insolvent. This insolvency will be cleared from the given income structure in table-4.

Table 4: Income structure among the self-employed day labor work force (in percentage)

Year (type of employment)	1-500 tk	1-1000 tk	1-3000 tk	3000 or more	10000 or more
2002-2003(self-employed)	-	14.2	75.8	24.2	1.2
2005-2006(Day labor)	52.55	93.47	-	-	-

Source: Compiled data from BBS, 2010

Here almost 94% of day labor earns 1000 tk. in a month and 76% of the self-employed worker earns 3000 or less. At present this situation has not been changed. Moreover, for the high inflation rate, this situation has been degraded more.

Table 5: Minimum wage rate in various levels in Bangladesh

Year	Wage rate in current price	Consumer's cost	Real wage
1973	155	168	73.80
1977	270	419	51.55
1985	560	941	47.60
1992	950	1449	52.45
2000	950	1973	38.52

Source: Wage commission report,1992, GOB,2001, quoted from Anu Mahammad

On the other hand, wage has been increased in current price but real wage has been decreased. In table-5, it can be seen that in 1973 real wage rate was 73.80 but in 2000 this rate decreased to 38.52. So, it is cleared that new liberalized reform activities have increased the unemployment problem. For the pressure of reform activities in Bangladesh a large number of industries have been closed which has increased the unemployment problem. This is the real picture in the case of the employment situation in the economy of Bangladesh.

Present unemployment situation in Bangladesh

The unemployment problem is becoming severe day by day. The severity of the unemployment problem can be imagined if we see the data of labor force statistics. In table 6, It can be seen that the total labor force of Bangladesh was 46.3 million in 2002-2003, 49.5 million in 2005-06, and this rate was increased to 53.7 million in 2009-2010 of which 40.2 million were male and 13.5 million were female.

It also can be seen from Table 6 that the employment rate of the labor force has increased from 39.0 in 1999-2000 to 51.0 in 2009-2010. But at the same time, the unemployed population has increased from 1.8 million in 1999-2000 to 2.7 million in 2009-2010. This increase in unemployed indicates that with the increase in the labor force, employment opportunity has not been flourished.

Table 6: Labor force statistics

Characteristics	LFS 1999-2000	LFS 2002-2003	LFS 2005-2006	LFS 2009-2010
Labor force (million) (15+)				
Both sex	40.7	46.3	49.5	53.7
Male	32.2	36.0	37.4	40.2
Female	8.5	10.3	12.1	13.5
Employed Population (million)				
Both sex	39.0	44.3	47.4	51.0
Male	31.1	34.5	36.1	38.5

Characteristics	LFS 1999-2000	LFS 2002-2003	LFS 2005-2006	LFS 2009-2010
Female	7.9	9.8	11.3	12.5
Unemployed Population (million)				
Both sex	1.8	2.0	2.1	2.7
Male	1.1	1.5	1.2	1.7
Female	0.7	0.5	0.9	1.0

Source: Compiled data from BBS,2010

In table 7, comparative statistics of HSC, ALIM, and HSC (BM) examinations from 2007 to 2011 (Male & Female) are shown. Here it can be seen that in 2007, 349749 students were passed among the appeared 533158 students. But in 20011, the number of passing students has increased to 574261 among the 764828 appeared students. This increasing rate indicates that the number of the educated labor force is increasing day by day but the level of employment is not enlarging at an increasing rate. As a result, the number of an educated unemployed people is also augmenting day by day.

Table 7: Comparative statistics of HSC, ALIM and HSC (BM) examination from 2007 to 2011 (Male & Female)

Year	**Total no. of appeared students**	**No. of passing students**
2007	533158	349749
2008	612381	466570
2009	607872	442389
2010	718084	533369
2011	764828	574261

Source: Dhaka education Board Bangladesh

Now, in table 8, total number of students passed from different universities in the last three years is shown .It can be seen from this table that, total number of higher educated students has been enhanced from 13, 99,843 in 2007 to 11,76,969 in 2008 and 13,82,216 in 2009.The recent announcement of the prime minister of Bangladesh indicates that only 4 lack labor force both educated and uneducated has been employed in 2010(annual announcement of prime minister 2011).This employment level indicates that only a tiny fraction of labor force has got unemployment in 2010.If this scenario of employment is happened in every year in that case it can easily be guessed how much the unemployment problem will be severed after some years.

Table 8: Total number of students passed from different universities in the last three years

Year	2007	2008	2009
Total student	13,99,843	11,76,969	13,82,216

Source: 36th UGC annual report, 2009

The unemployment rate by level of education (2006-2007) can be shown in table 9. This table shows that the rate of unemployment among uneducated labor forces is 4.99 in 2006-2007. But the rate of unemployment is high among the educated labor force. Such as the rate is 6.00 in 2006-2007 among the labor force who has completed only the education level from class I-V,17.81 among HSC & equivalent, and 16.99 among engineering/medical completed labor force.

Table 9: Unemployment rate by level of education (2006-2007)

Level of education	Total unemployment rate in Bangladesh
No education	4.99
Class I-V	6.00
Class VI-VII	9.72
Class IX-X	13.37
SSC,Equip	12.73
HSC &Equip	17.81
Degree and above	11.37
Masters	10.31
Engineering/Medical	16.99
Technical/Vocation	6.56
Others	15.76

Source: Compiled data from BBS, 2010

At last, it can be said that with the passes of time, the population of Bangladesh is increasing and the rate of education is also augmenting. As literacy rate in 2009 was 54.8% and in 2011 this rate increased to 56.7 % (Bangladesh economic review 2011). Now, the total number of populations above 15 years is 84.6 million (BBS 2009). This number indicates that this is the time of the bumper population. For the development of the country, it is very important to utilize the bumper population. But in Bangladesh, the level of employment generation rate is very low than the increase in the number of the active labor force. As a result, the unemployment rate is augmenting day by day. Now, to get an instant solution to the unemployment problem early retirement is a crucial factor in Bangladesh. Because those factors are important for creating new employment opportunities are not available at this time.

Data analysis

Empirical Analysis

The goodness of fit R square is known as the coefficient of determination and is the most commonly used measure of verifying the fitness of a regression line. Verbally, R2 measures the percentage of the total variation in Y can be explained by the regression model. Here, in table 11, the summary of regression analysis shows that the value of R2 is 0. 994. This value of R2 indicates that the regression model is fit and the result is spurious at this level.

Table-10: Summary of Regression Result

Dependent variable: Employment			Number of observations =120	
Variables (independent)	Value of β_s	Standard Error *(se)*	*t* – value	*p* – value
Intercept term	8806.832	4407.889	1.998	.093
Retirement	.929	.047	22.316	0.000
Population growth rate	-.102	2508.087	-2.313	.060
Industrialization	.057	.040	1.651	.150
R^2 = .994	Adjusted R^2 = 0.991	*F* value = 341.331		

Source: Field survey, December, 2011, BBS & World Bank data

In the above table, the impact of explanatory variables retirement, population growth rate, and industrialization on dependent variable employment has been shown.

From the summary of regression result, it can be said that there is a positive relationship between employment and retirement i.e. if retirement is increased by 1 unit employment will be increased by .929 units. But there is a negative relationship between employment and population growth rate. Such as if the population growth rate is increased by 1 unit at that time employment will be decreased by -.102 units. From table 11 it can also see that industrialization does not keep a significant role in employment in Bangladesh.

Now in the case of the F test, we find that at 5% level of significance the value of F from F table, F0.05 =2.96 where Fc>Ft i.e.,341.331>2.96. So, we reject the null hypothesis that retirement does not significantly influence the employment of Bangladesh.

However, the estimated equation form of the derived regression model is;

$$E = 8806.832 + .929\ Re - .102\ PGr + 0.057\ In + ui$$

Here, the regression model suggests that retirement has a positive impact on the employment generation. But population growth rate hurts the employment generation.

Relation between employment and retirement

The employment and retirement data obtained from the selected three sectors show that there is a positive relationship between employment and retirement. When retirement increases employment also increases. But the fluctuation of employment and retirement is not the same among the three sectors. The data show that in the education sector in some years employment is too much low and, in some years, employment is too much high. In the banking sector, the same case mainly happens. This scenario mainly occurs for the late retirement of the employee. If the employees are retired early at that time more vacancy is being created and more people get employment. For this type of retirement and employment, these two sectors cannot bring benefits for the unemployed person. Though there is fluctuation in the education and banking sector, there is also a positive relationship between employment and retirement i.e.in which year retirement is high in that year employment is also high.

To solve the unemployment problem recruitment of unemployed persons is important every year. If an unemployed person does not get employment every year at that time

unemployment problem cannot be solved. Because if a new employment opportunity is not created, many unemployed laborers force will miss their opportunity of being employed for the age bindings. So, to solve the unemployment problem that type of sector is more important in which sector a large number of employees gets retirement in every year and a large of unemployed labor force gets recruitment in every year. This type of recruitment and retirement system is followed by the defense sector. In the defense sector, the fluctuation of employment and retirement is too low. Here in every year, a large number of employment opportunities are created with the same level of retirement. So, it can be predicted that though the fluctuation of employment and retirement is not the same among the three sectors, there is a positive relationship between employment and retirement.

The below charts will show the employment and retirement level of the selected three sectors over ten years.

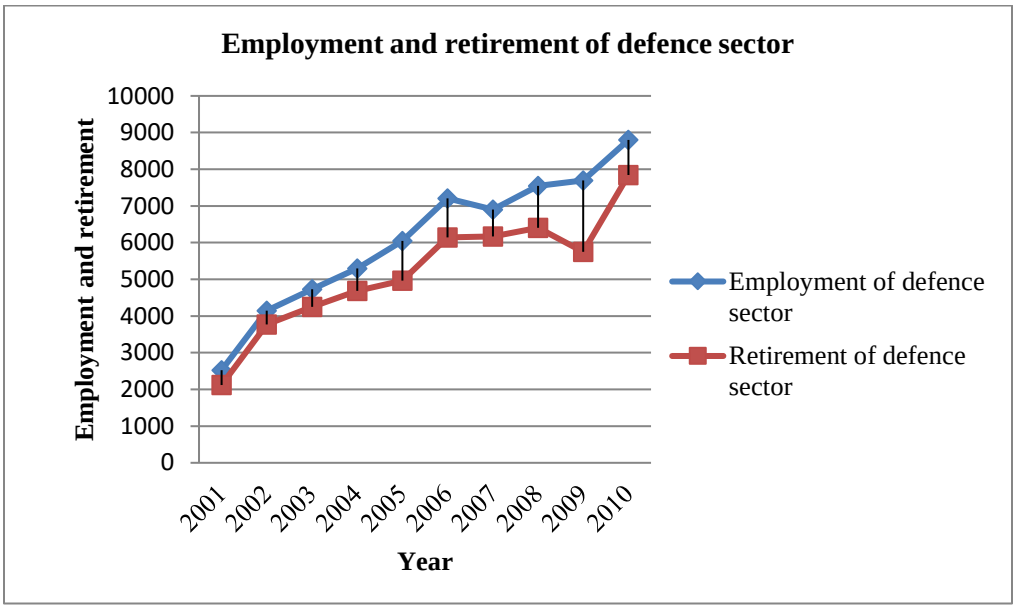


Figure 1: Employment and retirement level of defense sector in different years
Source: Field survey, December, 2011

In chart1 it can be seen that when the number of retirements in the defense sector was low at that time number of employments was also too low and when the number of retirements start to increase at that time employment level also start to increase in the same way. Such as in the year 2001 the retirement level was low and the employment level was also low. After 2001, employment increase at an increasing rate with the increase in retirement. But in the year 2009 employment level decrease with the decrease in retirement. In the chart, it can also be seen that after 2009 employment increase with the increase in retirement. So, there is a positive relationship between employment and retirement.

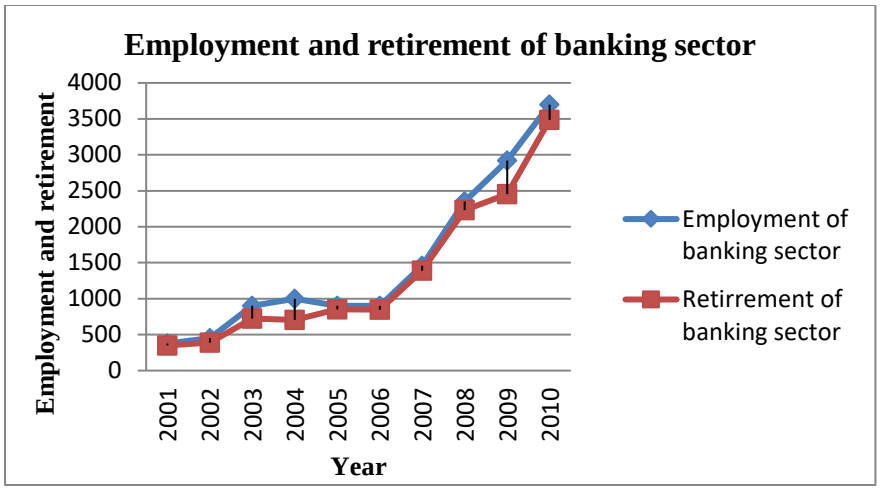


Figure 2: Employment and retirement level of banking sector in different years
Source: Field survey, December, 2011

The above chart shows that there is a positive relationship between employment and retirement. Here it can be seen that when retirement increases employment also increases. But the level of employment is too low because the level of retirement is not so high. Here it can be seen, up to the year 2007 the level of employment remains below 2500.After 2007 employment level crosses 2500 because at that period retirement level also crosses 2500.So in banking sector employment is being created with the retirement.

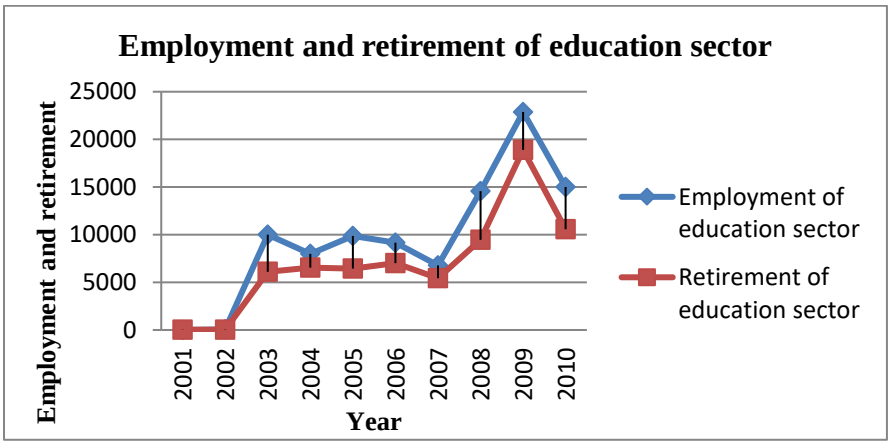


Figure 3: Employment and retirement level of education sector in different years
Source: Field survey, December, 2011

In the above chart, it can be found that in the education sector employment level increase with the increase in retirement. Here it can be seen that in 2001-2002 there was no employment. After 2002 employment increases when retirement increases. But up to the year 2007 level of employment remains below 10000 because in this year retirement level remains below 10000. After 2007 employment level crosses 20000 because in this period retirement was also near about 20000. So in the education sector, there is also a positive relationship between employment and retirement.

Finally, it can be said that though there is a positive relationship between employment and retirement but the rate of fluctuation between retirement and employment is too high in the banking and education sector over the years. Such as in the education sector before 2007 employment and retirement were not so much. But after 2007 a large number of labor forces have been employed because a large number of employees were retired after this period. But after 2009 the level of employment starts to decrease. If a new employment sector is not created then after two years the level of employment will reach about below 2000. The same case will happen in the case of the banking sector. The rate of new employment generation is very low in Bangladesh for various reasons which have been discussed before. But in every year a large number of unemployed labor forces will come out from various education sectors. So, this type of fluctuation is not good for an economy. On the other hand, in the defense sector every year a large number of employees get retirement. The rate of fluctuation is too low in this sector. So, if all the sectors of the economy follow this retirement policy in that case the economy can get a release from the unemployment problem to some extent. Since there is a positive relationship between employment and retirement, to solve the unemployment problem early retirement is very important.

Respondent's involvement in business

This study includes 120 respondents and all of these respondents are retired. Among these 120 respondents 40 respondents were involved in the defense sector, 40 were in the banking sector, and the rests 40 were in the education sector who were retired in different ages. Data collected from the three sectors indicate that the retired persons were involved in various professions do various works after their retirement. The data collected from the field survey also show that the persons who work in the defense sector retired early than the other selected two sectors of the economy.

It also can be found that the person involved in commissioner rank in the defense sector continued their job for 31 years or more and the persons who were involved in non-commissioner rank continued their job for 20 years. As a result, the retirement age for the defense sector is 55 years or less than 55 years. So, all of the retired persons who retired less than 55 remain physically strong and after their retirement, they involve themselves in various works. So, it can be seen that the huge amount of money that the retired person of the defense sector gets after retirement is being used for production activities in the economy. This type of performance helps to develop the economy by regenerating money. Moreover, for early retirement, the job vacancy is created in the economy which helps to join the unemployed person in the work.

This retirement helps to remove the unemployment problem of Bangladesh where the new employment generation rate is too low. On the other hand, data collected from the field survey also indicate that the other two government sectors such as the banking sector and education sector follow other rules in case of retirement. Here, people retired at the age of 57 years old. Generally, it can be seen that they become physically disabled after retirement. Though they are not fully physically disabled for doing the job for a long period they become dispassionate to do other work. As a result, without doing any business most of the retired persons of these two sectors keep their money in the bank or utilize their money for household purposes. This type of activity cannot bring any benefit

to the economy. Moreover, it increases unemployment. But early retirement at that time creates a new room for a job in the economy. The below chart shows the percentage of retired persons in the selected three sectors who have involved themselves in business-related work

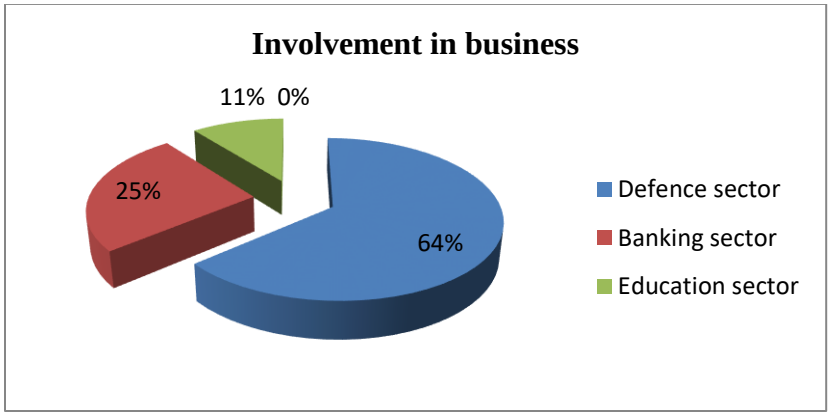


Figure 4: The percentage of retired person's involvement in business- related work.
Source: Field survey, December, 2011

Table12: Average consumption, savings and investment of the retired person in different sectors

Sectors	Time	Consumption (tk)	Precautionary Savings monthly(tk)	Asset building (tk)	Bank Savings(tk)
Education sector	Before retirement	20900	5992.5	641250	762500
	After retirement	13975	1500	491250	
Banking sector	Before retirement	33725	8237.5	1855000	1015000
	After retirement	29350	6975	950000	
Defense sector	Before retirement	49800	14800	1362500	840000
	After retirement	53100	24300	3470000	

Source: Field survey, December, 2011

In the above chart, it is seen that 75% of retired persons in the defense sector involve themselves in business after their retirement. This percentage for the banking sector is only 30%. But in the case of the education sector, only 12.50% of the retired persons involve them in business.

Retirement and financial condition

The economic state of the retired person of the selected three sectors is not the same between the two periods such as before retirement and after retirement. The data obtained from the field survey show that the person who retired early with a large amount of pension remains in a better position in society than the person who retired in old age.

Because a person who retired early can utilize his money for other purposes such as he can invest money in different firms or can start a business jointly. This type of activity helps to keep the consumption, precautionary savings, and asset building of the retired person in a good position after retirement. On the other hand, when a person starts a business or builds up a firm, he can create employment opportunities for some unemployed labor force in his business sectors. This type of activity can create new employment opportunities in a country.

Table12 shows that in education and banking sector average consumption, precautionary savings and asset building of the retired person of the 66.67% respondents decrease after retirement. But in case of defense sector this scenario is different. The average consumption, precautionary savings and asset building of the retired person of the 33.33% respondents of the defense sector do not decrease after retirement. This case mainly happens because most of the retired person of the defense sector invests their money in productive purposes after their retirement. For this type of investment their income increases after their retirement which increases their average consumption, precautionary savings and asset building. From table 12 it can be seen that average consumption, precautionary savings and asset building of the retired person of defense sector have been increased though average consumption, precautionary savings and asset building of the retired person of education and banking sector have been decreased after retirement. On the other hand, table 12 also shows that bank savings of the retired person of defense sector is low than the bank savings of the retired person of education and banking sector. The cause behind the low bank savings is that most of the retired person of the defense sector wants to invest their money without keeping money in bank idly. If they were also retired at the old age, they also can not invest their money like teacher and banker. In that case their bank savings becomes high.

Respondents view about early retirement

This study includes 120 respondents and all of the respondents are retired. These respondents give various views about early retirement. From the field survey, it can be seen that most of the retired people in the defense sector are satisfied with their retirement. For this reason, early retirement is supported by most of the retired people in the defense sector. But in the case of the education sector, some retired teachers are satisfied with their retirement and some are not satisfied. As a result, early retirement is not supported by most of the teacher. On the other hand, in the case of the banking sector, it can be seen that early retirement is supported by the retired person if there are job facilities for the retired person.

View	Percentage of respondents	Opinion
In favor	37.5%	1. It is possible to utilize the ability to another work. 2. Large amount of pension money can be utilized for other purposes. 3. Physical disability is being created after the age of 53 years and colleague's help become essential. 4. Rest is important after the age of 55 years. 5. Early retirement is good if large amount of

View	Percentage of respondents	Opinion
		retirement pension is given at a time. 6. After early retirement it is possible to do something for the social people. 7. If anyone retired early, at that time an unemployed person get employment at that place which helps to solve the unemployment problem. 8. If a large amount of money is used for business purposes it will be more profitable than job.
Disfavor	33.33%	1.Though there is physically strength, for retirement unemployed is being created 2. More money could be gathered if job is continued for more years. 3. After retirement an idle life has to lead. 4. Life becomes too much miserable after retirement for engaging into field cultivation work. 5. There are no available job facilities for the retired person. 6. If job is continued for more years, then no problem is being created for educating the son and daughter.
Neutral	29.16%	1. No comment

Source: Field survey, December, 2011

Conclusion

Findings of the study

In a developing country like Bangladesh, the employment level depend on retirement. If retirement is high employment will also be high. Here industrialization does not keep a significant role in the case of employment generation. Because, for the deficit of savings in the bank, lack of foreign direct investment, underdeveloped communication system, and for the shortage of electricity, the rate of industrialization is lower than the high rate of unemployment

In Bangladesh, the population growth rate affects negatively i.e., if the growth rate of the population is high, the rate of employment will be below. Because of the high growth rate of the population, employment opportunities will not be so high in a developing country like Bangladesh.

This study shows that most retired people of the defense sector involved them in business. But this rate is too low in the case of the retired person of banking and education sectors. This case mainly happens because of the difference in the retirement age among the three sectors. Most of the retired person of the banking and education sectors becomes physically disabled after their retirement so they cannot start a business or cannot invest their money in another purpose' the retired person of the defense sector remains physically strong and can take the risk to do another work.

As the retired person of the defense sector can utilize his money for other purposes the economic condition of the retired person of the defense sector is better than the economic condition of the retired person of banking and education sector. As a result, it can be found that the consumption, precautionary savings, and asset building of the retired person of the defense sector remain in a good position after retirement.

There is a positive relationship between employment and retirement i.e. when the rate of retirement increases at that time rate of employment also increases.

Recommendations

The unemployment problem is a burning issue in our country. Not only that, investigation shows that it is increasing day-by-day and it is the root cause of many miss haps; such as terrorism, robbery, snatching, theft, corruption, killing, political unrest, and many other peach breaking activities in our country. The man provided with an honest way of earning will not go under risky and hated way of earning. So, the unemployment problem must be solved for the sake of the welfare of the country.

But how to solve it? Statistics show that the employment generation fails to keep pace with the increasing rate of unemployed educated youths. Every year a large number of educated young people coming out of various educational institutions find no job. In a developing country like ours, there is a consecutive chain or cycle of happening that is-

No sufficient employment no sufficient income no savings no investment no production no employment.

This is the worst vicious circle within which unemployment is trapped. Now, this vicious circle must be broken at a weak and possible area and that is making posts vacant by early retirement.

There is no scope of rapid and large investment for rapid industrialization for creating a large job market. Even there is no good possibility of sufficient foreign investment and aid in this present situation of economic depression in the developed countries. So, this country herself must find out an effective way to solve the unemployment problem and early retirement which can go a long way to solve the problem.

This can be done in two ways—

(a). Retirement after a certain age (near about 55 years)

(b). Retirement after a certain length of service (around 25 years of service)

In the second system, early employment will make early retirement creating a vacancy for the unemployed. Both the way together will do much to solve the problem.

Now the question is, will the old employees enjoy more two- or five-year job benefits at the cost of the loss of the chance of the service of the young unemployed forever? It is a matter of great sorrow that in the present system of the age limitation for service. The age of many unemployed young will be barred within the last or extended period of service of the old employees. Here, the father will only enjoy job benefits only for two or five years when the son will bear the agony of unemployment throughout his whole life.

Youth is the best time of human life. It is the most energetic and productive time of a worker. Our country is being deprived continuously of this valuable service of the educated young people due to the unemployment vicious circle. This may discourage the education of the new and future generations.

In the present situation of the depression in the world economics, external help from the developed countries is not up to expectation. Moreover, our export goods fail to find an expanded market due to the economic depression. So, something must be done to provide the increasing unemployed youths with jobs.

There is a lack of energy, inspiration, innovative and productive activities in the person retired in the old age. They pass their time in idleness or at least, they spent their money on developing their homes and social festivals. They contribute a little productive sphere of economics. On the other hand, an early retired person comes out of the fixed activities of the service, and in this stage of his life, he gets sufficient energy in the body, inspiration in mind, and intelligence in the brain. So, he is still fit for hard work and facing challenges that are very essential for successful economic productive activities. He can invest his money in both savings and retirement facilities for more productive purposes.

At this age, generally, he gets strong inspiration to earn much more through self-employment than a fixed service salary. Thus, he can set up a poultry farm, dairy farm, agricultural farm, orchard, fruit processing farm, garment factory, fish cultivation, and so on. Thus, will create more employment, more employment will create more earning, more earning will create more savings, and more savings will create more capital, more capital will create more investment, more investment will create more employment. This creative circle will drive the economy of the country ahead.

All possible measures should be taken to solve the unemployment problem of our country. But early retirement is a new hope of solving the unemployment problem of our country.

Concluding remarks

The above analysis has important implications for development strategies and policies for reducing the unemployment problem of Bangladesh. The study attempts to identify how early retirement can keep a role in solving the unemployment problem of Bangladesh. In this study from the analysis of the primary and secondary data, it can be found that in the case of solving the unemployment problem of Bangladesh retirement keeps a great role. Here it is seen that in which sector retirement level is high in that sector employment level is also high and those who are retired early by getting a huge amount of pension, they remain in a better position in society than others who have been retired at the age of 57 years. Moreover, the person who retired early, invest money for business purposes and helps to create employment for the other unemployed people by giving employment in that business. So here the unemployment problem is solved in two ways, firstly for retirement, an unemployed person get employment in that post, secondly, for investing money in business new employment opportunity is created by the retired person. But in case of late retirement the person who has retired at the age of 57 years, in that case, it can be seen that they are now in a bad position than the early retired person. Most of the

retired person who has been retired at the age of 57 years keep their money either in the bank or utilize it for consumption purposes. So, they do not bring any benefit to the country. In Bangladesh, the unemployment problem is great and for solving the unemployment problem the other facilities are not available at this time. But for the unemployment problem, various problems are created in the country such as crime, social instability, etc. Now to solve these social problems it is very important to solve the unemployment problem of Bangladesh. To solve the unemployment problem early retirement is very important at present time. If early retirement exists in the country at that time younger and more energetic people will come into the job which will help to increase the productivity of the country and indirectly will help to solve the unemployment problem of Bangladesh.

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Can Macroeconomic Volatility Affect Industry Stock Return? A Study of the Banking Industry Using the GARCH Model

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Abstract: This study focused on developing a banking industry index and studying the impact of time-varying macroeconomic risk on the volatility of industry stock returns. The study considers DSE for industry index building and used five macroeconomic risk factors entitled consumer price index (CPI), T-bill rate (TBR), Broad money (M3), the exchange rate (EXCR), and DSE general index (DSEGEN). To achieve the specific objectives, the authors created an index for Banking sectors that takes into account all of the listed companies in the industry and adjusts for all types of corporate changes (i.e., new listings, deletions, bonus shares, and so on) to produce a clear picture of industry performance. All calculations were carried out utilizing data from 2005 to 2019. Several tests models, including the Augmented Dicky Fuller (ADF) Test and the Generalized Autoregressive Conditional Homoscedasticity (GARCH) Model, have been considered to find linkage evidence between industrial stock returns and macroeconomic conditions to facilitate the implementation of the study. The findings of the study suggest that Consumer Price Index, M3, Exchange rate do not significantly affect banking sectors return volatility, but general index return and T- bill rate is significant here. This study has shed light on how the banking industry performs in the face of various macroeconomic conditions. So, investors will infer whether the banking industry will provide the most benefit or not and how they should act in various portfolios and thus in investment decision-making.

Keywords: GARCH, ADF, Industry index, CPI, Volatility

1.0 Introduction

The question of whether time-varying macroeconomic risk contributes to stock price volatility is now a well-known fact for scholars to investigate. The changes in economic factors seem to be an essential and dominant exposure to the stock price fluctuation. The basic logic behind this assumption is that economic growth is crucial for stock market development as it provides liquidity and an avenue for risk-sharing and diversification. Furthermore, it enables organizations to allocate resources wisely to profitable initiatives and reduces information and transaction costs, allowing them to make remunerative investments (Ibrahim, 2011). Theoretically, the fundamental value of a corporate stock depends on expected future dividends. These dividends or future cash flows depend on the volatility of expected future economic conditions. Thus volatility of macroeconomic conditions affects the stock market performance or return. Volatility in stock outcome directs to the detachment in stock prices that alters in all respects to a time. The financial system's health, macroeconomic stability, and external market disruptions all play a role in stock market development (Aliyu, 2012). Several models indicating the inner relation between stock remuneration and its fixing factors are present today. The Capital Asset

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Pricing Model (CAPM) explains stock return variation as a linear function of market beta variations. These prophecies have become a focus of examination in a slew of subsequent studies. Much of the testimony revealed the CAPM theory's empirical contradiction (Fama and French, 1993). Most of these research recommended employing a multifactor approach to find the additional market factors that explain stock market price volatility (Campbell et al.1993). This approach is based on the concept that a few economic factors influence the stock return. Arbitrage Pricing Theory (APT), developed by Ross (1976), is the forerunner in this approach.

APT was tempered by Roll and Ross (1980) in the form of a model that could testify to its fitness. According to Saji (2013), APT, but a multi beta CAPM technique, can be utilized to find additional components to market return that contribute to stock return volatility. Bangladesh is an emerging economy, and over the last few years country's economies has witnessed significant development. The stock market, namely the Dhaka Stock Exchange (DSE), has also seen very high growth. The DSE all-share price index (DSI) has reached 3747.53 at the end of 2009, about 199 percent higher than that of 2005 **(**Rahman and Moazzem, 2011). This rally of enlarging trend is also optic for other major demonstrators such as the DSE general index (DGEN), the blue-chip companies (DSE 20), and their decisive influence on growing market capitalization. In the industry growth, the textile sector has a massive opportunity in the global market as Bangladesh is a cost-efficient labor country. On the other hand, as the pharmaceutical industry has excellent exposure to the global market, the global financial crisis badly affected the earnings of this sector, but it has great potential in the future. The performance of the fuel and energy industries has been affected by price variations in the oil market. The banking sector's performance is also affected by different factors. In order to boost investor confidence, some questions about the economy and volatility in return should be answered. This paper tries to figure out that answer.

The authors of this paper are inspired by the lack of evident and robust evidence on time-varying macroeconomic risk and industry/sectoral stock return volatility in Bangladesh based on DSE data. Although much research has been done in Bangladesh on volatility factors, they have always focused on the DSE's overall stock return volatility rather than the industry stock return. This is partly due to the lack of a dedicated industry index in the DSE and the difficulty in gathering data. There is no apparent index calculation methodology or rules in DSE, and if anyone wants to calculate this, it takes a long time. As previous research was flawed in this area, the authors find it crucial to determine the impact of time-varying macroeconomic risk and industry stock return volatility in DSE and calculate a valid sectoral index. The remaining study is arranged as follows: Section II provides theoretical and empirical findings from dynamic literature. Section III represents the study objectives; Section IV explores data and research methodology; Section V explains the analysis and results of the data and Section VI concludes the study.

2.0 Literature review

Economists and financial experts have used various methods to examine the relationship between macroeconomic variables and stock returns for various countries and times. Recently, the time-varying macroeconomic risk and volatility in industry stock return have become prominent issues for research.

Because CAPM only evaluates the one-factor effect, and the APT theory is based on the idea that various factors influence stock returns, multifactor asset pricing models are preferred over CAPM for this detailed examination (Economic online, n.d.). Moreover, GARCH type models are ruling over 30 years for measuring market data volatility (Bhowmik & Wang, 2010).

Chen (1983) was a pioneer in this field by giving an economic interpretation to statistical factors. However, Gertler and Grinols (1982) examined the relationship between unemployment, inflation, and common stock returns and discovered a statistical relationship between predicted security returns and macroeconomic parameters. Based on monthly data from 1953 to 1983, Chen et al. (1986) employed a six-factor model to discover that the significant stock checkerboards remuneration in the US market was industrial production, term structure premium, and risk premium. The well-preferred literature by Schwert (1989) investigated the relationship between stock volatility and the volatility of real and nominal macroeconomic variables in the United States. The author discovered weak evidence that macroeconomic volatility can predict stock return volatility using inflation, industrial production, and money supply data.

On the other hand, this study reveals a helpful link between macroeconomic instability and stock market volatility, with the direction of causality leaning more toward macroeconomic variables. Madura and Zarruk (1995) investigated the interest rate sensitivity of bank stock returns. Their sample included 29 banks from the United Kingdom, Canada, Japan, Germany, and the United States, with data collected from January 1988 to April 1993. They discovered that interest rate risk differed by country, partly attributed to differences in bank rules and managerial traditions.

Using panel data analysis, Diebold and Yilmaz (2008) investigated the relationship between macroeconomic and stock market volatility in a cross-section of around 45 developed and emerging nations from 1984 to 2004. One of the study's significant flaws is that it is only based on aggregate market-level data, excluding sector-level data and thus missing out on industry-level information. For Finland, ARMA et al. (2008) investigated the relationship between macroeconomic and stock market volatility. They discovered a bidirectional relationship between stock market volatility and monthly macroeconomic volatility using univariate GARCH and Vector Autoregressive Models.

Using the GARCH model, Butt et al. (2010) examined how stock returns varied by industry (banking and textile) and firm-level to specific economic variables. The test is applied to each firm's stock returns and the entire industry's data set, using data for the selected firms and economic indicators acquired for ten years. The outcomes reveal that market yield is mainly accounted for disparity in stock revenue. Other macroeconomic and industry-related variables, on the other hand, have added to the explanatory power of the stock returns variation. In terms of stock revenue, it has been discovered that economic manifestation is higher at the industry level than at the firm level. Chinzara (2010) investigated how systematic risk in the macroeconomy translates into stock market volatility. The study analyzes whether financial crises impact the link between macroeconomic uncertainty and stock market volatility using augmented autoregressive GARCH (AR-GARCH) and Vector Autoregression models. The findings show that stock market volatility is mainly controlled by macroeconomic uncertainty.

Wei-Chong et al. (2011) investigated the association between stock market volatility and some macroeconomic indicators in Japan using daily data on the currency exchange rate, oil price, gold price, and Nikkei 225 index from May 1997 to July 2009. They found no impact of macroeconomic variables on the volatility of Japan's stock market.

Using a GARCH-M model, Chancharat et al. (2007) investigated the effect of different stock market price indices and macroeconomic variables on the Thai stock market from 1988 to 2004. Changes in indices in Malaysia, Singapore, and Indonesia before the 1997 crisis and changes in Korea, the Philippines, and Singapore after 1997 immediately impacted returns in the Thai stock market. Only fluctuations in oil prices had a negative influence among five macroeconomic variables.

This study also discovered a significant association, although it suffers from the same flaws as Diebold and Yilmaz (2008). Most researchers utilized the GARCH model for volatility testing, and the majority of them discovered a strong relationship between macroeconomic and stock market volatility. However, using bivariate and multivariate VAR Granger Causality Tests and regression analysis for Malaysia.

Zakaria, and Shamsuddin (2012) found minimal support for the existence of a relationship between stock market volatility and macroeconomic volatility. GDP, Inflation, Exchange Rate, Interest Rates, and Money Supply were chosen as independent variables based on monthly data from January 2000 to June 2012, but the only interest rate and inflation volatility were determined to be Granger-caused stock market volatility. Granger does not generate stock market volatility because of the irregularity of macroeconomic events as a group. Regression analysis reveals that only money supply volatility is significantly related to stock market volatility. The unpredictability of macroeconomic variables as a whole is not linked to stock market volatility in a significant way. Due to the lack of institutional investors in the market, an uneasy alliance between stock market inconsistency and macroeconomic instability is possible. It could also point to a problem with information asymmetry among investors.

Saji (2013) uses monthly data from India's post-2000 period to examine a relationship between time-varying macroeconomic conditions and industry stock returns. The study used the Banking, Energy, FMCG, Information Technology, Pharmaceuticals, and Automobiles sectors to look at industry-level stock price return volatility. Multifactor modeling utilizing the GARCH model is used in the empirical methodology. According to the study's findings, India's expected premium on stock market investments varies over time and is driven by macroeconomic factors with time-varying conditional volatilities. The impact of economic changes differed by industry, and the sectoral disparities in stock market returns underscore the benefits of industry distribution in terms of investment risk diversification.

Emenike Kalu and Okwuchukwu (2014) investigated the impact of macroeconomic variables on Nigerian stock market return volatility by focusing on data related to all-share index, broad money supply, consumer price index, private sector credit, exchange rate, and net foreign assets from January 1996 to March 2013 and by applying the conditional variance model. It discovered that changes in the US dollar/Naira exchange rate and credit to the free enterprise sector positively influence NSE return variability, while changes in the broad money supply and inflation negatively impact. Changes in net

overseas assets, on the other hand, have a negative but not significant impact on stock market yield volatility. However, the most crucial point is that the sectoral differences were not included in this study.

Oseni and Nwosa (2011) used the AR (k)-EGARCH (p, q) approach to examine the unpredictability or elasticity in the stock market and macroeconomic variables, and the LA-VAR Granger Causality test to explore the nexus between stock market variability and macroeconomic variables instability in Nigeria using time-series data for the years 1986 to 2010. Stock market volatility and actual GDP irregularity are bi-causal, according to the research. The interest rate and inflation rate volatility have no causal relationship with stock market inconsistency. The study recommended reducing stock market volatility; the government should take a proactive role in creating a stable market by capitalizing on ordinary people's growing interest by increasing share supply.

To show the impact of macroeconomic volatility on stock market volatility in Bangladesh, Chowdhury and Rahman (2004) used a Vector Auto Regression (VAR) and seasonality adjusted forecasting model and found a unidirectional impact. Chowdhury et al. (2006) explored how expected macroeconomic instability is related to stock market elasticity in Bangladesh using monthly data on stock price, CPI, exchange rate, and industrial production from 1990:01 to 2004:12. Using the GARCH model, the authors found a relationship between stock market volatility and macroeconomic volatility. Finally, to analyze the relationship between the variables, VAR (Vector autoregression) is used. The findings reveal a notable unidirectional causality between industrial production ticklishness and market return instability, as well as market return elasticity and inflation volatility.

Using Vector Auto-Regression (VAR), Rahman and Moazzem (2011) attempted to empirically demonstrate a causal association between reported volatility in the country's major stock exchanges, mainly the Dhaka Stock Exchange (DSE), and the SEC's regulatory decisions. A statistically significant or relevant relationship was discovered between regulatory authority decisions and market outcomes.

Hossain et al. (2021) have forecasted the volatility of selected banks by applying the GARCH (p,q) model, where it is found that E-GARCH and GJR-GARCH are more suitable in determining the existence of asymmetry. Masuduzzaman and Wing (2013) used an impulse response function and a variance decomposition test to assess long-term and short-term performance based on five macroeconomic variables. The researchers discovered that short-term dynamics could not be estimated using macroeconomic variables, and there is a very weak long-term relationship. Rayhan et al.(2011) used the ADF, GARCH model to explore time-varying DSE overall return volatility. The tests showed that the monthly DSE price index follows a random walk but not the monthly DSE returns. Monthly DSE returns follow GARCH features, according to the study. The study's flaw is that it didn't take macroeconomic factors into account. Quadir (2012) also looked at the effects of macroeconomic factors on stock gains on the Dhaka Stock Exchange between January 2000 and February 2007 using monthly time series data and the Autoregressive Integrated Moving Average (ARIMA) model.

Using the Chittagong Stock Return Index from 04 January 2004 to 14 September 2014, ACMA (2015) investigated a wide range of popular volatility models for stock index

return, including Unit Root Test, Random Walk Model, Autoregressive Model, Generalized with Normal, and Student t-distribution assumption and discovered that the five models GARCH-z, EGARCH-z, IGARCH-z, GJRGARCH-z, and EGARCH-t could all capture the major characteristics of the Chittagong Stock Exchange (CSE). Ahmed et al. (2020) considered DSE to determine volatility based on historical circumstances in breakpoints were sightseeing around events and regulations.

The research gap the authors have found from the research work conducted in Bangladesh is that none of the research papers considered sectoral return volatility issues with time-varying macroeconomic risk. So this is the cardinal focus of this research paper.

3.0 Objectives

The general objective is to determine the time-varying macroeconomic risk and industry stock return volatility in the Dhaka stock exchange for 2005-2019. The specific objectives of the study include the following:

- To establish a reliable industry index (Banking) for DSE and to determine the returns of the same.
- To find out the macroeconomic risk factors contributing to industry stock return volatility.

4.0 Data and Methodology

The majority of the data for this study has been collected from online sources like various national and international data collection websites. The paper focuses on different statistical methods that are mostly learned and taken from online sources.

Sampling: The authors use monthly data from 2005 to 2019, which means the sample size is 180 months. Monthly frequency and this time frame have been chosen to maximize the observation so that robust estimation of the model can be possible. The sample is determined according to the data availability in DSE as well as other reliable sources. The sectoral index, one of the variables of this study, is determined based on the following condition.

- Weighted Average Price Index (WAPI) calculation methodology is employed.
- The market capitalization of each company is calculated by adjusting dividends and other changes.

Data and Variables: The study includes six independent macroeconomic risk factors entitled Consumer Price Index (CPI), three month T-bill rate, Broad money M3, Exchange rate, and DSE general index (DSEGEN) and the dependent variable is industry return (relative change in closing price index). The authors focused on the banking industry. For closing price index of all companies registered in DSE of banking sectors' is used. The following is the description of these variables and data:

1.	Inflation	The consumer price index is used to calculate inflation. It reflects the percentage change in the cost to the median consumer purchasing of a basket of goods and services that may be hooked at specified interims, such as yearly.
2.	Broad money (M3)	Currency and coins, deposits in current accounts, deposit accounts and small-time deposits, overnight repos at commercial banks, and non-institutional money market accounts make up broad money (M3). This is the dominant money supply standard and the economic yardstick for assessing the level of liquidity in the economy. This variable's data has been gathered from international financial statistics (IFS).
3.	Three-month T-bill rate	The three-month Treasury bill's coupon rate is used in this analysis. The data on Treasury bill interest rates were gathered from the Bangladesh Bank's website for the entire period.
4.	Exchange Rate	The rate at which one currency is exchanged for another is known as the exchange rate. We obtained this data from IFS and estimated the exchange rate as TK/$.
5.	Market Return	As a market index, the study used the DSE all-share index or the general index, with the relative change in these indexes serving as the return. The information was gathered from the Bangladesh Securities and Exchange Commission's quarterly review.
6.	Industry Return (relative change in closing price index):	All information was gathered from the DSE website. The closing price index is calculated using the WAPI approach and collecting all of the firms' monthly closing prices, number of securities information, and market capitalization.

Data Analysis Procedures and Modeling:

After selecting necessary variables and collecting data, the research has been continued by applying various statistical methods. Before that, the authors calculated the industry index. Price-weighted, Market Capitalization Weighted, Equal Weighted, and Factor Weighted are the four weighted average methods for index calculation. The authors employed the Price Weighted method detailed in the CFA Institute's Security Market Index presentation.

Weighted Average Price Index Method:

The price-weighted index works similarly like the Dow Jones Industrial Average Index (Fontanills and Gentile, 2006). According to the Chartered Financial Analyst (CFA) Institute, the weight on each constituent security is derived by dividing its price by the sum of all the prices of the constituent securities. But a problem may arise in stock split, and stock merge (reverse stock split) as these change the value of the weight on all securities. To solve this problem, we adjusted the value of the divisor properly. The Price weighted equation which is typically used is:

$$w_i^P = \frac{P_i}{\sum_{i=1}^{N} P_i}$$

The method we used for index calculation is according to a presentation given by Chartered Financial Analyst (CFA) Institute. The summary of the method is like this:

Index Today= Base Period Index* [1+∑ {market capital Weight*(EOP-BOP)/BOP}]

- Here Market Capital = Price*No of Shares Outstanding
- Weight=Market Capital of Individual Company/∑All companies Market capital
- EOP=Ending Price
- BOP=Beginning Price

GARCH (1, 1) has been focused on determining volatility because this is one of the best models and researchers use this frequently. For the stationarity test of data, the ADF test was conducted. The study also tries to find causal relationships using the granger casualty test and general statistics descriptive statistics. E-views 7.00 were used to perform all of these tests. The following is a general overview of the entire test:

Augmented Dickey-Fuller (ADF) Test: To solve the problem of autocorrelation of DF test, an advance procedure of DF test is initiated and called ADF test. For controlling higher-order correlation, this is a parametric test method. This is accomplished by attaching the dependent variable's lagged difference terms to the regression's right-hand side. There are three basic forms of ADF test. They are

i. $\Delta Y_t = \gamma Y_{t-1} + \sum_{j=1}^{p} (\delta_j \Delta Y_{t-j}) + \epsilon_t$

ii. $\Delta Y_t = \alpha + \gamma Y_{t-1} + \sum_{j=1}^{p} (\delta_j \Delta Y_{t-j}) + \epsilon_t$

iii. $\Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + \sum_{j=1}^{p} (\delta_j \Delta Y_{t-j}) + \epsilon_t$

Where

- t is the time index,
- α, a drift is an intercept constant,
- β is the time trend's coefficient,
- γ is the coefficient showing process root, i.e., the focus of testing,
- is the first-differences autoregressive system's lag order,
- e_t is an identically distributed residual term that is independent.

The standard form of equation used here is

$$\Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + \delta_1 \Delta Y_{t-1} + \cdots + \delta_{p-1} \Delta Y_{t-p+1} + \epsilon_t$$

Here α is a constant, β is the time trend's coefficient, and p is the autoregressive system's lag order.

Modeling a random walk with imposing the constraints $\alpha = 0$ and $\beta = 0$, and a random walk with a drift with the constraint $\beta = 0$.

The H_o hypothesizes that the time series Y_t is non-stationary (has a unit root). If the calculated ADF statistic is bigger (in absolute) than its critical value, the null hypothesis is rejected, implying that it is stationary.

GARCH (1, 1) Model: Volatility congregation is common in financial markets data, where time series show periods of high volatility and periods of low volatility. However, time-varying volatility is more common than constant volatility, and accurate modeling of time-varying volatility is critical in financial engineering. In such scenarios, the assumption of homoscedasticity is quite restrictive, and it is preferable to look at patterns that enable variance to be determined by its history.

Bollerslev (1986) developed the ARCH model to the Generalized Autoregressive Conditional Heteroskedasticity (GARCH), which shared many of the ARCH's essential traits but required considerably fewer parameters to explain the volatility process correctly. According to the GARCH Model, conditional variance is dependent on the previous mean and variance lags value.

If independent variables are chosen, including the specified exogenous variables, a GARCH model (GARCH = Generalized Autoregressive Conditional Heteroskedasticity) can be either a univariate or multivariate model. Below is the conditional variance equation.

$$h_t = \alpha_0 \sum_{i=1}^{q} \alpha_i \, \mathscr{E}^2_{t-i} + \sum_{j=1}^{p} + \beta_t \, h_{t-j}$$

As a result, the parameter p denotes the Generalized (or "AR") order, whereas the value q denotes the regular ARCH (or "MA") order. If p is non-zero, q must likewise be non-zero, else the model will be unidentifiable. Setting p to zero and q to a positive value, on the other hand, can be used to estimate a standard ARCH model (Saji, 2013).

The study used the standard procedure of unit root testing using the ADF test on the variables in level, first difference and second difference to determine stationary.

5.0. Analysis

5.1. Descriptive Statistics of Portfolio Returns:

The summary statistics of the banking sector's return for 2005-2019 are presented in Table 1. The highest and minimum rates of return provided by the banking sector's index over time and their respective mean, standard deviation (S.D), and skewness were summarized. A lower rate of volatility in the return distribution suggests greater market consistency and a lower risk of investors losing money. In most cases, a value of zero skewness indicates that the observed distribution is normal.

Table 1: Descriptive Statistics of Industry Return

	BANKR
Mean	-0.004
Maximum	0.17491
Minimum	-0.44917
Std. Dev.	0.04059
Skewness	-7.32273

The Banking sector's monthly mean return is the lowest -44.91 percent to its investors. The return in the banking sector is negative, and its risk term is 0.4%. The skewness coefficient for banking sector return is -7.32, which is less than zero, indicating that significant price decreases are more likely than price rises.

5.2 Unit Root test results:

The stationarity of all variables, both stock return, and economic variables, are tested by applying the Augmented Dicky Fuller test. The research has used two assumptions.

H_o: Time series has a unit root

H_1: The series has no unit root

Table 2: Unit root Test Result:

	At level		1st difference	
Variables	test stat	P- value	Test stat	P- value
M3	1.566320	0.9994	-0.348256	0.9137
CPI	- 1.70783	0.9997	-2.996725	0.0372
EXCR	-1.18674	0.6799	-3.394596	0.0124
TBR	-0.90456	0.7851	-12.05479	0.0000
DGNR	-12.5131	0.0000	-12.4329	0.0000
BANKR	-14.9215	0.0000	-10.2250	0.0000

Table 2 summarizes the ADF unit root tests results by considering intercept and trend at the level and first difference. Based on test statistics, at level among the economic variables, only the DSE general index (DGNR) and Bank index rate (BANKR) have no unit root or stationary as the respective P-value 0.000, and .0000 are < 5% and the T stat > t crit. So the H_0 is rejected.

The other macroeconomic factors M3, CPI, EXCR, and TBR have unit root as the respective P-values 0.9994, 0.9997, 0.6799, and 0.7851, are greater than 5%. So here we accepted H_0.

At the level (raw or initial data) which series is not stationary, 1st difference is used to make them stationary. So at 1st difference, all data series except M3 are stationary or have no unit root.

As M3 is not stationary at level and 1st difference, so 2nd difference has been applied to make it stationary as stationarity of data is a must for a model like GARCH, VAR, etc. If the data series under calculation is not stationary, then the result or t value may not be viable.

Table 3: Stationarity Test Result at 2nd difference

At 2nd Difference		
variables	t stat	P- value
M3	-16.25486	0.0000

Table 3 summarizes the results of ADF unit root tests by considering intercept at 2nd difference. From the statistics, it is clear that at the 2nd difference, M3 has no unit root that means it got stationary.

5.3 GARCH results

The authors have analyzed industry stock returns by using the GARCH model. The fitted GARCH models estimate the diverse relationship between the macroeconomic parameters and industrial stock returns in Bangladesh.

Table 4: GARCH test Result

	BANKING	
Dependent var	coefficient	p-value
M3	2.23E-16	0.8979
CPI	-3.02E-06	0.3998
EXCR	-5.19E-06	0.7442
TBR	-3.14E-05	0.0560**
DGNR	-0.002381	0.0013*
ARCH	0.043987	0.0355**
GARCH	0.554959	0.0000*

*significant at 1% level
** Significant at 5% level
*** Significant at 10% level

In the banking sector, ARCH has a p-value of .0355, which is less than 5% and 10%. So, the ARCH term is significant in this sector. As well the GARCH term also is statistically significant here. The P-value of the GARCH term is .000, which is significant at a 1% significant level which aligns with Saji (2013). That means the condition of the previous day's volatility or variability affects the characteristics of banking sector return but no effect of the previous day's volatility performance information.

Market exposure or market return or DSE general index significantly impacts determining industry stock return whis is also supported by Saji (2013).This is because market return expectation may affect industry return expectation. From the summary, it is

seen that DSE general index affects the banking sector's return as its p-value is significant at 1% significance level which is also supported by GARCH estimation result also provides the scope and evidence for the changes in stock performance to the changes in economic conditions. M3, and exchange rate have no significant effect on banking industry stock return which is also the same as (Saji, 2013) results. As well as Singh et al. (2010) also found that their money supply and exchange rate have a negative relationship with the return, whereas Saji (2013) found T- Bill rate is not statistically significant for the banking sector.

GARCH test model would be best if there is no serial correlation, residuals are normally distributed, and there is no ARCH effect.

Table 5: ARCH LM and Normality Test of Residuals

ARCH LM		Normality Test	
F-statistic	Prob. Chi-Square(1)	Jarque-Bera	Probability
0.001333	0.9707	59087.37	0.000

From Table 5, it is evident that the p-value of the ARCH LM test is greater than 5%. So here, the null hypothesis is rejected. That means there is no ARCH effect in the residuals. But the p-value of the normality test is less than 5 %, indicating that the residuals are not normally distributed.

6.0 Conclusion

The capital market is one of the most important venue for fund flow which deals with the investors' expectancy of gaining high and borrowers' expectancy to collect capital at a comparatively lower rate. These two expectations are a function of economic performance which creates investors' confidence. If investors are confident about return, then fund flow increases. So macroeconomic conditions have an important relation with stock market performance.

The cardinal focus of this research is to observe the impact of macroeconomic conditions on Banking industry stock returns by using multivariate asymmetric GARCH modeling concentrating on monthly data from 2005-2019. DSE general index has an important ability to explain the volatility of the banking sector's returns. Furthermore, the return volatility of the banking sector can be explained by its family shock that means by GARCH term, which means previous days squared residuals and previous days lag variance or volatility can explain today's return volatility. TBR can also explain the volatility of the banking sector's return. On the other hand, M3, and exchange rate have no significant impact on determining return volatility. CPI also can not affect stock return and Iqmal and Putra (2020) also found the same.

It is very obvious that the share market, economy, organization's performance, and the investors' tendency to invest are interrelated, and share returns are very sensitive to the economic news. New information related to the economy, like real GDP, inflation, etc., influences market participants to make adjustments that directly impact return volatility (Solakoglu & Demir, 2015). The study's primary weakness is that it was limited to the

banking industry. As a result, the findings of this study are unlikely to apply to other industries. Although macroeconomic volatility has an impact on industry returns, numerous other factors, such as investor behavior and unanticipated shock (COVID-19), have an impact on stock returns that are not taken into account here. So further study can be done by focusing on the behavioral issues of the investors and fund managers on fund management and thus on stock return. As well as there is a vast scope of the future focus on determining the impact of multiple external and internal factors impact on other industry's return volatility as well as the spillover impact of international economic factors on industry return.

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Evaluation of Digital Land Information System (LIS) in Bangladesh: A Case Study on Savar Upazila, Dhaka

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Abstract: Land information system involves database containing, spatially referred land related data, which is used in an efficient manners through systematic collection, updating and distribution. But the manual system of the land information system requires more man power while collection, updating, distribution a management. On the other hand it also very complex system to continue this process in the context of Bangladesh where lands are splatted, developed and exchanges frequently. The emergence of the digital land information system reduces the complexity for the development and use change of land also. Savar is the first Upazila near Dhaka introducing the digital land information system, which represents all over Bangladesh with both urban and rural context. Nevertheless, practically the stakeholders of digital LIS are not well educated for practicing. This digital system with the proper evaluation and the proper implementation will reduced the systemic complexity of land in Bangladesh.

Keyword: Land, Administration, Management, Digitalization, Information

Introduction

Bangladesh is a South Asian developing country with a rapidly growing population and limited land resources. It results in haphazard and spontaneous land development both within cities and across the country. The country's landman ratio is decreasing due to fast population increase. As a result, there is a lot of land transfer and conversion. Rapid population increase, combined with the rapid transformation of land, necessitates the implementation of an efficient land administration and management system. The traditional land management system is unable to keep up with rising demand and changing market conditions. Unplanned growth and issues in community life are the result of an ineffective land administration and management system. Land records that are incomplete or incorrect make it more difficult to secure land tenure and transfer. For this reason, the most practicable systematic strategy for building an efficient land administration and management system in Bangladesh is the Land Information System (LIS) (Nahrin & Rahman, 2009). The foundation of LIS is a uniform referencing system, which could make it easier to integrate different types of data inside the system and with other land-related information. The quantity of data that can be handled, the speed with which these data can be processed, and the ways in which the data can be altered and evaluated are the most essential aspects of land information management. (Ali Shakir, 2012). The LIS is also a GIS system which provide a reliable and current information of land as a base for land markets, development, and other economic activity as well as land planning, infrastructure development and maintenance, environmental protection and resource management, emergency services, social service programs and so on (<en.wikipedia.org>, 2014 & <ncgia.ucsb.edu >, 2014). On the other hand, perfect IT environment's first requirement is the digital land mapping (Enemark, 1999). Moreover, It also allows for revenue generation to the government (taxation), maintenance of

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environmental quality, and provide security of tenure (Usman, 2010) in various countries. The LIS for the Environment can influence the planning at regional and local levels through, national planning directives and public information (Enemark, 1999). The sectoral land-use provisions are managed by the county and municipal authorities on the basis of sectoral land-use programmes that also form the basis for comprehensive planning at regional and local level (Enemark, 2008).

However, the traditional land management system is unable to keep up with rising demand and changing market conditions. Unplanned growth is the result of an ineffective land administration and management system, which eventually leads to issues in community life. Inadequate and incorrect land records make securing land tenure and transferring land more difficult. As a result, establishing an appropriate land administration and management system through a holistic approach becomes a requirement.

The last decade has seen moves towards establishment of fully digitized cadastral systems throughout the world. It is recognized that cadastral systems are not self-contained. It is also acknowledged that digital cadastral systems must be adapted to allow an efficient land market as well as effective land-use administration, thereby promoting economic development, social harmony, and long-term sustainability. Cadastral systems must be multipurpose in order to fulfill the demands of today's GIS and IT environments (Enemark, 1999). For the GIS and perfect IT environment the digital Land Mapping is the first requirement.

Land administration is the process of effectively placing land and information about its ownership under the control of a central authority that regulates the structure and patterns of land ownerships, land use, and public access to land resources in such a way that they are used in an environmentally and economically sustainable manner. An ideal land administration would be able to provide land information in an effective and efficient manner, appropriately identifying people with real estate interests and delivering information about their interests (such as duration of leases). It must also allow easy access to land for development where it is needed, increase efficiency in land use management through good planning, and promote greater social equity. It should also allow for revenue generation to the government (taxation), maintenance of environmental quality, and provide security of tenure (Usman, 2010).

At the moment, the ministries and agencies in charge of land management and administration work in silos, with minimal collaboration. The entire procedure is tedious, time-consuming, and manual. Land administration and management is incomplete and ineffective due to traditional techniques of land survey, land record generation and upkeep, and the maintenance of all relevant data for each parcel of land. Furthermore, land record distortion at many phases (e.g. plot-to-plot survey, traditional record preparation and map drawing, objections, trash / inspecting works, printing, etc.) impedes land development control and property tax collection. Because the deed system does not give the final proof of the proprietary right, insufficient and inaccurate land registrations exacerbate challenges in land security tenure and land transfer in Bangladesh (Alam, 1992; Hossain, 1995). Inadequate capacity of the Settlement Press for printing land records and poor quality of record maintenance also aggravate the inefficiency of the existing system. For those the LIS as well as the Digitization of the Map is required with

proper evaluation. With the proper evaluation and the proper implementation the LIS will reduced the Land Complexity in Bangladesh.

Objectives of the Study

The aim of the study is to identify the efficiency of the existing digital land information system in Savar as welll as Bangladesh. The objectives of the study are

- To determine potentialities of LIS through the Digital Land Mapping in Savar upazila for an effective land administration and management system in Bangladesh according to the present land management situation,
- To identify the Digital Land Information procedure ongoing in Savar for the LIS of Bangladesh and
- To address the pitfalls of Digital Land Information System and identify the possible solution for the betterment of the digatal LIS.

Study Framework

Methodology is the course of action by which the study will be accomplished. People who lived in the study area they were surveyed through the Two Stage Sampling Method. The sizes of the primary sampling units are decreased and applied two-stage sampling to each stratum (<www.fao.org>, 2014). The population size of the study is so large. On the other hand the all population are not directly related to the study. Most of the cases tha land are relate dto the male population and they usually handle the issues of the land. The first stage of sampling method is to select the cluster from the population and second Stage of sampling is to select elements from the selected cluster. To avoid potential bias, simple random sampling approach was applied in both selection. This approach is particularly useful when "each unit of the population is given the same probability of independent selection" (Kitchin and Tate, 2000). Then the sample was selected on the basis of holdings bearing the numbers M, M+k, M+2k, ……, M+(n-1). Persons to the related authority are only one so the survey was specified as the Snowball Method. Persons as the specialists will be survey under the Snowball surveying. The sample size for the study area was 200 according to the area size and related persons of the land information system of Savar Upazila. However, the authorities and specialist of related to LIS are according to the necessity.

Observation and Findings

Digital LIS is worldwide famous procedure for the development and planning. The system of LIS changeds its procedure and pattern day by day requirements. To understand the procedure of the digital LIS it is required to understand the terms related LIS. The overall findings are as bellows.

Land information system (LIS): Land Information system means to acquire, manage, retrieve, analyze, display land records. LIS as component of GIS or vice-versa... a long-standing debate, mostly a matter of semantics and disciplinary orientation (Stephen, 2000). Typical LIS are cadastre as a primary component, maintained by unit of government responsible for tracking land ownership, control; typically county

government in US which is parcel-oriented hard copy maps and/or CAD or GIS software for spatial representations relatively large (cartographic) scale (e.g., 1:4800 in rural areas, 1:1200 in developed areas) bridge between legal (e.g., deeds) and technical (e.g., maps, GIS coordinates) land descriptions. It may incorporate other technologies as parcel indexing systems (relational data base management systems), fiche and document imaging systems and surveying. The multipurpose land information system includes

- alternative to multipurpose cadastre
- parcels as one component of layer-based system
- oriented to integration and analysis of data
- geodetic reference framework as organizing principle (Stephen, 2000).

LIS Players: Local government is the administrative player for the LIS. Local government officials maintain land records, deed registry and other land information for tax assessing, zoning administration and to serve every other agency who needs to know about land for its various uses (Stephen, 2000). Public interacts with local LIS primarily in land conveyances and land tax assessment: may also some involvement in particular application. The land related business officials and NGOs also required LIS for the development as well as real estate, land banking, title abstracting and insurance, conservation and environment protection, and finally community , land use and economic development (Stephen, 2000).

History of LIS: In the early age the land information system was very poor. People has to maintain by name and address. But when the number of owner increase by inheritance or selling this procedure required more maintenance by the government (<ncgia.ucsb.edu >, 1998). One concept for a modern system is the access to all pertinent records for other government functions public access interface for routine record retrieval by companies and citizens, with appropriate privacy restrictions/protections (Stephen, 2000). The first Digital Mapping in Land Information Systems was cadastre in Poland was established in the nineteenth century, whilst the contemporary Polish cadastre was created in the 1960s. Its base document is the land register. The latter solution was chosen in Poland. Since 1991 the process of conversion of the existing cadastre from the analogue to digital form and creation of the basis of countrywide LIS is being realized (Cichocinski, 1999).

Geographic features too small to be depicted as lines and areas are represented by points, features too narrow to depict as areas are represented by lines, and homogeneous geographic features are represented by areas. Such points, lines and areas are represented as a list of coordinates instead of as a picture or a graph (Cichocinski, 1999). Finland uses totally digitized processes in cadaster maintenance and information services (Tella, 2016). An accurate geodetic framework and cadastral system has been developed, many analysis of land-tenure change could be performed with the assurance of high degree of measurement accuracy. This will help arrive at compatible multiple land uses within selected parcel of land (Hossain, 2015). LIS application combines both traditional survey methods and Global Positioning System (GPS), a sophisticated satellite system for acquiring the local information on land (Demers, 1999). The Cadastral Survey (CS) and Mapping methodology based on ground survey or aerial survey supplemented by ground survey is to be adopted. Completion of these operations would provide digital mauza

maps. Using Satellite navigation systems or GPS, surveyors collect field data using portable backpack or hand-held devices. In this process, they use signals from GPS satellites to work out the exact location on the earth's surface. Most GPS receivers store collected co-ordinates and associated attribute information in their internal memory, so they can be downloaded directly into a GIS database (Heywood, et. al. 2002).

When the 'Transfer of Property Act, 1882' went into effect, the notion of registering land ownership first came up. This law made it legal to transfer land in the present and future. Later, the 'Registration Act of 1908' was passed to create land records and collect 'ad valorem' taxes based on registration fees and other transfer-related duties. At the office of the sub-registrar, the registration records are kept in registers (Rahman and Talukder, 2016). The present system of land recording in the local land management and registration offices follow the age-old system of writing down a great deal of details on how specific land ownership titles were handed down through generations, changed hands, current ownership, heirs on both side (buyer and seller) of the families, the specific land area owned on each 'parcel' or 'daag', in an archaic customary language, which is incomprehensible to most 'lay' readers. The land record and registration offices are not well managed; documents and archives are damaged and frail due to poor storage facilities (Rahman and Talukder, 2016).

The recent scheme taken by the Government of Bangladesh intends to digitize the land records, integration of AC land and Sub-registry offices, e-filing requesting Khatian (RoR) from District Record Room and scanning of tattered Khatian and maps. This intervention is expected to not only save in Conduct RS or BS Mutation on property Verify the record of rights (ROR) Obtain inspection for RS Mutation Obtain the non-encumbrance certificate from the relevant Sub-registry office Prepare deed of transfer and pay stamp duty Pay capital gains tax, registration fee, VAT and other taxes at a designated bank Apply for registration at the relevant Sub-registry Register the change in ownership at the Land Revenue Office 7 government expenditure but also to reduce fraud and litigation in connection with land ownership. Access to Information (A2I) has been given the responsibility by the Prime Minister's office to digitize the land sector. Some AC Lands of various Upazilas have also taken the initiative to digitize the land administration system. The implemented projects are –

- The digitization projects are being implemented in six Upazilas under two different technologies, digitalization of land records and integration of AC land and Sub-registry offices in 45 upazillas of 7 districts, e-filing requesting Khatian (RoR) from District Record Room and scanning of tattered Khatian and maps. ′
- In Savar Upazilla, for 4 mauzas, digital piloting program has been completed. Savar Land office has digitized their system (Office Automation System) to improve official performance (linking sub-register office with land office) and ease the civil service (e-filing for mutation or requesting of RoR).

A2I has started an application simplificati service for Porcha (ROR), known as 'Electronic-Porcha Delivery System', which also helps to update the land records. The digitize process is shown in the following chart (Access to Information, 2014)–

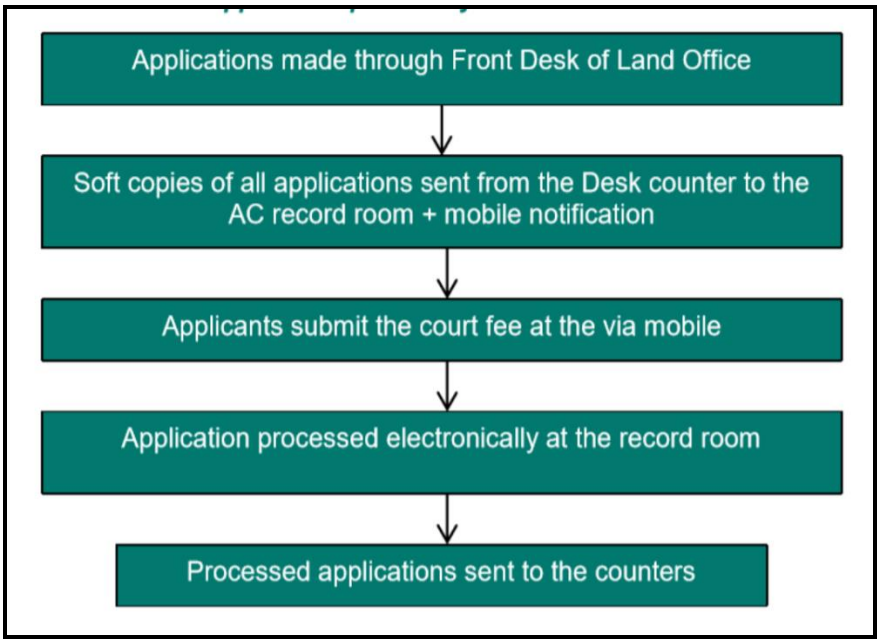


Fig 1: Application process of E-Porcha
Source: Rahman and Talukder, 2016

Before buying any property in Bangladesh, it is necessary to check the ownership of the property. Property ownership disputes are fairly common in Bangladesh. Property documents are easily falsified and untrustworthy. If a person is not cautious while purchasing a property, he or she may face complications, including possible litigation with the property's ownership later. However, verifying property ownership in Bangladesh is a time-consuming process (ogrlegal, 2018).

Process of Digitizing LIS: As part of digitizing Bangladesh's land management, around 65 lakh bhumi khatians (records of land rights) have been scanned and indexed into a computerised system under a government initiative. According to an official document, 18,500 map-sheets have also been scanned and indexed under the "Digital Land Management' project" that began in July, 2011, and ended in June, 2016. The Land Record and Survey Department has finished the necessary civil engineering for the construction of a central data center, as well as installing the necessary equipment. Bangladesh Computer Council has managed the installation of a data backup and recovery facility at the University Grants Commission (UGC) in the city's Agargaon region. The official document further said the refurbishment work of 53 district and upazila offices under the project has already been completed. The document also mentioned that 20 upazila Land Information and Service Centres have already started offering services and consultants have been appointed to run them. On completion of the current project, the Land Ministry plans to implement another project titled "Land Management Automation," which was sent to the Planning Commission for approval, said the ministry official. After gaining the Planning Commission's approval, the land management system of the entire country will be run through a computerised system following the project’s implementation, according to another official document. Besides,

the document reveals that a pilot project, "Strengthening Access to Land and Property Rights to All Citizens of Bangladesh," is also being implemented. Under the pilot project, AC (Land) office, sub-registry office, settlement office, and two union land offices of Monirampur upazila in Jessore district have installed "Integrated Digital and Land Record System" software to digitalise the land management system. Once the system is fully automated, landowners and buyers will not have to visit more than 10 government offices regarding documents. All the documents will be uploaded to a central database, to which the government officials and the people, in some cases, will have access. Through this project, a plan has been put in motion to simplify land management through countrywide land mutation, collection of land development tax, khas land and sairat mohal (water bodies) management and office and finance-management.

The government also has further plans to resolve problems related to land management through digital system. To this end, three projects have been taken so far. The projects are- Strengthening governance management project (Component- B: Digital Land Management System), Digital land record, Survey and Maintenance project, and National Land Zoning project. Once the ongoing land digitization projects are completed, the government officials sitting at their offices will be able to check any transformation of land, including infrastructure and ownership. Bangladesh's land has been divided in terms of authorisation, which continues to pose a problem.

Digital Land Information System of Savar Upazila Land Office: Savar is an Upazila of Dhaka District in the Division of Dhaka, Bangladesh. It is located at a distance of about 24 kilometers (15 mi) to the northwest of Dhaka city. Savar AC land has taken the initiative to digitize the land administration system. Office Automation System is the software used by Savar AC Land office to improve official performance and ease the civil service in a unique way. The purpose of the software is to finish the land office work in a quick, easy and accurate manner, which makes the land management as well as other official matters simple and automatic. The software was inspired by the National e-service system or NESS, and the procedure is also similar to NESS; 50% of the system has been completed (Rahman and Talukder, 2016). With this software, currently the following work is being done:

- Mutation / Jomakharij (sub-division) / consolidation
- Miss-case (currently only review clerical correction which is under section 150) regarding activities are being performed
- Various SMS notification sent to users
- Automatic digital archiving of documents
- Immediate signatures of AC land where approved
- Immediate copies of documents
- The Land Development Tax notice and mutation information are directly passed online to the Assistant Commissioner (Land) by the Sub-Registrar. According to the AC Land Savar, the government can save 5-10 thousand BDT per month on documentation.

- Finding out the latest update of the applications from any mobile phone and websites via SMS
- Preparing different registers (register I, II, IX (Part III), XIII, etc.
- Monitoring of land offices by the higher authority

Application for Mutation: This process is done at the front desk of the Land office by computer operators, who are support staff at the office. The application process is given below-

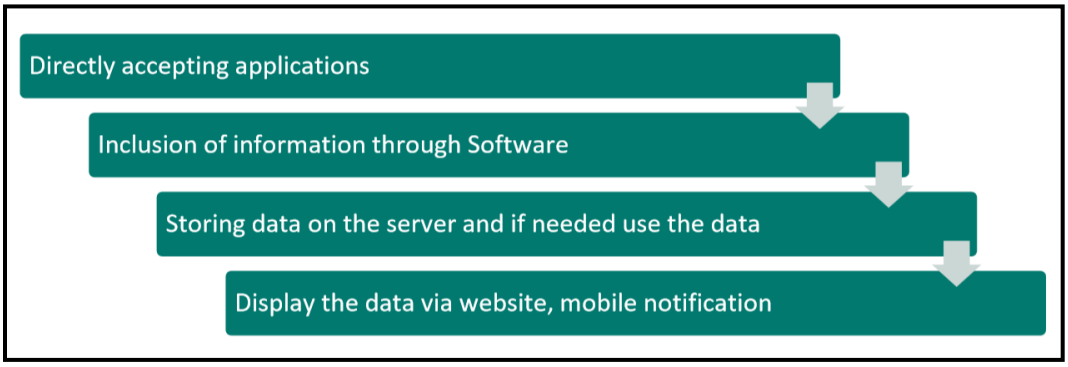


Fig 2: Application of Mutation at Savar

Source: Rahman and Talukder, 2016

After the submission of the application, applicants are notified about all the process associated dates via SMS, if needed, applicants can also check the progress via SMS. Even though, any applicant can submit applications themselves, in truth, everyone has to submit through middlemen or agents (Rahman and Talukder, 2016).

Mutation Automation: The system has a different interface for different officials. AC (Land) and each assistant have been assigned to do their particular work in their respective interfaces. After receiving the mutation application, the next activities are –

- The initial authorization of the application by AC (Land)
- Concerned ULAO submits an investigation report on the land
- If the repost is positive from ULAO, then the date of hearing is announced
- Kanungo / Surveyor or Sub-assistant officer to the report
- If each steps is verified, one can submit an recommendation for mutation to the AC Land
- After collection of fees via DCR, applicants will be supplied the ledger. These DCRs copies are being stored by the system as well.

If the concerned ledger of application is entered in the database from before, then it can be selected; otherwise at the time of the new application, it should be added. Because of a shortage of employees, old land records are not computerized. Only the current mutations and its relevant ledgers are being computerized and digitized. In the case of more than one owner, several concerned daags, comments, any kind of land-classification –

everything can be updated in this system. According to the AC Land, the mutation process is done within 28 days, whether they approve or deny the application. For this process, the user has to be present for 4 days (Rahman and Talukder, 2016).

Activities of Upazila Land Office: To provide information regarding land management, a digital land record system was launched at Savar Upazila Land Office. Dhaka district administration office assisted to introduce the automated system, a pilot project under the Access to Information (a2i) Programme of Prime Minister's Office. The system, first ever in Bangladesh, will help people to get land-related information online without hassles (the daily star, 2015). In practice the digital land record system is still not in work. The service of the Upazila Digital Centre and the access to Information (a2i) is below-

- One can apply online for the land Mutation
- One can apply for Settlement record through online.

The web address for the online application is land.gov.bd and land.gov.bd/application. On the other hand for the web address ther is two services provided by online as the application for

- Land Mutation and
- R S Khatian

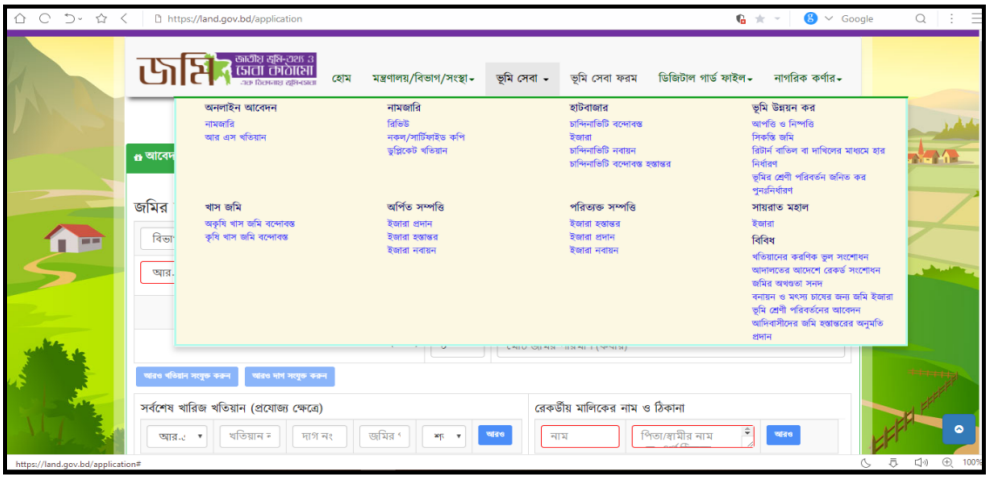


Fig 3: Online Application server for Savar Upazila

Source: <land.gov.bd/application>, 2018

There is no other services for the land owner or related people online or in work. On the other hand there is the services (show the Mauza Map or Khatian Book, providing any copy in white paper or the photocopy of record or correct the ownership paper or photocopy of mutation paper) that are not provided form the Upazila land office. But the digitization process of the land is ongoing. The process includes the Satellite image turned in to the GIS image through Arc GIS and then the attribute will be added as the owner name and other information. Now the Digitization of the Satellite image is finished now the attribute of the land parcel are being added.

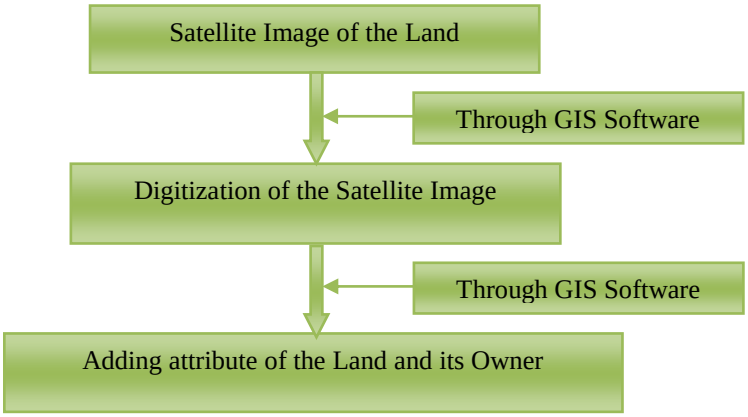


Fig 4: Land Digitization Process

Source: Field Survey and Self Illustration 2018

Challenges and immerging issues of LIS in Savar Upazila

Land Information System (LIS) is the most feasible systematic approach for developing an efficient land administration and management system in Bangladesh (Nahrin& Rahman, 2009). There are some challenges and emerging isseues regarding LIS in this upazila which may affect overall land administration and management system.

The people related to the land and its ownership are one of the stakeholders for the digital land mapping and the Digital land information system. The main concern is the land information system is not properly digitized yet. On the other the media and the local authority do not have the proper knowledge about the Digital land Information and the Digital land mapping. The survey was made to know that the digital land mapping and the digital land information system. The knowledge of a2i of the people around 38% to 83% according to the area of the upazila. The people of the paurashava area around 85% people are aware about the a2i but the are not using them directly. Most of them usually go to the shop and use the a2i if needed by paying a small amount. Near the Upazila land office there are people who take it as an extra income.

However, the general people of the upazila are the direct stakeholder of the digital land information system, but the rate of the knowledge of the digital land information system are very low in the upazila. most of the people are not well known about the system. But they are aware that it’s a step of Bangladesh government as the digitalization of the system. The ration of the people knows about the digital land information system is 18% to 55% which varies in the paurashava area and outside of the paurashava.

The people of the area are not friendly with internet as to use for the necessary activities of the digital land information system. the young generation are used to the internet for the social networking mostly but the people related to the land and its ownership activity as well as exchange land through buying and selling are not well known about the internet or the system. the rate of the surveyed people about the internet access to internet is around 51% outside the paurashava area and 86 % in the paurashava area.

Table: Summary table of Survey regarding Savar Upazila

Ward/Union No.	Knowledge about the a2i	Knowledge about the Digital Land Information System	Access to Internet	Using the a2i Service	Satisfaction of the Upazila Land Office (a2i)
Amin Bazar	61%	23%	65%	11%	85%
Ashulia	53%	36%	51%	8%	69%
Yearpur	43%	41%	55%	5%	75%
Kaundia	38%	35%	49%	16%	78%
Tetuljhora	64%	39%	68%	17%	68%
Dhamsana	62%	18%	73%	23%	51%
Pathalia	55%	32%	80%	19%	82%
Banagram	49%	28%	55%	17%	73%
Biralia	61%	23%	38%	29%	75%
Bhakurta	43%	21%	54%	26%	45%
Shimulia	51%	19%	61%	31%	52%
Savar (Paurashava Area)	83%	55%	86%	59%	70%
Savar (outside Paurashava Area)	65%	33%	51%	35%	21%

Source: Field Survey 2018

The user of the a2i services is very poor outside the Paurashava area. But in the paurashava area the percentage is about 59%. Most of them are using these services before buying a land ort property. On the other hand in the outside paurashava they usually buy land or property by using their general knowledge regarding the land ownership or the existing paper. Though the land ownership is a very complex matter to be owned or sell local people are not interested to go throuh the process as much as possible. They usually do not update the tax issue or maintion the development changes of the land.

Most of the surveyed people are satisfied about the digitalization of the LIS because they learn that this will make the complex LIS in a very easy way. On the other hand, their concern about the digital LIS is also paying less illegally for the information they need. The government officials concern about digital LIS is that the people generally dot pay tax unless they need any mutation paper of selling the land. The officials as well as government are agreed that this system may improve the taxation system. they also agreed that the documents of the land aare esy to find out and need not to preserve as before.

Unlikely Bangladesh, Savar Upazila is also far away to serve thyself the internet and computer education. More over people ususlly pay tax and work regarding land during selling or buying property. General people always try to pay lass regarding tax and follows illegal way.

In the study area, while collecting survey data for the digitalization process ther are some problems regarding ownership. The land data was collected from the BS and BRS survey but bofore that CS and SA data was not considered so that the previous problems remain same.

Moreover most of the general people of the Savar upazila are not compatible with the digital land information system. The people of the city corporation are are more aware about the digital land information system. Most of them are using the existing digital land information system in a analogue way. On the other hand the officials are attending various tanning session for the knowledge of the digital land information system. But they are not directly related for the updating the system still now.

Recommendations

Several research findings were arrived at after carefully analysis of the data collected. Several recommendations have been made based on those findings. The LIS system is not completely digitize either, though there are some pitfall of this system. The possible solutions are as belows.

- The image conversion from the paper based map to the digital map is a quite hectic process. Automation in this function can be done by image processing tools. Some work can be done in the database side also for keeping track of the owner information more wisely. For example, in spite of containing the information of the current owner only, the database can keep track of the history of ownership for a particular land. With the ownership history land area can also be tracked that has changed over time, e.g. if a land divides into two owners then the system should keep track of the division. In our system there is only textual information about the land type such as whether it's a plain land or a hilly land. Contours of each land can be stored; in fact if the land view can be converted in to 3D view using DOM technologies then the system will be more realistic towards the general users. (Choudhury, E., et al, 2011). Though the study area mostly plain but some edditiona data shaoul be added as the low land while it is water body ar not or a n uncultivated area.
- Large-scale geographic and land information systems (GIS and LIS) are developing rapidly in local and state governments and other organizations across the country. These systems handle critical information related to land parcels, transportation, utilities, and other infrastructure and facilities. They are changing the way organizations operate and make decisions, and therefore, they affect the daily activities and lives of the citizens and customers of these organizations. According to Ibraheem (2012), the attributes of different types of geospatial data such as land ownership, roads and bridges, buildings, lakes and rivers, counties, or congressional districts can each constitute a layer or theme in GIS. In this regard the data of the upazila should be clarify form the previous record of CS and SA.
- GIS has already become a standard tool for handling spatial data. Adding multimedia material and organizing friendly entries and alternative search techniques, the system

then becomes an efficient tool for different users. This system may be improved, by adding the following steps: (Ibraheem,2012).

- Promote and ensure the reliability and integrity of large-scale land information systems and Facilitate collaboration between GIS and surveying professionals at the local levels like field area of Savar Upazila.
- Promote the use of sound surveying and mapping principles in the development and the use of land information systems. The general people and the owner of the upazila should be included.
- Foster the development and adoption of useful standards, specifications, and procedures for the development, operations, and the use of land information systems by informing the people of the Upazila its consequences and effects. This informing can be done through field training.
- The LIS's structure conducts the user's navigation through alternative searching paths, created by the application.

- The importance of sound information management principles cannot be underscored. Computerization of data and the processing of that data to form relevant information for use in land rent record management can solve the difficulties currently faced in the retrieval of land information. The computerized database should be available for use by the different departments within the Ministry of Lands and Settlement and other organizations by the use of Intranet and Internet respectively. Each user of the land information would therefore have easy access to this information each time it is needed and many users can access the information simultaneously (Monica, 2001). In this regard the related officials of the Upazila can be incorporated while trainning or other activities.
- There is however a danger of making information readily available. The danger is that it would be susceptible to use by unauthorized persons. This danger can however be curbed by the use of data protection mechanisms like user names and passwords.
- The problem of outdated land rent records can be solved by the use of computer aided valuation techniques and land rent review using Excel spreadsheets. Land value modeling can be done with the development of a land value map to guide values on property values for specific areas. The use of mass appraisal techniques can also be used as it enables the valuation of larger geographic areas within relatively shorter time periods.
- Strict Enforcement of Legislation Implementing strict Laws on non-payment can solve the problem of leaseholders not paying their rents on time. Frequent reminders should also be made in the media to create awareness of the need for annual land rent payment. Implementation of the law- stipulating auction of properties should also be done to serve as an example to leaseholders that do not pay their rents. The Government should embark on rent arrears collection campaign and issue out deadlines for such payment and stiff penalties for failure to pay within the stipulated time.
- Improved Communication Network may reduce the problem of rent demand notes communication to the leaseholder can be solved by electronic communication. Each

leaseholder should give the names of their employers or e-mail addresses or banks, where the information on land rent demand can be sent electronically.

- Staff Training in the use of Computerized LIS Change is not easy. Many people have eyed computers with a lot of suspicion. The personnel employed in the land rent section must be educated in the use of computers so that they will be able to perform their functions efficiently. A computerised LIS cannot bring about change unless there is competent personnel to use it. Computers will cut down the need for many clerical staff, especially those employed to manually retrieve land rent records. With the advent of computerisation, these employees will be rendered should therefore be re-deployed or trained in other fields like maintenance of the computers or inputting of data into the databases.
- Decentralisation of Land Rent Payment Currently, the payment of land rent is limited to land offices or their respective revenue offices. The use of alternative payment points should be established to reduce over crowding at the land offices, especially as the deadline approaches. These alternative payment points could include commercial banks, grocery stores, parastatal offices and other convenient places.
- Policy Implications for the effective collection of land rent, policies must be formulated that ensure stringent penalties for non-payment. The present penalty of interest rates payment per period for non-payment has failed to prompt leaseholders to pay their rents on time. The legislation on land rent payment recommends that only 1% of Unimproved Site Value should be reserved as rent. This figure is quite low and requires to be revised. The current rate used by the valuation section of the Ministry of Lands for land rent determination is actually 5% unlikely Savar Upazila.

Digital LIS is to reduce the hassle and unconvinced of the officials by implementing proper way. The third party should the removed with proper training of the stakeholders and by influencing them with the proper knowledge of the positive consequences of the digital LIS in the study area. The use of sound surveying and mapping principles in the development and the use of land information systems. This system may be improved, by promoting and ensure the reliability and integrity of large-scale land information systems and Facilitate collaboration between GIS and surveying professionals at the local, regional, and national levels (Ahmed, 2012). The digitization should be the two way path as collecting information from the stakeholders through survey and application and using the policies for the betterment of the system as soon as possible.

Conclusion

Land administration and management system in the country is very complex and time consuming. LIS could bring an appropriate land administration and management in Bangladesh. However, the initiatives of LIS through the digital land survey all over the Bangladesh would face a great challenge regarding the legal and institutional matters of the country as well as for technical constraints. LIS responsive land reform, institutional arrangement, extensive privatization, sufficient training, and the overall political will would be needed for introducing the new system. Despite the huge installation and recurring cost of new technologies, once the land record is completely computerized, various space-specific parameters could be hooked-up to the land record. The same

record could be utilized for various purposes such as taxation, subdivision planning and other tasks in urban, rural and regional level. For this purpose, demand responsive step-by-step approach within a timeframe would bring the effective results for land administration and management through LIS. The First step of the LIS in Bangladesh is already started over. So with the help of proper evaluation of the LIS through the Digital Land Mapping will play a great revolution for the LIS in Bangladesh.

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Altitudinal distribution and spatial pattern of species richness of the high mountain flora: A case study on Ladakh (Himalaya)

Raunaq Jahan*

Abstract: Species diversity is a well-documented resource in biodiversity, but its spatial pattern for remote areas like Ladakh is lacking. We estimated species profiles for all growth forms applying published data on the floristic and elevational distribution of vascular plants in Ladakh and converted them to the spatial distribution of species richness. The spatial distribution of species richness has been quantified according to 100 m a.s.l. and visualised by the SAGA software. We found the highest species diversity and the peak of all growth forms at around 3000 m a.s.l. The heights of species richness curves shift upward along the elevational gradient in the order of epiphytes/lianas – trees – graminoids – shrubs – herbs. The humped patterns of species richness found in Ladakh are consistent with findings from previous Himalayan mountain studies. Further research and fine-scale local data can facilitate the evolutionary issues and conservation purposes of flora in Ladakh.

Introduction

A primary current focus in species richness is how to ensure the sustainability of biodiversity. It is generally accepted that high mountains are the most suitable habitat for species richness. Ladakh is a land of unearthly beauty in the Transhimalaya of Northwest India, containing around 1250 species of vascular plants, including cultivated ones (Dvorský et al., 2018). The plants and wildlife of this high altitude cold desert are adapted to the harsh circumstances, with a small population, and get very little precipitation (< 100 $mm.yr^{-1}$) (Kala & Mathur, 2002; Singh and Gupta, 1990). Over half of the plants in the region have been identified as having therapeutic use (Kala and Mathur, 2002; Kumar et al., 2011; Singh and Chaurasia, 2000), which is very important for the economic growth of the inhabitants of Ladakh in the emerging world market.

There is extensive literature on the identification and exploration of species in Ladakh (Blatter, 1984; Dickoré and Nüsser, 2000; Khuroo et al., 2011, 2010; Klimeš and Dickoré, 2005; Sharma and Jamwal, 1988; Shukla and Srivastava, 2020; Singh and Kachroo, 1987; FRLHT, 2010) and since the early nineteenth century, the association between vegetation and altitude has been established (Bunzhuo et al., 1997; Kala and Mathur, 2002; Mani, 1978). However, although the species distribution individually was demonstrated by Dvorský et al. (2018), the regional distribution of total species richness in Ladakh has received little consideration.

There is a growing demand for biodiversity conservation in high mountains in the national and international context. The present paper presents the altitudinal and spatial distribution of species richness, including information about dominant families and genera of flora in Ladakh. This research will help to develop a strategy for the conservation of biodiversity in this area.

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Methods

Study area

Ladakh has been a part of the Jammu and Kashmir state since 1947 and has been explored by scientists from several disciplines, including botany, ecology, geography, etc. Ladakh covers about 87,000 km^2 or, including disputed territories, 117,000 km^2, of high mountain terrain bordering Pakistan lies to the western part, and China is to the northern and eastern part (Fig. 1). This region ranges from approximately 2550 m in the Indus Valley along the Pakistani border to 7672 m on the Saser Kangri Peak in the Eastern Karakorum (Dvorský et al., 2018).

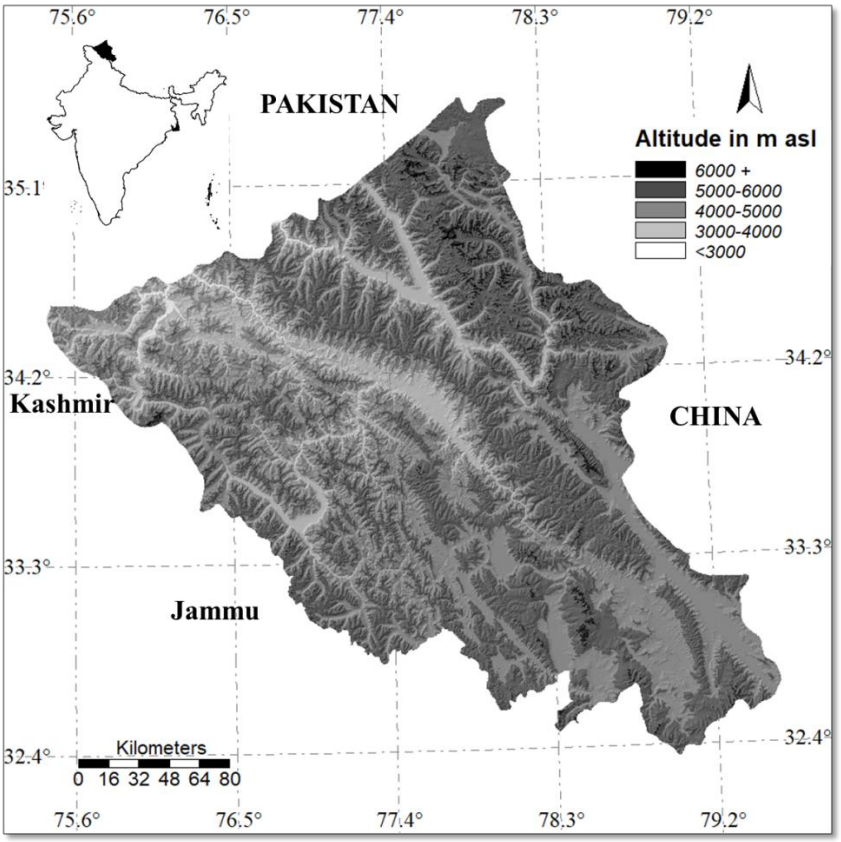


Figure 1: Physical map of Ladakh.

Methods

The current investigation involved gathering and analyzing data on the flora of Ladakh. The information on flora was collected from numerous published sources on Ladakh and Jammu & Kashmir (Blatter, 1984; Dickoré and Nüsser, 2000; Khuroo et al., 2011, 2010; Klimeš and Dickoré, 2005; Sharma and Jamwal, 1988; Shukla and Srivastava, 2020; Singh and Kachroo, 1987; FRLHT, 2010). A total of 1379 species was recorded with elevation information and then analyzed for the elevational distribution. The abundance of species for dominant families and genera were calculated, and the total number of species for 100 m interval was quantified. The species data subsequently converted as the

richness of species or spatial distribution of species by the tool 'Change grid value' in SAGA 7.9.0 (System for Automated Geoscientific Analyses) GIS software (Conrad et al., 2015).

Results

It was apparent beforehand that species richness pattern would be a desirable outcome of elevational zonation of vegetation. The vegetation of Ladakh displays striking vertical zoning, which is diversified by aspect, exposer, and substrate (Dvorský et al., 2018). As can be seen in figure 2 (upper), the elevational zones of different vegetation belts are subsequently distributed. The submontane belt (up to 2900 m a.s.l.) is the lowest altitudinal vegetation zone, comprising only a small part (less than 1%) of the arid gorge section in the lower Indus valley (Dvorský et al., 2018). The montane belt extends between about 2900 and 3700 m a.s.l. and hosts a semi-desert vegetation (7% of total area), characterized by scattered coarse subshrubs, sturdy herbs, including several halophytes (Dvorský et al., 2018). This belt supports the most considerable oasis cultivation because of high summer temperatures and large tracts of relatively level ground. The subalpine vegetation belt stretches from around 3700 m up to 4200 m in the west and more than 4400 m in the east of Ladakh (Dvorský et al., 2018). The alpine belt is composed of herbs and dwarf shrubs and altitudinally extends from 4,200 to 4,900 m a.s.l. (occasionally 5,500 m a.s.l. on the Tibetan border) (Dvorský et al., 2018). The subnival vegetation belt is located above 5200 m a.s.l. to 5600 m a.s.l. and a very sparse vegetation can be seen there (Dvorský et al., 2018).

Figure 2 (lower) shows the elevational zones of vegetation in which half of the total area is the alpine belt and the subnival vegetation belt covers 33% of the entire region. That represents the dominance of the higher portion (more than 80%) of the study area falls in the high altitude of the cold desert.

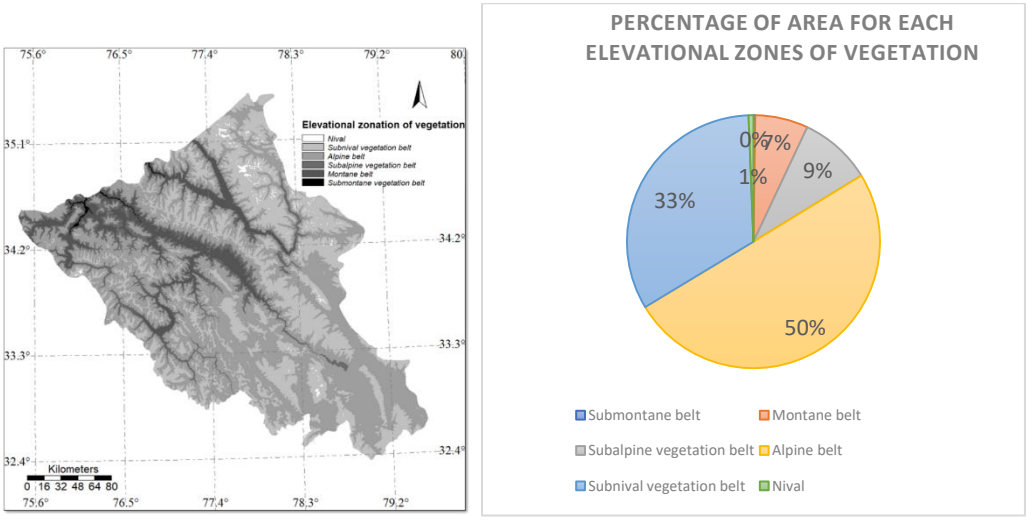


Figure 2: Elevational zonation of vegetation in Ladakh (upper figure) and the percentage of land covered by each vegetation zone at different elevations (lower figure) (according to Dvorský et al., 2018)

The current analysis found a total of 1379 species spread throughout 461 genera in 95 families. The leading families are Poaceae (with 194 species), followed by Asteraceae (162), Fabaceae (91), Cruciferae (88), Cyperaceae (58), Scrophulariaceae (51), Ranunculaceae (48), etc. and the dominant genera are Astragalus (39), followed by Carex (32), Corydalis (26), Nepeta (24), Artemisia (24), Polygonum (21), Potentilla (19), Stipa (17), etc. (Fig. 3 and 4). These analyses of family and genera show a considerably higher number of species than the recent study by Shukla and Srivastava (2020).

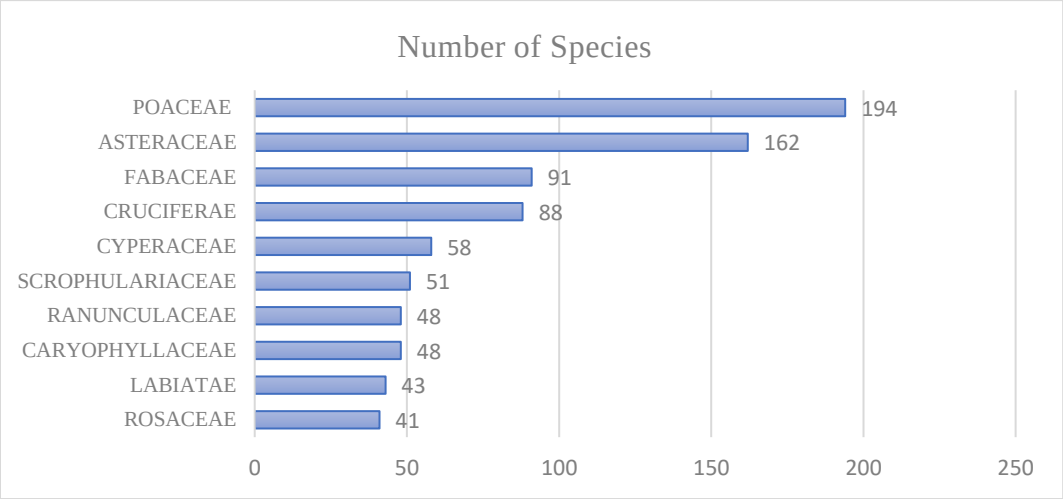


Figure 3: The ten most species-rich families of the Ladakh flora (vascular plant species).

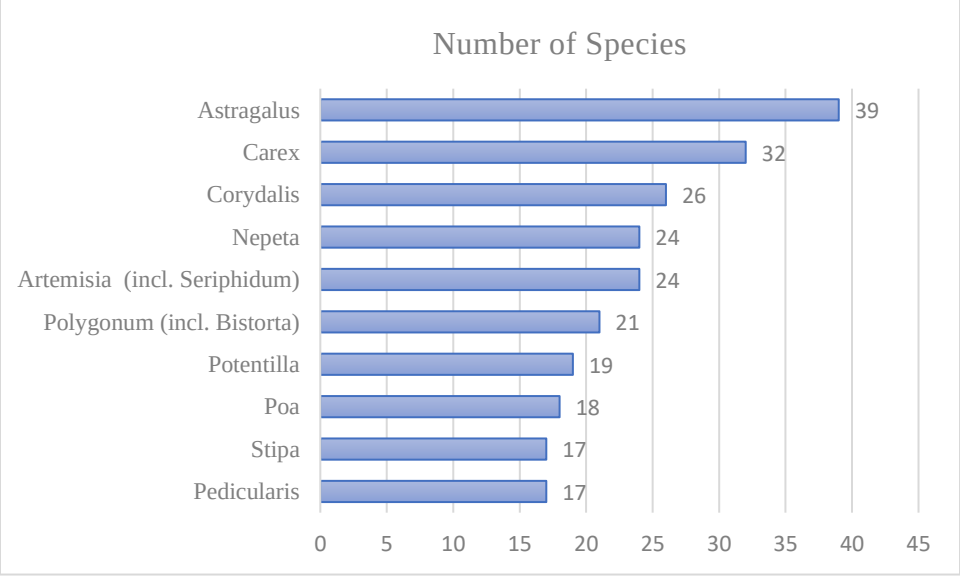


Figure 4: The ten most species-rich genera of the Ladakh flora (vascular plant species).

There were 1140 species with information about altitude in Ladakh and used to generate the species richness distribution pattern along gradients. Between 3000 and 3500 m a.s.l., most plant species (667) were discovered, with the number of species decreasing as elevation ascended. Figure 5 depicts the elevational distribution of plant species in Ladakh graphically. This distribution pattern has been converted to a spatial extent (Fig 6), and the highest species richness (more than 600 species) was observed in the montane and submontane vegetation zone. Alpine vegetation belt has moderate species richness (around 300 to 400 species), and the higher altitude region has very poor species richness.

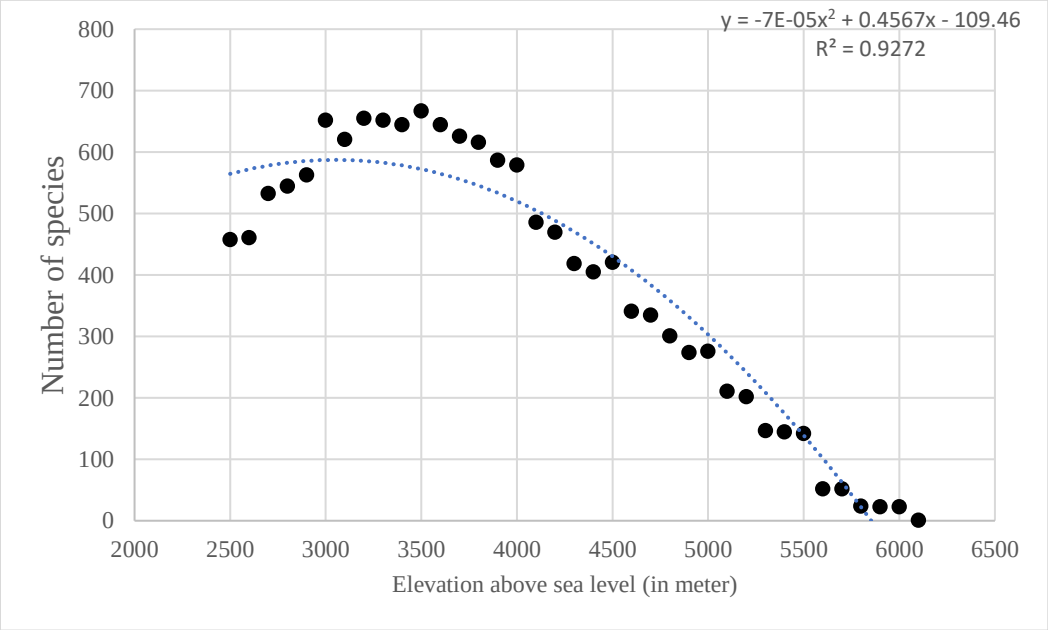


Figure 5: Species richness according to different altitudes in Ladakh.

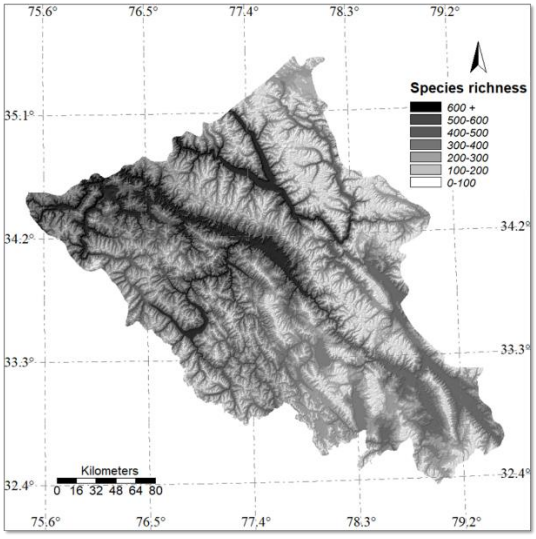


Figure 6: Spatial distribution of species richness in Ladakh.

As shown in figure 7, the richness distribution of each growth form of the species also differs, and the herbaceous species show the highest richness along the whole study area (Fig 7, right). The peak of this unimodal distribution consists of around 550 species and is distributed from 3,000 to 4,000 m a.s.l. which is notably higher than other growth forms of that region. To compare, the second dominating growth form of plant in Ladakh is a shrub, and the highest number of shrubs is also found in the elevation range between 2,800 to 3,500 m a.s.l. followed by graminoids and tree species (Fig. 7, left). Only two epiphytes and lianas can be seen in these montane areas.

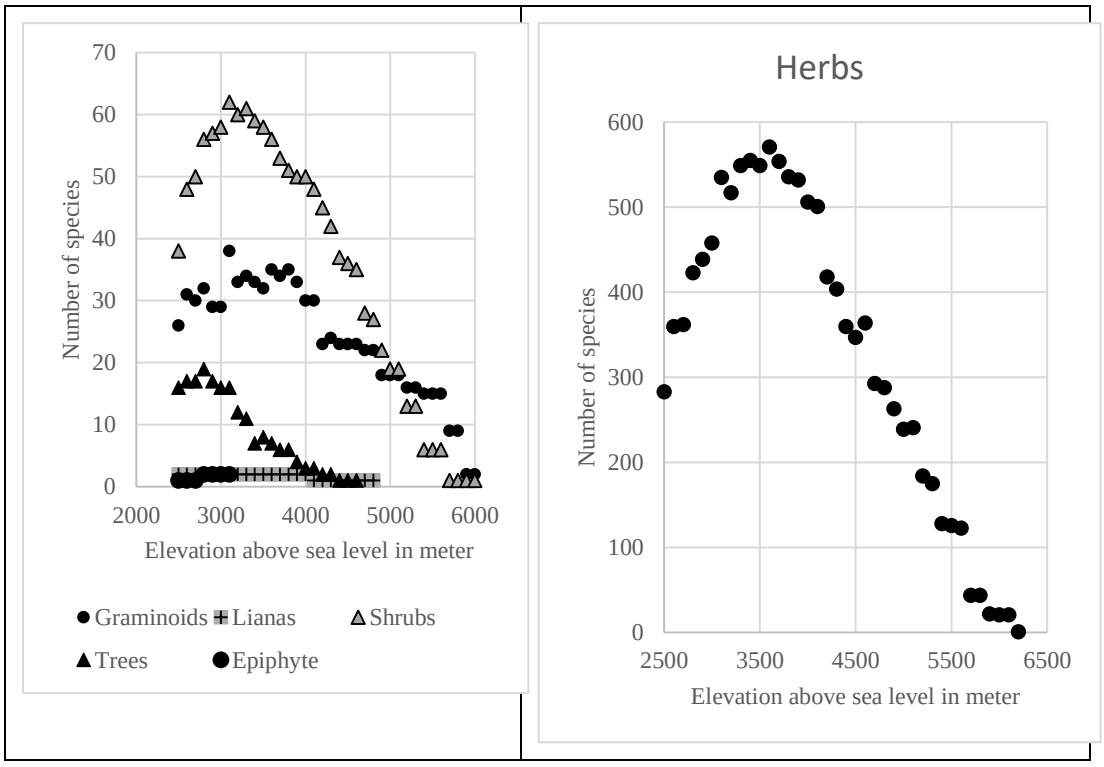


Figure 7: Elevational species richness of different life forms in Ladakh.

Discussion

Prior work has documented the occurrences of species in different parts of the Himalaya, and the spatial distribution, including elevation records, has been documented precisely (Dvorský et al., 2018). However, these studies have either explored floral records or have not focused on the spatial distribution of those flora and species richness. In this study, we analyzed species data for 100 m elevation and plotted the distribution of species richness over space in Ladakh. We found that the elevational distribution of vegetation revealed a humped shape and a unimodal pattern in virtually all cases.

The results suggest that we have unique peaks in species richness, distributed along the gradient of elevation from the montane belt to subalpine vegetation. These findings extended to draw spatial information for the species-rich areas in the study area. In addition, the added spatial information of the species richness in our study was related to

elevational zonation of vegetation or vertical differences of species distribution. Therefore, this study indicates that the updated vegetation distribution can be used for analyzing further spatial factors or variables that have relative importance for species richness. There is a decline in richness at high elevations due to less precipitation in the mountainous area (Bhattarai et al., 2004; McCain, 2007; McCain and Grytnes, 2010; Vetaas et al., 2019). In temperate to cold climates, thermal energy could be a critical variable (Hawkins et al., 2003; Vetaas et al., 2019; Whittaker et al., 2006).

Conclusion

Plant growth forms influence elevational richness gradients in our study area. Like other studies (Manish et al., 2017; Kluge et al., 2017), varied growth forms have different elevational richness patterns, but the dominant growth form with the highest number determines the overall shape. Montane belt has the highest species richness, consisting of only 7% area of the entire region. For the conservation approach, analyzing the richness patterns of each growth form is essential, especially for medicinal plants. It is crucial to have assessments for small plots and conservation of remote areas like Ladakh for nature conservation and study of mountain biogeography. Spatial distribution of species richness is also applicable to a correlation between geodiversity and species richness, while mountains represent varied diversity of all variables. This research will also bring light to the botanical studies of Bangladesh's conservation areas and hill tracts to manage biodiversity.

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Spatial Variations in Meander Geometry of the Banar river

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Mohd. Shamsul Alam[**]
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Abstract: This study illustrates the spatial variations of meander geometry and changing trends of channel pattern of the Banar river. A time series satellite images of 1976 and 2016 have been used for thestudy. Remote Sensing and Geographical Information System (GIS) technique were used to measure and analyze the river geometry, and descriptive statistics used to represent the data in tabular form and graphs. The study reveals that the sinuosity ratio, river width, river meander wave length, and radius of meander curvature of the Banar river have variance in different reaches. In 1976 average width of river was 38.38 meter which was reduced to 35.79 meter in 2016. Average meander wave length and radius of meander curvature has increased 23.71 meter and 24.87 respectfully within the study period. Besides, the sinuosity ratio in 1976 and 2016 are 1.45 and 1.59 respectively. The study concludes that the study sections of the river Banar are reflecting a declining energy gradient. For further understanding of the relationships, it is essential to relate meander parameters with hydrologic and hydraulic parameters at the entire length of the Banar River.

Keywords: River width, Meander, Geometry, Sinuosity Ratio, Satellite Images, Banar River

Introduction

Meander geometry is simply a plan form of a watercourse/channel. It reflects the shape and size of the channel (Pierre, 2002). River channel morphology includes the consideration of channel geometry or channel cross-sectional characteristics e.g., channel length, channel width, channel depth, wetted perimeter, channel slope, channel bend etc. (Singh, 1998; Alam et al., 1998). An understanding of the channel geometry would enable us to relate it with the state of the valley in terms of energy gradient, cross and long profile characteristics and thus it can be related with different basin ecosystems developed along the channel. Besides, it would also help to generate ground data on meander reach specific bank line shifting tendency, stretches relatively vulnerable to erosion and valley sections to be restored thus help in basin management (Stewardson et al., 2021).

Interest on meandering river research had been shown initially by Davis 1899. From then on different techniques and approaches were followed by many researchers on this issue. Some of the pioneers were Leighly (1936), Leopold and Wolman (1960), Schumm (1967), Hickin (1974), Hooke (1984), and Hasfurther (1985) among them. In Bangladesh context, research on meandering river started back in 1959 (Chowdhury). Then interest on this issue continued with focus on understanding the hydraulic characteristics and sedimentation processes of the river channel in order to build infrastructures like embankment, bridge and river training(Thorn. et al. 1993 and Uddin et al.2010). Some of

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the later works have focused, on meandering river and their plan form geometry in Bangladesh (Islam et al. 2018, Biswas et al. 2018 and Mondal 2018). Apparently, specific works on central part particularly, Pleistocene terrace area-based research on meandering river channel are scanty. To fill this information gap, the present initiative attempted to follow an approach of graphical analysis along with techniques known as superposition or comparison of courses which reveals the results of spatial changes of pattern of the channel as proposed by Hooke (1984).

The Banar is one of the main rivers of the Madhupur Pleistocene Terrace. The Terrace itself has been subjected to tectonic upliftment and tilted towards northwest to southeastward (Morgan and McIntire 1959).Following the same slope direction, the Banar passes through Mymensingh district (Banglapedia, 2020). Consequent to the land upliftment, the rivers of the terraces have a general tendency to be entrenched. River bed and bank line of the Banar river have changed due to erosion, deposition and the volume of water flow decreased during the recent years. The river bank erosion and channel shifting are causing hindrance to the people's resources and livelihood. From this perspective, it was attempted to find out the spatial variations of meander geometry and changing trends of channel patterns of the Banar river.

Aim and Objectives

The main aim of this study was to find out the characteristics of meander geometry and their changing patterns over a period of forty years. In order to achieve the study aim, the objectives were as follows:

a) To measure the meander geometry of the Banar river; and

b) To analyze the channel shifting pattern of the study area between 1976 and 2016.

Methodology

This study focused on the spatial variation of meander geometry of the Banar River and its shifting pattern based on the satellite images. To meet the study objectives both primary and secondary data have beenused. Landsat TM satellite image for 1976 was collected from the USGS website and Google Earth image for 2016 have been used to analyze the characteristics and spatial variations of meander geometry of the lower Banar Riverfrom 1976 to 2016. The study years were chosen on the basis of availability of imagery as well as for better understanding of the characteristics of meander geometry and spatial shifting pattern. In this research work, to create precise and comparable maps of river channel features Geographic Information systems (GIS) and Remote Sensing (RS) were used for image processing and interpretation. In data encoding and analyzing purposes, ArcGIS 10.2 and ERDAS Imagine 10.2 version software and human interpretation have been used.Then, data were tabulated, analyzed and presented by MS excel, and MS word.The following formula given by Schumm (1963) is applied in this study to compute the sinuosity ratio (SR):

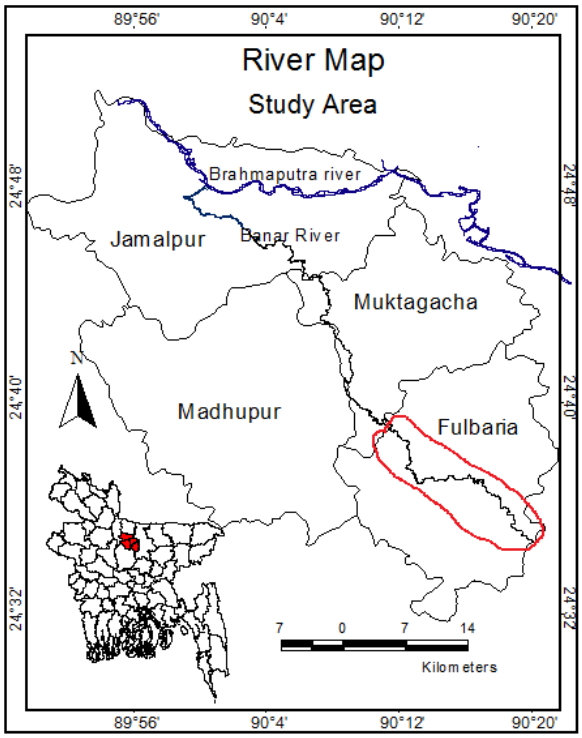
$$SR = \frac{Sl}{CI}$$

Where, SR is the sinuosity ratio, Sl is the stream length (m) and Cl is the channel length (m)

Initially, the river has been divided into three major sections according to its alignment, then it was divided into16 reaches according to the major bends for analyzing the sinuosity ratio and other meander characteristics. This study has some limitations which are the Banar river is a small river, average width of this river is about 40 meters. To analyze of this type of small river needs high resolution images which are not available. There are very few hydrological gauge stations available for the Banar River. Moreover, hydrological and hydraulic data are scanty and insufficient. Hence, this study merely focused on the meander characteristics of the Banar River.

Study area

The lower part of the Banar river of Fulbaria upazila in Mymensingh district is selected as the study area. The absolute location of the study area is 23°56´26.04´´ N to 23°55´45.85´´ N latitude and 90° 9´55.64´´E to 90° 9´0.81´´ E longitude (Map 1). This river enters into Fulbarianear Shibganga Bazar and flow north to south toward kasergang bazar than it turns into west to east, then the river again turns into southeastern direction and move in Trishalupazila. Flowing south, the river bifurcates into two, the eastern arm flows into the Old Brahmaputra and the southeastern arm falls into the Shitalakshya. The eastern arm which meets the Old Brahmaputra flows further ahead and ultimately joins with the Shitalakshya. Finally, the Banar becomes a tributary of Shitalakshya (Banglapedia, 2020).It is one of the key river of Fulbariaupazila. The total length of this river in the part flowing over Fulbaria upazila is about 12 km.



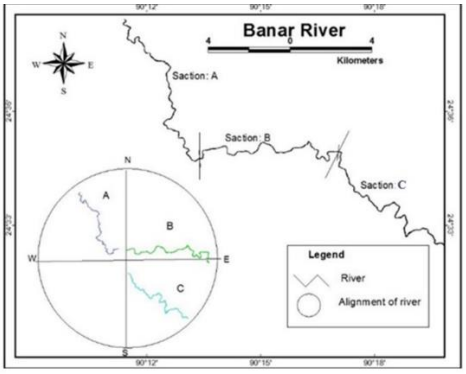
Map 1: Study Area- the Banar River
Source: USGS; analyses by authors, 2020

Results and Discussion

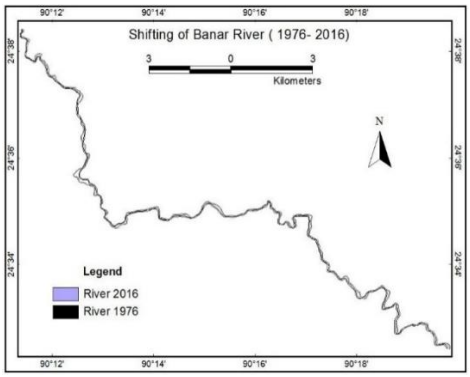
This study explainsthe spatial variations of meander features like meander wave length, river width, sinuosity ratio, radius of curvature, meander amplitude and other characteristics of meander and changing trends of channel pattern of the lower Banar River.

Alignment of the Banar River

The Banar River mainly flows into the south-east direction. The part of this river that flows on Fulbaria Upazila has been divided into three sections according to its alignment. The first section named Section-A is flowing from the north to south direction. The second section of the study river named Section-B flows from west to east direction. The last section named Section-C flows into the south-east direction (Map 2).



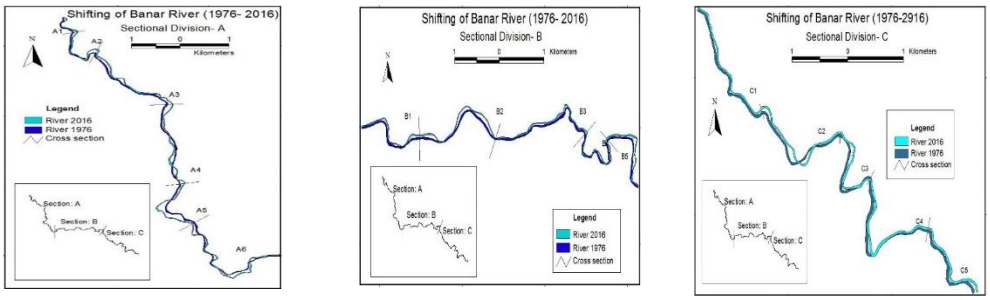
Map 2: Alignment of the Banar river study sections.
Source: USGS; analyses by authors, 2020



Map 3: Channel shifting trends of the Banar river.
Source: USGS; analyses by authors, 2020

Shifting pattern of Different Reaches

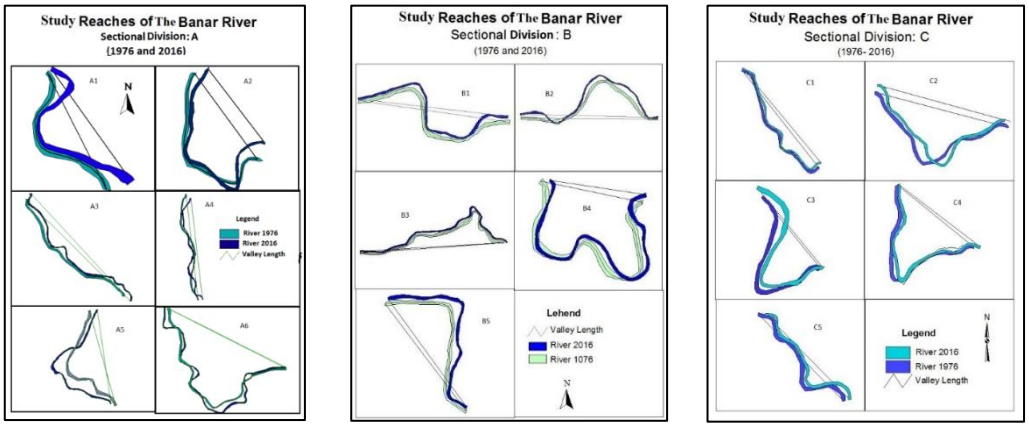
Overlapping2016 on 1976 study reaches of the river channels, it was apparent that channel has shifted over the years (Map 3). In the Map 4 and Map 5channel shifting patterns have been clearly reflected according to the study river length and occurred mostly along the river bend instead of straight part.



Map 4. Cross sectional shifting trends of the Banar river across the sectional divisions A, B and C (1976-2016).
Source: USGS; analyses by authors, 2020

Reaches of the Banar river

The sectional divisions of the Banar river A, B, and C have been further divided into six, five and five reaches respectively based on major bend of the river to analyze the sinuosity ratio. The Map 5showsthe shifting of reaches, their valley length and the sinuosity of sectional division of the Banar river from 1976 to 2016.



Map 5: Reaches of the Banar river sectional divisions.

Source: USGS; analyses by authors, 2020

River Width of the Reaches

Meandering rivers are characterized by a relatively uniform river width, which can be considered constant in the long-term (Brammer,1996). The width of the Banar river has decreased during the last forty years (Table 1). The Figure 1 shows the widths and its changing pattern of the Banar river sectional division. In 1976 average width of the river was 38.38 meter and it was reduced 35.79 meter in 2016 reflecting a declining energy gradient. In reaches A3, A4 A5, B5 and C3 the rate of reduction of river width is higher than other reaches. It is sharply clear that width of Banar river is reflecting a decreasing trend.

Table 1: Sinuosity Ratioof Different Reaches of the Banar River (1976-2016)

Reach	1976				2016			
	Width	Valley Length	Thalweg	Sinuosity	Width	Valley Length	Thalweg	Sinuosity
A1	25.34	467.1	558.4	1.26	23.04	443.7	676.8	1.45
A2	27.58	584.2	1152	1.71	24.71	675	1408	2.41
A3	37.16	2068	2053	1.08	31.51	1897	2429	1.17
A4	33.41	2040	2252	1.06	23.43	2124	2345	1.15
A5	35.87	1095	1511	1.33	27.05	1140	1793	1.64
A6	29.29	1794	2801	1.6	25.71	1748	3346	1.87
B1	26.43	1208	1538	1.26	24.34	1219	1619	1.34

Reach	1976				2016			
	Width	Valley Length	Thalweg	Sinuosity	Width	Valley Length	Thalweg	Sinuosity
B2	27.85	1658	2035	1.25	23.17	1624	2209	1.33
B3	32.16	1746	2105	1.24	35.14	1696	2223	1.27
B4	32.37	507.6	1472	2.72	26.43	540.3	1635	3.22
B5	37.41	967.4	1296	1.34	23.25	965	1405	1.45
C1	31.81	1723	1986	1.14	25.91	1746	2092	1.21
C2	33.24	1343	1839	1.36	27.38	1349	1933	1.44
C3	42.72	738.9	1328	1.88	34.81	705.5	1359	1.84
C4	42.67	1112	2045	1.92	39.75	1063	2187	1.97
C5	38.35	1198	1452	1.19	32.13	1217	1450	1.21

Source: USGS; analyses by authors, 2020

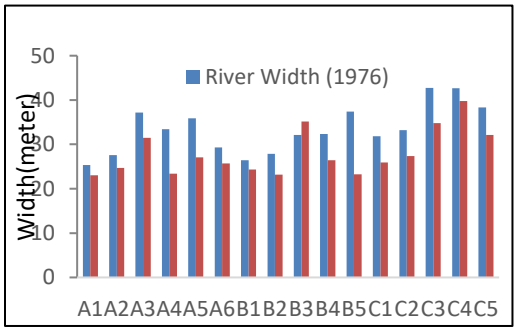


Figure 1: River width of different reaches of sectional divisions at the Banar river (1976-2016)

Source: USGS; analyses by authors, 2020

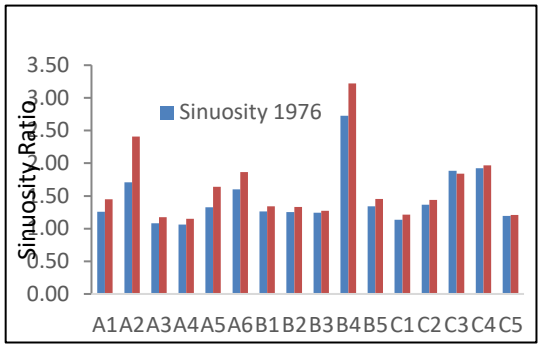


Figure 2: Sinuosity Ratio of different reaches of the Banar river (1976- 2016)

Source: USGS; analyses by authors, 2020

Sinuosity Ratio of the Reaches

Sinuosity ratio of a river depicts that the river is straight or sinuous (Leopold et al, 1963). The Figure 2 shows the sinuosity ratio of the reaches of the Banar river for the years 1976 and 2016.The sinuosity ratioof 2016 of all reaches of river has increased than 1976. In the reaches A2 and B4, the increasing rate appears higherand, in the reach, B3 and reach C5 the increasing rate appears lower than other reaches. The average sinuosity ratio of the river was1.42 in 1976 and 1.59 in 2016reflecting a declining energy gradient.

Meander Wave Length of the sectional Division

The distance of one meander along the down-valley axis is the meander length or wavelength(Hey, 1975). The following diagram 3 shows the meander wave length of 1976 and 2016 of three major Sections of the Banar river. The meander wave length of most of the reaches has increased in sectional division-A river band A6, A7, A8 and A9 it has decreased steadily within the study period. There are 11 meander bends in the

sectional division B. Though in this section the meander wave length was almost same over the 40 years but it has increased at all bend. In the sectional division C, there are 11 meander bends. The river band C6 the meander wave length decreased and in C11 the increasing rate appears high. But meander wave length of all other bend was about same from 1976 to 2026.

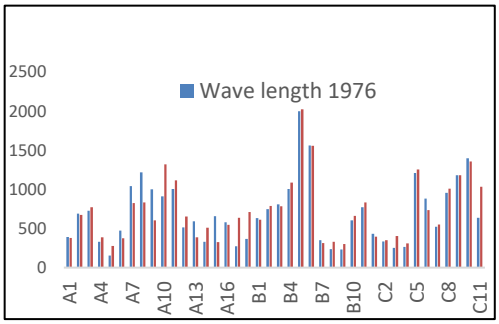


Figure 3: Meander Wave Length of the Banar river (1976- 2016).

Source: USGS; analyses by authors, 2020

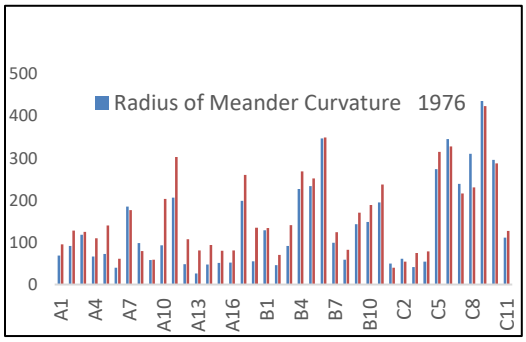


Figure 4: Radius of Meander Curvature of Banar River (1976 and 2016)

Source: USGS; analyses by authors, 2020

Radius of Meander Curvature of Sectional Divisions

Radius of curvature is measured from the outside of the bankfull channel to the intersection point of two lines that perpendicularly bisect the tangent lines of each curve departure point. Radius of curvature is expressed as a ratio to the bankfull channel width (Rc /Wbkf)(Leopold et al., 1957; Rosgen, 1994;Reza, 2016).Radius of meander curvature of the Banar river sectional division presented in the Figure 4 appeared to have increased in the sectional division during the last 40 years. Changing pattern of section, A and B is almost matching. In reaches A10 and A11 of sectional division A, rate of increase appeared higher and only one reach like A8 decreased. In sectional division C, changing pattern is a bit changed from section A and B. Radius of meander curvature of eight reaches of this section have decreased except three reaches where it has increased. It is clear that radius of meander curvature has been on increasing trend during last forty years.

Comparison between Meander Wave Length and Radius of Curvature

The Figure 5 shows the relation of the meander wave length and the radius of meander curvature from 1976 to 2016. There is a positive relation between meander wave length and the radius of meander curvature. With the increase of meander wave length, the radius of meander curvature also increased.

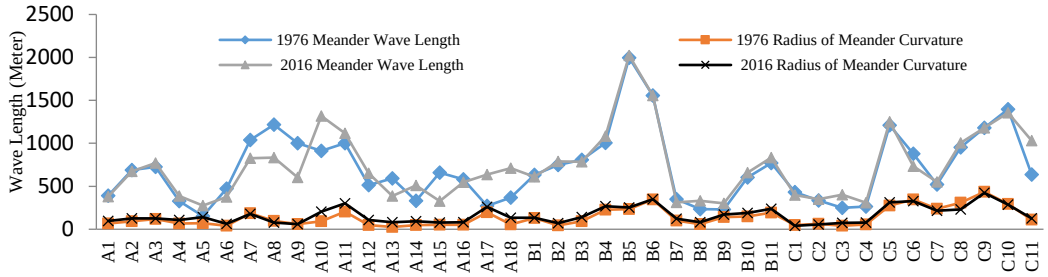


Figure 5: Comparison between meander wave length and radius of curvature of the Banar river sectional divisions (1976- 2016)

Source: USGS; analyses by authors, 2020

Conclusion

The study reveals that there has beena spatial variation in meander geometry of the Banar river. The sinuosity ratio, river width, river meander wave length and radius of meander curvature of the Banar river reflects variance in different reaches within the study period. Both average meander wave length, radius of meander curvature and sinuosity ratio has increased. The Banar River width reflecting a decreasing trend, indicating low energy availability and low water flow. The river channel shifted mainly along the meander bend. For further understanding of the relationships, it is essential to relate meander parameters with hydrologic and hydraulic parameters at the entire length of the Banar River. Given the locational orientation of the Banar river, it passes through northern edge of the Madhupur terrace maintaining several distributary channels which are dependent on this river for discharge. Unless the Banar river is restored, the drainage ecosystem will be impacted negatively. The study thus, recommends for initiating more scientific research on restoration of Banar river through systematic dredging of the river, particularly at the mouth of the Banar river at old Brahmaputra point.

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Effect of Variation of Vegetation Species (Rubber and Natural Forest) on Enhanced Vegetation Index (EVI)

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Md. Shahedur Rashid[****]

Abstract: The Enhanced Vegetation Index (EVI) is one of the most adequate and popular indices to monitor the vegetation cover. However various types of environmental and topographical factors can produce hindrance in the EVI values. Like all other factors the species variations and characteristics have also an effect on EVI values. To find out the effect of vegetation species on EVI values the Landsat OLI image acquired from a forest dominated area with species variations from the central part of Bangladesh named Madhupur forest. To calculate the EVI values the arithmetic combination of three bands (Blue, Red and NIR) are used in QGIS environment besides for mapping purposes and for extraction of EVI values from processed raster the ArcMap 10.6 software are also used here. The output of the study indicate that high dense rubber *(Ficus elastic)* forest gives the highest EVI value like 0.62 and for moderate and low dense rubber forest the values are in between 0.44 to 0.54 where the high dense natural *(Shorea robusta)* forest gives the lowest EVI value like 0.05 and for moderate and low dense natural forest the values are in between 0.23 to 0.26. Which clearly stated that, the species characteristics and its variation has a direct impact on EVI values.

Keywords: EVI, Landsat OLI, Spectral bands, Vegetation species, Vegetation characteristics.

Introduction

The vegetation classification, phonologic information and biophysical derivation of radiometric and structural vegetation parameters are important concepts to understand different species in particular forest. Owing to monitoring these issues, the Vegetation Index (VI) is considered the suitable way, that is defined as arithmetic combination of two or more bands which are directly related to the spectral characteristics of vegetation (Huete et al., 1999). For monitoring the variations in vegetation and vegetation cover, different vegetation Indices (VI) are now considered worldwide for definite results. The quantitative measure of any biomass or plant vegetation or forest or species are defined generally as the Vegetation indices. The combination of several spectral bands in Satellite imageries with particular values has is usually formed different Vegetation indices whose are segmented or multiplied by each other in order to attain the value which helps to identify the amount or vitality of vegetation (Halos & Abed, 2019). The Vegetation Index (VI) was developed to obtain the characteristics of vegetation and the land use with

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the combination of two or more particular wavelength bands – blue, green, red, and near infrared (NIR), which are vastly related to photosynthesis (Huete et al., 1999). Therefore, VIs are often applied to identify the vegetation cover and to analyze the land use and land cover changes, especially, to detect the spatial variability of different species (Matsushita et al., 2007), vegetation cover distributions in particular locations and its densities over time (Lunetta et al., 2006; Myneni et al., 1997; Saleska et al., 2007). To detect Land Use-Land Cover (LULC) dynamics, the method of EVI indices are used broadly (Ehsan & Kazem, 2013; Singh et al., 2016). Furthermore, measuring the EVI are mostly used for the assessment of the spatiotemporal characteristics of LULC, highlighting the vegetation cover (Kinthada, 2014). Though NDVI measurements are generally used to assess the spatiotemporal characteristics with vegetation cover, its principle is derived from the reflectance characteristics of photosynthesis. Due to the testing vegetation greenness with red bands signal are absorbed by plants and NIR band signals are reflected by plants. More advanced indices like EVI, EVI2, GRVI etc. were developed reduce these issues and broadly used in addition to NDVI (Phompila et al., 2015). Specially, the EVI helps to enhancing greenness signals from the ground surface including forest canopy structures with the use of blue band (Huete et al., 1999; Shishir & Tsuyuzaki, 2018). Thus EVI can reduce soil and atmospheric interference for more accuracy (Holben & Justice, 1981). The reflectance characteristics of photosynthesis is the main principle of EVI, in particular, through the test of the greenness in whole vegetation absorbed by the plants with the blue and red band signals of the sensor and reflected the near-infrared band signals (Shishir & Tsuyuzaki, 2018). The weakness of this EVI index is that in some cases its accuracy can be distorted by the atmospheric (clouds), various ground conditions over surface (soil types) (Kushida et al., 2015; Miura et al., 2001). The greenness signal including forest canopy structures is mostly enhanced by the accumulation of the EVI with the use of blue band (Ronchetti et al., 2020) and it also reduces the extra soil and atmospheric interferences consequently (Holben & Justice, 1981). Assessing any VI calibration, the topographic effect is an important environmental factor contributing to the noise in hilly areas (Dymond, 1999; Meyer et al., 1993; Smith et al., 1980; Trotter, 1998). As the effects are visible and near infrared parts of a surface's solar spectrum are comparable, these could be eliminated or weakened when NDVI is expressed as band ratio (Lee & Kaufman, 1986). Nevertheless, EVI includes a constant term titled the soil adjustment factor or canopy background L, in its denominator (Equation 1). The constant L allows the EVI assessment to include the term without a band ratios format (Matsushita et al., 2007). Different studies showed that lack of definite datasets of radiances regarding topographic effect put hindrance especially in vegetation cover of hilly region (Trotter, 1998). Again, datasets of vegetation composition, biomass and diffuse illumination contain variation because of slope, aspect, altitude etc. This type of complexity in data brings difficulties in distinguishing radiance variations. As a consequence, the spectral data variances are observed in EVI which evaluates topographic effects despite of having these factors (Matsushita et al., 2007). Remote sensing techniques can deliver accurate vegetation information with the correct selective sensors and image processing methods, those are really proficient and even cost-effective (Kamal et al., 2015). For accomplishing method, the prior component is long term medium resolution remote sensing data provided by the Landsat mission (Schultz et al., 2016). Landsat offers the longest running cross-calibrated data at medium resolution of

the Earth's surface that is also consistent globally. Since the archive is developing for a longer time, several studies had been demonstrated using Landsat's capabilities for mapping forest cover and also related changes (Abdullah et al., 2015; Faruq et al., 2016; Hossain et al., 2015; Kamal et al., 2015; Schultz et al., 2016). Due to this reason the Landsat OLI satellite image are used in this study. The main aim of this study is to examine how the vegetation indices response for different vegetation species on the basis of their characteristics. All the vegetation species have their own characteristics which has also impact on all vegetation indices like EVI, NDVI, SAVI etc. This study had been conducted to find out the effect of various types of vegetation species on EVI values. For evaluating this and calculating EVI values, the electromagnetic blue, red and NIR band of Landsat 8- OLI satellite imagery had been used thoroughly.

Study Area

Madhupur tract is situated in the central part of Bangladesh which is a large upland area and the Madhupur upazila is situated in the northern part of Madhupur tract. This region contains with the overall high Land topography (M. M. Rahman et al., 2008). Only a union in the dense part of Madhupur forest is selected for conducting this study, that is placed under Madhupur Upazila of Tangail District. This forest is located in between the River Banar in the east direction and the River Bangshai in the west direction and only the forest located in the flood free central part of Bangladesh. Its landform is largely dominated by the Pleistocene Terrace area of Tangail District (Shishir & Tsuyuzaki, 2018). Madhupur forest is largely consisted of deciduous species and having characteristics of tropical with moist. About 45,565.18 acres area are associated in the total area of this forest and from these, about 2,525 acres are restricted for reserved forest. On the other hand, about 4, 304 acres are under the process to be declared as reserved forest (Hossain et al., 2015). About 129 species were found where 65 species including in trees, 15 by shrubs, 26 climbers and 23 by herbs. Sal forest is the dominant of these species, generally forms 75% to 25% of the upper canopy in the natural growth (M. Rahman & Vacik, 2010).

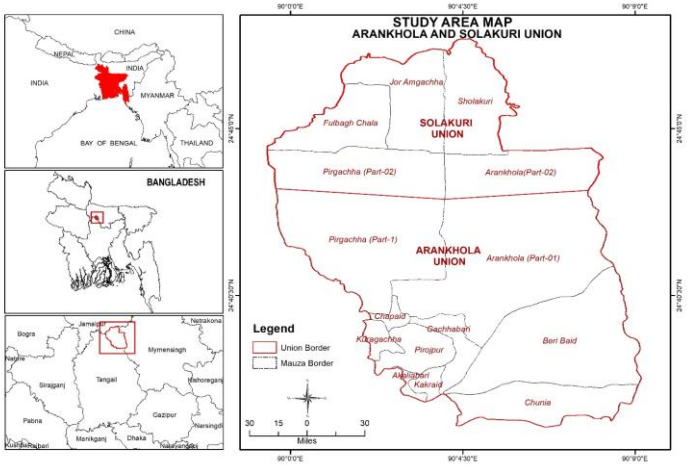


Figure 01: Geographical location of Solakuri and Arankhola Union where Madhupur forest situated

Image Acquisition

We use multi-temporal satellite image to identify the vegetation cover of the in the Madhupur forest (Faruq et al., 2016). We have downloaded the Landsat OLI Satellite Images from USGS- Global Visualization Viewer (GloVis). The image acquired during the mid of March at this time the sky is clear with only 20 to 25 percent cloud cover. From the mid-February to mid-April it is considered as spring season in Bangladesh and at the beginning of this season the leafless trees get back leaf (Banglapedia, 2021) and the mid-march it turns into the maturity which gave the highest spectral reflectance for the specific electromagnetic wave. The study area is mainly the forest dominated area so for best analysis and result in EVI values and spectral reflectance profile this image is collected which also lessen the effect of cloud and rainfall (Giri et al., 2008).

Table 1: Properties of Landsat imagery

Sensor	Year	Projection	Path-Row	Date Acquisition Date	Spatial Resolution (m)	Cloud Cover
LS 08 (OLI)	2014	UTM	137-43	17/03/2021	30	0.36

Source: (GloVis, 2021)

The Landsat Operational Land Imager (OLI) has 11 spectral bands respectively. Amongst them, the first nine spectral bands with the finest spatial resolution of 30m (except for Band 8, having 15m spatial resolution). The last bands have the spatial resolution of 100m. For fulfilling of the objective of the study, the band 2-blue,4-red and 5- NIR have been used to evaluate the EVI value. All band values are mentioned precisely in Table 2.

Table 2: Landsat OLI Bands and Their Spectral Wavelength

Bands	OLI (Landsat 8)		
	Band Name	Wavelength	Resolution
Band 1	Coastal Aerosol	0.433- 0.453	30 m
Band 2	Blue	0.45- 0.515	30 m
Band 3	Green	0.52- 0.60	30 m
Band 4	Red	0.63- 0.68	30 m
Band 5	NIR	0.84- 0.88	30 m
Band 6	SWIR- 1	1.56- 1.66	30 m
Band 7	SWIR- 2	2.10- 2.30	30 m
Band 8	Pan	0.5- 0.68	15 m
Band 9	Curus	1.36- 1.39	30 m
Band 10	TIRS-1	10.6- 11.2	100 m
Band 11	TIRS-2	11.5- 12.5	100 m

Source: (NASA, 2019)

Materials and Methods

The focus of this study is to identify the effect of various species on EVI values. EVI is mostly used to identify vegetation cover in any considered area, which uses the arithmetic combination of three bands- blue, red and NIR. These bands are related to vegetation spectral characteristics that precisely provide consistent spatial and temporal information of vegetation (Shen et al., 2009). Here in this study, we will calculate and extract the EVI values for a forest dominated area which contains two major classes of vegetation species and try find out the differences and variation of the EVI values for these two types of species.

Enhanced vegetation index (EVI) using reflection blue to develop correct signals of the background soil and reducing atmospheric effects such as scattering particles. The combination of empirical relationships for atmospheric correction has resulted in develops of vegetation index (EVI) (Mokarram et al., 2016).

For conducting preferred output, methods of image pre-processing, geometric and atmospheric corrections had been performed with QGIS 3.6.2 software. Then, the following indices were used for calculating the Enhanced Vegetation Index (EVI) in this study (Mokarram et al., 2016):

EVI = G * ((NIR – R) / (NIR + C1 * R – C2 * B + L)) …… (1)

Where,

G (gain factor) = 2.5

L = 1 [Adjust of Canopy Background]

C1 = 6 and C2 = 7.5 [C1 and C2 = Coefficients for Atmospheric Resistance]

In Landsat 8- OLI:

EVI = 2.5 * ((Band 5- Band 4) / (Band 5 + 6 * Band 4 – 7.5 * Band 2 + 1)) …….. (2)

The sequence of procedures followed in this research had been indicated in the below flow chart (**Figure 02**).

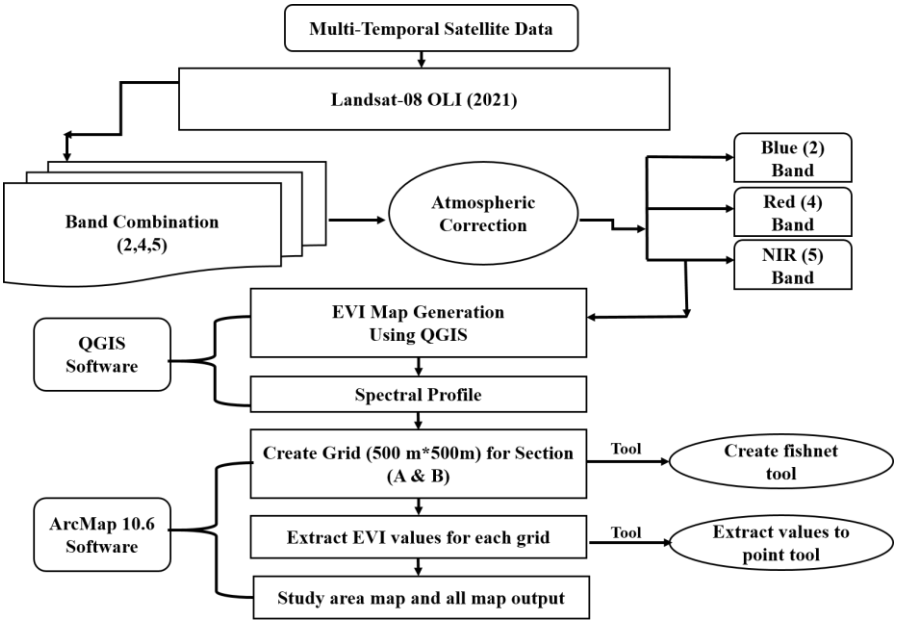


Figure 2: Flow Chart with Methodological Procedures in Definite Sequence

The multi-temporal satellite image of the Landsat OLI sensor of 2021 was used in our study. The QGIS 3.6.2 software were used for image pre-processing, atmospheric collection, EVI calculation and spectral profile drawing.

To keep this research rational and easy analysis of the data we only consider the densely forest dominated area as our study area. There are two dense area are found in the Madhupur forest one is rubber plant (Ficus elastic) dominated area and the other is natural (Shorea robusta) forest (Faruq et al., 2016). Based on the density of the forest we divided our study area into two section. The rubber plant dominated area are marked as (section a) and the natural forest dominated area are marked as (section b) (figure 03).

To make the analysis comparable we created (500*500) m grid and its midpoint of the study area where each grid containing almost 287 pixel of the image. After calculated the EVI in QGIS we extract the cumulative EVI values for each grid. The EVI values for each grid gives us the idea about the difference between the EVI values for two sections of our study area (figure 05). All of these work also with study area map and all other map output are produced using ArcMap 10.6 software.

Study Area in Landsat 08 (OLI) image

There were some modifications in the calculation of EVI and this EVI algorithm had been adopted coefficients where NIR, red, green and blue bands can present atmospherically corrected surface reflectance effectively. Here, L had been used for denominating the adjustment in canopy background, that is used for addressing the nonlinear, differential transmittance of NIR and red wavelength (Shishir & Tsuyuzaki, 2018). These parameters had improvised the sensitivity in EVI for the vegetation monitoring capability by dissociating the canopy background signal, which actually detects the atmospheric influences for removal (Huete et al., 1999).

Figure 3 shows the distribution maps of the aspect of EVI in the study area. From the considered forest area, the vegetation cover had been displayed brighter in section A and deep disappearing shadowed in section B due to the light- blocking forest canopy having the characteristics of uniform vegetation surface. Therefore, the reflectance of the A is brighter that can be clearly seen in the images accumulating EVI than the B due to spatial distribution. The reflectance values between A and B are largely different and these values have detected different vegetation covers alongside aspect area. The results shows that the variations of the reflectance in EVI values mainly caused for the species variations.

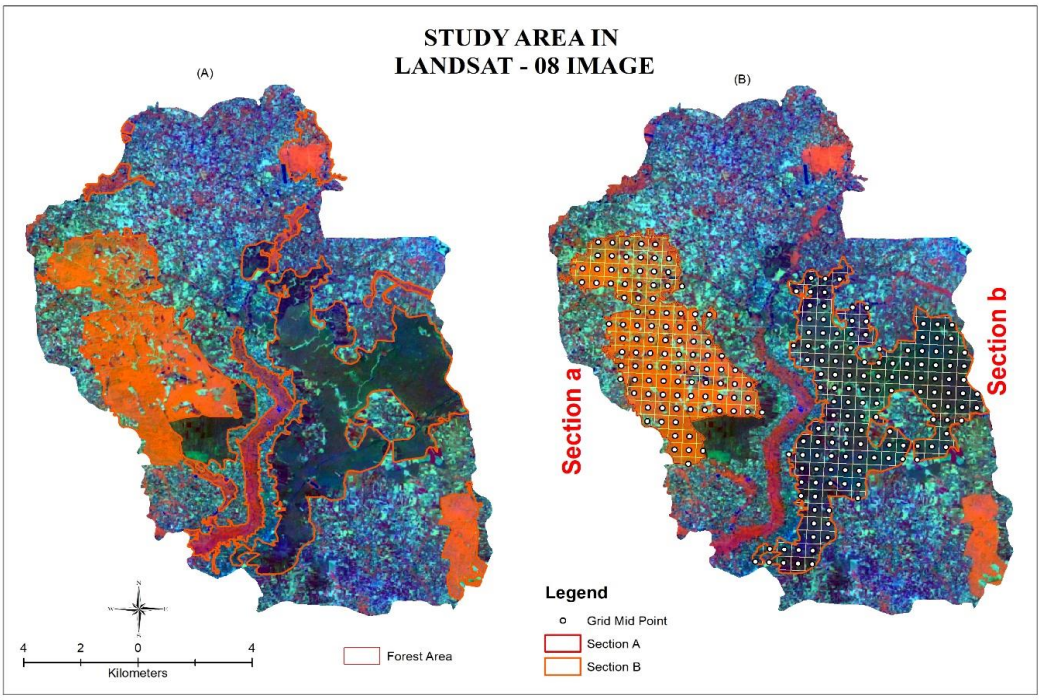


Figure 3: False color combination map of Madhupur forest. (A) Dominated forest area in Madhupur region. (B) Grid map of the two sections (a and b) of study area. Rubber *(Ficus elastic)* forest area marked as (section a) and Natural (Shorea robusta) forest marked as (section b).

EVI Map of the Study Area

The EVI values were shown in the highest range of 0.62 for Rubber *(Ficus elastic)* forest while the Natural (Shorea robusta) forest ranges of lowest value in between -0.0035 and 0.3642. The EVI separates these two vegetation covers clearly. According to (Shishir & Tsuyuzaki, 2018) research, they found EVI values between 0.37 and 0.48, which were mostly associated with respective cropland and occasionally grassland in the considered study area. Besides, EVI values were fluctuated largely over the Shorea forest and homestead vegetation. So, calculating the vegetation cover of Rubber forest and the Shorea forest (Natural) were respectively different in the EVI values. The difference is supposed to be the reflectance criteria of canopy.

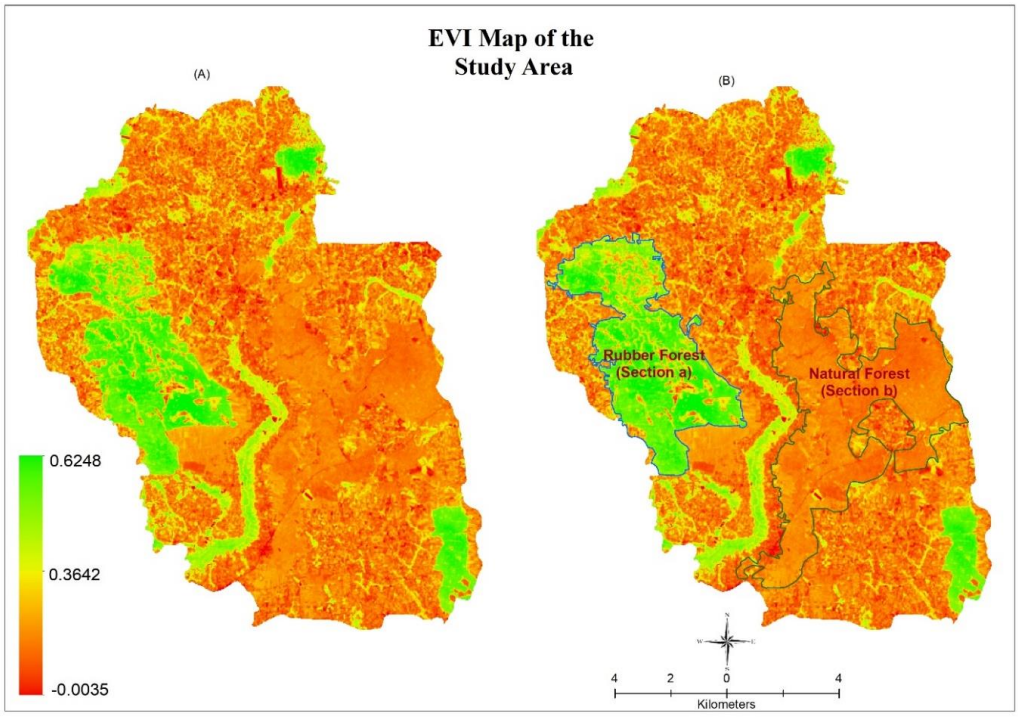


Figure 4: EVI map for the whole study area

EVI map for Rubber forest and Natural forest

For better understanding in the variation of EVI values and comparable data analysis we consider only the two highly clustered and dense forest cover area for this research. One is the Rubber (Ficus elastic) forest which is marked as (section a) and the other is Natural (Shorea robusta) forest (section b) (figure 04) which contains various types of trees.

From EVI map of this two section (figure 05) it found that the EVI values for Rubber *(Ficus elastic)* forest is very high and its values is as like as healthy vegetation. The value range for EVI is -1 to +1, and for healthy vegetation it gives high positive values close to +1 (Halos & Abed, 2019). Form the map (figure 05) the EVI values for dense rubber forest is very high like 0.62 and for moderate and low dense rubber forest the range is in between (0.62 to 0.44) which is very much similar to reality. In comparison to (figure 03) and (figure 05) we found in every grid where the density of the rubber forest is high the EVI value is also very high. That means in case of rubber forest EVI values has a close relation with the density of the forest. When the density of the rubber forest increased the EVI values also increased and vice versa.

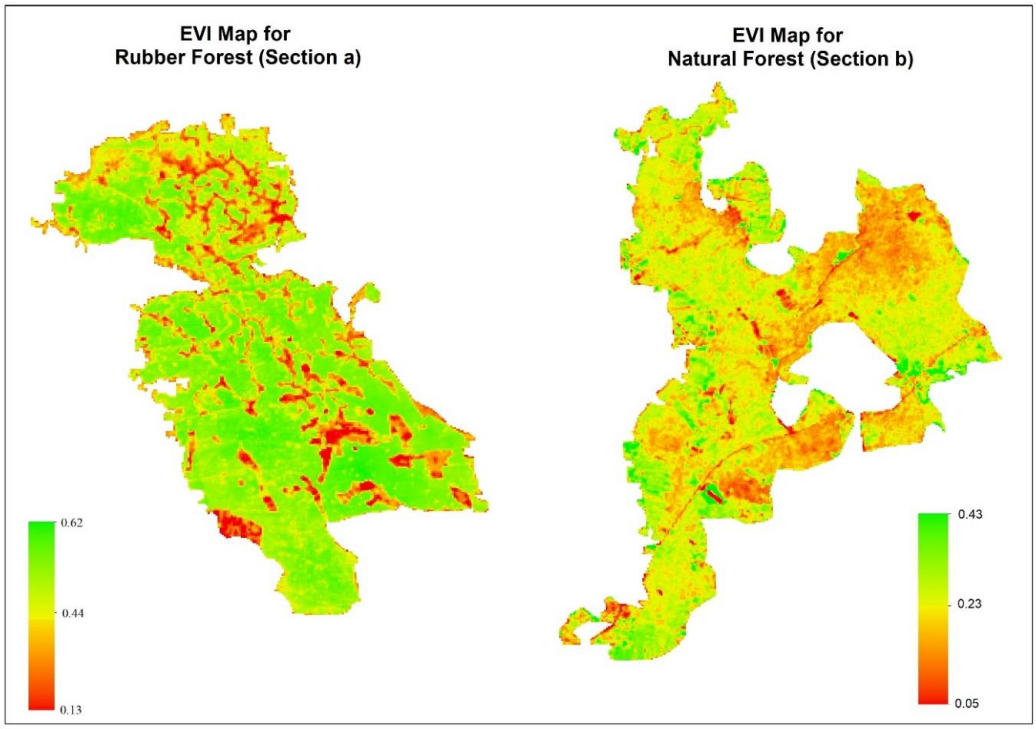


Figure 5: Generated EVI map for Rubber forest (section A)
and Natural Forest (section B)

On the other hand, the density of the particular natural (Shorea robusta) forest (section B) is also similar to the rubber forest but the EVI values is not similar. From the map (Figure 05) the highest EVI value is 0.43 and lowest value is 0.05. According to the EVI value range the health vegetation means the dense vegetation will give high EVI value and the low dense vegetation will give low value. But in case of natural forest (section B) we found completely different things. And that is where the natural forest density is very high the EVI value is very low and in case of low vegetation density it gives high EVI values. In EVI map (Figure 05) for natural forest the highest EVI value is 0.43 but in reality (Figure 03) in these areas we found low vegetation density and lowest EVI value is 0.05 but in reality (Figure 03) in these areas we found it as highly dense vegetated area. Which means the natural forest of this study area did not give expected value like as rubber forest. It means the EVI values for all species is not same and the species have a direct effect on EVI values. This variation in EVI values can be happen for various reason like leaf structure, maturity, pigmentation (Roy, 1989), soil quality etc.

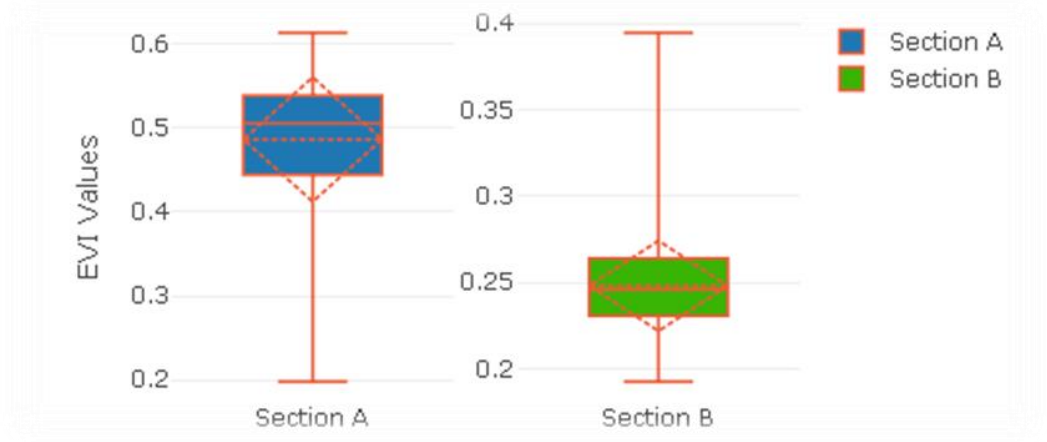


Figure 6: Boxplot for the EVI values of rubber (section A) and natural (section B) forest

The above boxplot (figure 06) shows the difference and variations between the EVI values of Rubber (Ficus elastic) forest and natural (Shorea robusta) forest. In the boxplot, section A indicates the brighter and deeper EVI values of rubber forest and section B indicates the shadowed EVI values of Natural forest, which had been extracted from the EVI map using the grid midpoint (figure 03).

For the dense and moderate rubber forest (section a) the EVI values are in between (0.44 to 0.54), the mean EVI values is 0.49, the median is 0.51 and the lower fence is 0.31. Its means the rubber forest gives high EVI values as like as the reflectance value. For the dense and moderate natural forest (section b) the EVI values are in between (0.23 to 0.26), the mean EVI values is 0.248, the median is 0.246 and the upper fence is 0.31. Here for natural forest (section b) the mean and median EVI value are almost same and there is a little variation in EVI values range among the dense and moderate forest. The boxplot clearly stated that the natural forest gives lower EVI values compare to rubber forest.

Spectral profile

To identify and monitor vegetation conditions and to map land cover changes, the different vegetation indices derived from Satellite image data are considered one of the primary sources (Teillet et al., 1997). For the identification of vegetation cover, Remote sensing techniques use passive sensors to obtain the electromagnetic wave reflectance information from canopies (Xue & Su, 2017). Accumulating the spectral reflectance of leaves, various factors can affect e.g., leaf structure, maturity, pigmentation, sun exposition, turgidity (water content), nutritional status, disease etc. Besides, anatomy of leaves and soil water content imply effects primarily and thus, these give diversifications in the spectral reflectance values in vegetation (Roy, 1989).

In this study two types of vegetation are found in the two sections (A and B) of the study area and they give different EVI values as well as reflectance values in the spectral profile. This is happening for the above-mentioned factors and it can be for the phonological development in reflectance details (e.g., the progression of a crop toward maturity) (Odenweller & Johnson, 1984).

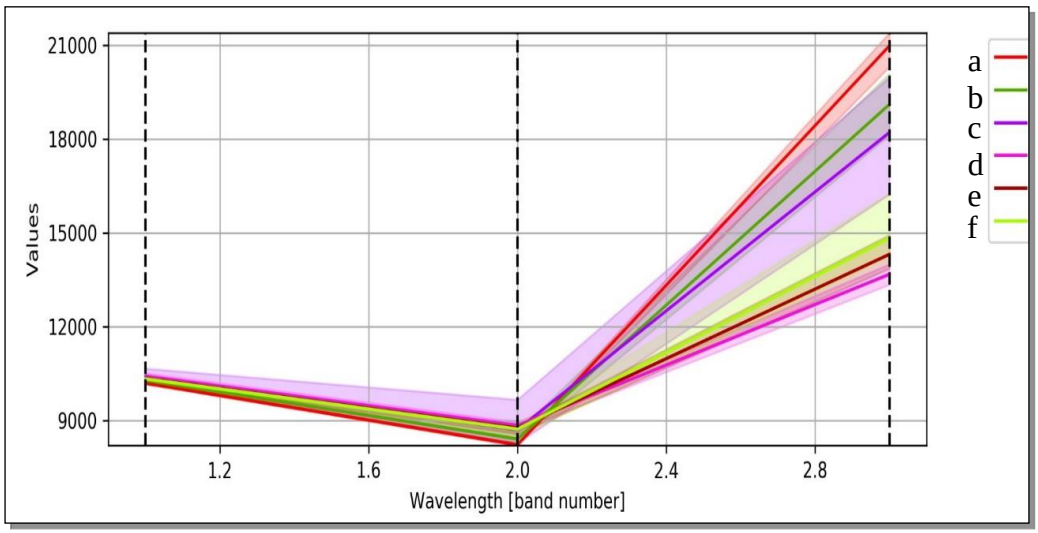


Figure 7: Spectral profile for rubber (section a) and natural (section b) forest. The legend for the profile are given at its right ride. Here high dense rubber forest (a), moderate dense rubber forest (b), low dense rubber forest (c), high dense natural forest (d), moderate dense natural forest (e) and low dense natural forest (f).

The spectral profile (figure: 07) shows that, in case of blue (band 2) and red (band 4) the reflectance value for rubber forest (section a) and natural forest (section b) are almost same. The NIR (band 5), consistently it provides high spectral response for rubber forest (section a) as like as healthy vegetation and gave the highest reflectance value but for natural forest (section b) it gave the lowest spectral value and greatest spectral separation identified compare to rubber forest (section a) (Kamal et al., 2015). Though both are the densely forest dominated area but due to leaf structure, maturity, pigmentation (Roy, 1989) and also for various other factors the spectral reflectance are different and which have a direct effect on the EVI value for both rubber (Ficus elastic) and natural (Shorea robusta) forest.

Conclusion

The EVI can classify the grassland, cropland and agricultural low land types influenced the different land use (Shishir & Tsuyuzaki, 2018). This EVI method doesn't consider the adverse effects of environmental factors such as atmospheric conditions and soil background in calculations, though these manually impacts on the reflectance. The calculation of EVI accompanies a change in orientation from horizontal direction to an inclined surface. A change in light source and sensor position can be responsive giving different values. For this reason, this study had been claimed two EVI values in different vegetation species covered in study area (Holben & Justice, 1981). The advanced quantitative relationship in vegetation indices like EVI between spatial scale and topographic effect needs further study for recommending the topographic hierarchical effect. As these characteristics are removed from EVI in applications, still the factors work on vegetation and thus EVI performs better than does the NDVI in many accumulations (Matsushita et al., 2007). The EVI responses in reflectance can be utilized

more effectively in conjunction with higher spatial resolution data extracted from Satellite images of an area with rough terrain and topography. These characteristics effects on the vegetation indices having only one band ratio format in Bangladesh. To reduce both atmospheric and soil background noise simultaneously, the EVI can be constructive research method for planning forestation and divert contribution in reserved with homestead vegetations. This study can serve a counter analysis of species richness of both species at highly protected core area. The findings can provide information describing well balanced distribution undisturbed forests areas to formulate more conservation plans and to understand plant diversity.

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Assessment of Psychological Well-Being in Hazard Prone Area

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Abstract: Bangladesh is in South Asia's low-lying region. For this unique geographic location, this country is endowed with immense natural beauty. The flip side of the coin, on the other hand, is extremely enraged. Bangladesh faces devastating damages every year for this kind of geographic and geologic setting. Bangladesh has been ranked 7th among the countries which are severely affected by hazardous events since 1998. Besides economic and social damages, hazards are known to impact individuals' mental well-being severely. Also, a poor psychological state works as an influential factor to increase hazard consequences. For this research, both secondary and primary data sources have been considered. Satellite imageries, published documents, and maps are secondary data collected from Google Earth and other online platforms. Also, MHI-5, a self-assessed questionnaire, has been used to estimate and calculate the psychological well-being as well as the psychological vulnerability of individuals. Several statistical methods were used to analyze data, such as ROC curve analysis and several GIS techniques throughout the research. Results show that biophysical vulnerability in the study area creates psychological vulnerability. Government and policymakers should consider this dimension in disaster management to identify the most vulnerable individuals because only structural recovery will not be enough to reduce vulnerability in a holistic approach.

Keywords: MHI-5, Vulnerability, ROC Curve, Geographic boundary.

1. Introduction

Both Geologically and geographically,Bangladesh is located in a high-risk area to natural hazards, including cyclones, floods, riverbank erosion, coastal erosion, landslides, drought, and groundwater contamination. Bangladesh is only at risk from earthquakes as far as endogenous hazards are concerned, and there is no danger of volcanic activity. Bangladesh faces devastating damage every year, and these hazards have a significant impact on our society and economy (Hossain and Miah, 2011). Over the past 40 years, nearly 5,20,000 deaths recorded due to cyclones, floods, storm surges, and other associated natural hazards. In 2007, Cyclone Sidr alone caused worth 1.7 million USD in the coastal areas of Bangladesh (GFDRR, 2019)

Bangladesh is in the 7th position in the damage index for its damages due to severe hazards events since 1998. In 2018, Germanwatch claimed that about 407 people lost their lives in several hazardous events like cyclones, floods, landslides, and storms in Bangladesh. Also, the country sustained a total loss of 2826.68 million U.S. dollars (Eckstein, Hutfils and Winges, 2019; DhakaTribune, 2019; The Finance Express, 2019, UNB 2018; The Daily Star, 2019). Besides that, depending on locations, Bangladesh endured 1 to 35 million U.S. dollar economic loss in livestock and 1 to 11.8 million U.S. dollars in poultry sectors due to these natural hazards (Biswas, 2019). UNDRR has

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estimated that Bangladesh's average annual loss is more than 3084.33 million U.S. dollars (Ozaki, 2016; Kamal, 2016).

Though economic implications are commonly considered after or during disasters, social and human impacts are frequently overlooked(Short, 1987; Dekens, 2008). Community displacement, degradation of social status, and disturbance in going to school are serious hazards tothe societal system. But nowadays, social impact assessment is getting the concern of many researchers in disaster management.Not only on society and economy,but hazards are also known to substantially affect the affected population's physical and mental health (Kim, et al., 2008, Rahman, and Shaw, 2015; Jha, 2010; Ericson, 2005) besides other structural damages. Hazard-affected people suffer from long-term trauma and poor mental health (Freedy and Simson, 2007; Gruebner et al., 2015). WHO's epidemiological projections show that "post-disaster mental health problems range from mild distress to very severe mental health problems. Almost 20-40% of the affected populations suffer from mild psychological distress, while 30-50% suffer from moderate to severe psychological distress" (WHO, 2019).

During a disaster, those with poor mental health are more vulnerable, and they cannot adapt and overcome the circumstance along with others. They are less resilient to hazard due to psychological vulnerability. The level of psychological exposure of a community can tell us about the intensity of other impacts of a hazard on mental health besides other structural damages, their coping capacity level, and positive adjustment to that hazard (Fingerle, 2009). Considering these facts, researchers wanted to measure the psychological vulnerability of the local community to different threats.

2. Methods

2.1 Study Area Selection:

Based on the nature of this research, several assumptions were considered for selecting the study area. Considered assumptions are:

- Area with a geographic boundary with isolation
- Vulnerable area to hazards
- Vulnerable and stressful community

Natural hazards might have geological or geographical extend. Such earthquakes generally occur where the earth's plate is tectonically active, and the extent of damages will depend on the intensity. Hazard impacts have no administrative boundary. That's why a geographic area of Inani in Jalia Palong union of Ukhia Upazila in Cox's Bazar district has been selected as the study area.

Two different rivers bound the study area in the north and south directions. Both rivers flow westward and fallen into the Bay of Bengal, which draws the west side boundary. On the Eastside, there are hills and a channel connected to both rivers. The channel has been considered as an east side boundary for the study. These geographic settings have given a unique geographic boundary to the study area. Also, this area is potentially vulnerable to various kinds of hazards for its geographic location.

On the other hand, the studied community's majority population is involved in fishing and boating with no significant subsidiary occupation. A very small group of the people engaged in farming, and few people work as day labor. Moreover, the women of that community are not directly involved in any economic activity. It is very alarming for a community and any society when most of that population engages in primary activity rather than other economic activity. This type of engagement indicates underdeveloped community practices (Pettinger, 2016).For all these facts, this area has been chosen for this kind of research.

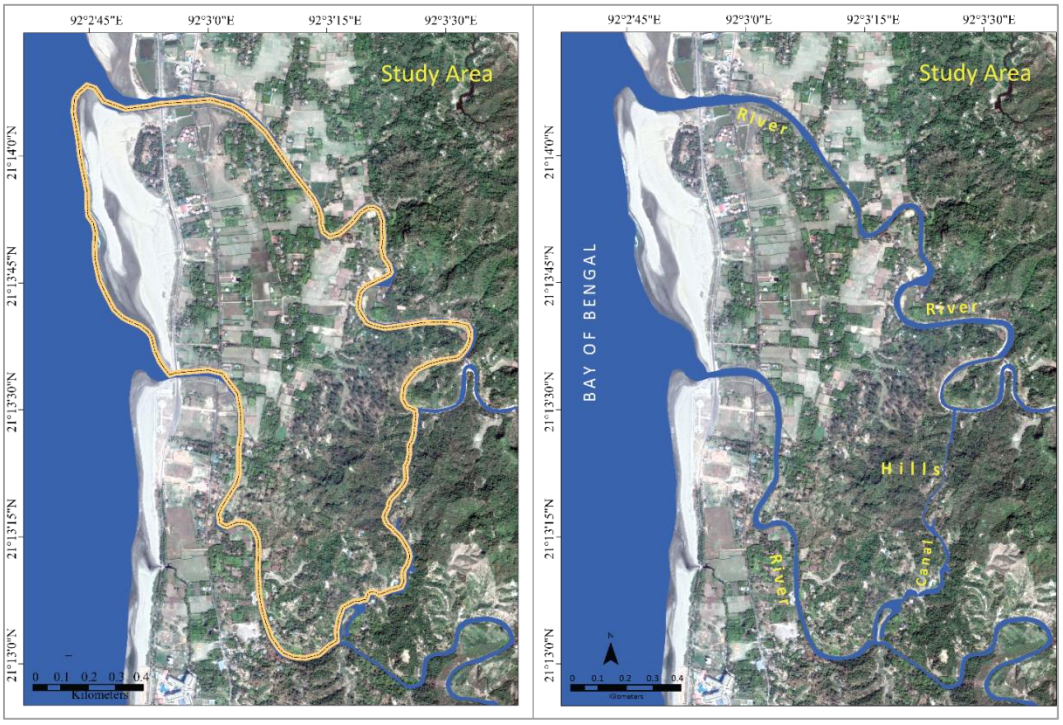


Figure 1: Study area

2.2 Sampling:

The sampling process has been stratified into two layers for this study. First, a rectangular box has been drawn around the study area and then divided into small boxes with an area of 10000 sq meters (100m*100m) for each small box. Besides, boxes that cover the study area have been taken into account for the further sampling process.

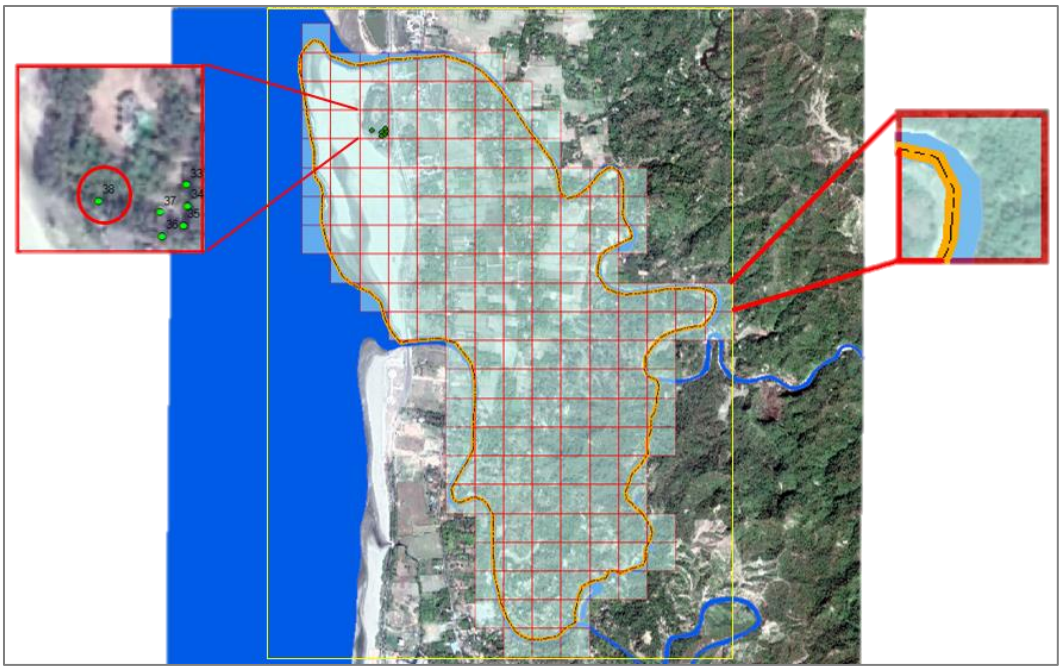


Figure 2: Sample selection procedure

Secondly, for determining the possible settlement of sample collection, random number table has been considered. Because the population from the study area will have an equal and independent chance to get selected as a sample in the sample selection process.

2.3 Study Variables and Tools:

Both primary data and secondary data were used to conduct this research work. Various hazards information and satellite imageries are the secondary data, and those were collected respectively from published websites, atlases documents and Google Earth. Also, several informal interviews and discussions were arranged with the community members to observe theirsocial conditions and psychological state. Thenthe value of psychological vulnerability has been collected and measured by MHI-5, which is a self-assessed questionnaire.Besides, GIS and remote sensing have been used throughout the study for georeferencing, digitizing and producing new maps.

2.3.1 Hazard potentiality identification:

Researchers considered three spheres of the earth to identify the hazard vulnerability of the study area. Because natural hazards' occurrences or processes that occur naturally in the earth's system. (GFDRR, 2009). Different types of tools have been considered to explore the hazard vulnerability, which have been categorized as follows-

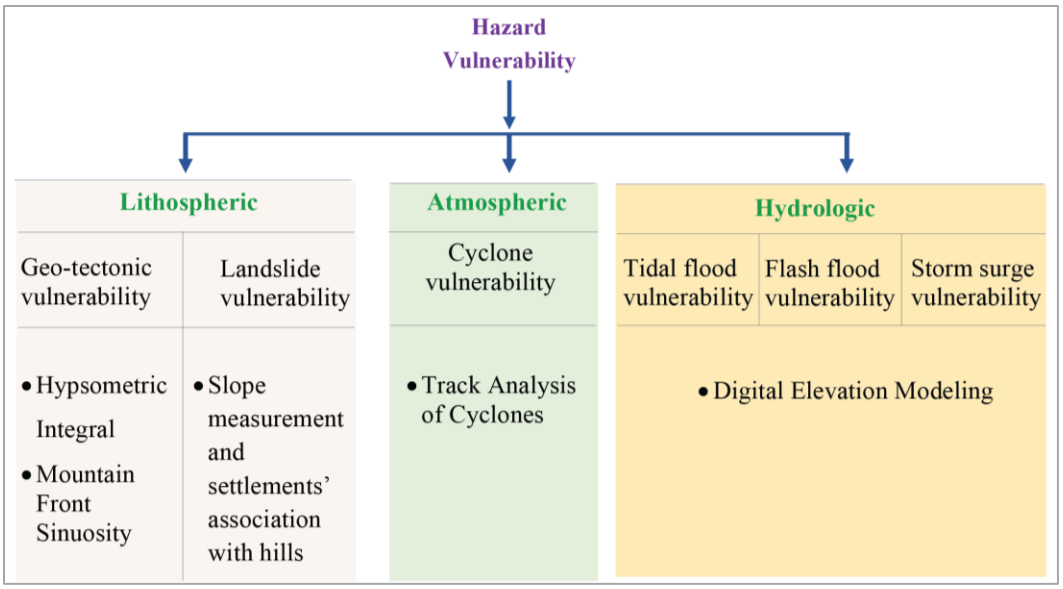


Figure 3: Hazard potential identification

2.3.2 Mental Health Inventory-5 (MHI-5):

Veit and Ware developed MHI-5 in 1983 (Multiple Sclerosis Centers and Ritvo, et al., 1997). MHI-5 has the advantage that it is equally suitable for assessing psychological distress symptoms and psychological well-being in non-psychiatric people. Because it is developed considering the psychological state and information from general people, making it convenient to community population measures (Marques, Ribeiro and Lopez, 2011). In below there has been given a sample of MHI-5-

Table 1: Sample of Mental Health Inventory-5 (MHI-5)

Questions	All the time	Most of the time	Most of the time	Some of the time	A little of the time	None of the time
5 Questions	1	2	3	4	5	6

3. Calculation and Analysis

3.1 Hazard Potential Analysis-

Geo-tectonic vulnerability:

There are several indices to calculate the geo-tectonic activity of an area. Some of the most useful geomorphic indices in active tectonics research are Hypsometric Integral by Strahler (1957), Mountain Front Sinuosity by Bull and Mc Fadden (1977), etc. These two geomorphic indices have been calculated for the selected study area.

- Hypsometric Integral:

  Hypsometric Integral refers to the study of landmass's horizontal cross-sectional area distribution with respect to elevation. Using Google Earth, the elevation was directly

collected for the study area. Then, Hypsometric Integral has been calculated using the following formula:

$$H_i = \frac{Mean\ Elevation - Min\ Elevation}{Max\ Elevation - Min\ Elevation} \quad \text{-------} \ (3.1a)$$

- Mountain Front Sinuosity

'Mountain front sinuosity' is a common investigationapproach for locating regions with tectonic activity. Researchers have collected the study area image from Google Earth and analyzed it in ArcGIS for this study. Mountain Front Sinuosity is usually calculated by using the following formula:

$$S_{mf} = \frac{L_{mf}}{L_s} \quad \text{-------} \ (3.1b)$$

Where,

S_{mf} = Mountain Front Sinuosity Index

L_{mf} = Total length of the mountain front

L_s = Straight line length of the mountain front

Landslide Vulnerability:

Researchers have reviewed previously published documents and used a clinometer to collect the slope measurements of the study area. Also, the placement of settlement is taken into consideration. All data was compiled and analyzed in ArcGIS to produce a landslide vulnerability map.

Cyclone Vulnerability:

Various published maps and documents and cyclone track analysis have been used to explore the cyclone vulnerability in the study area.

Tidal flood, Flash flood and Storm surge vulnerability:

Researchers have identified the flood vulnerable area by using Digital Elevation Modelthatseveral field visits have verified.

3.2 Psychological Vulnerability Calculation-

The calculation and Scoring system for the MHI-5 is relatively complex.There are five questions with six possible responses (scored from 1 to 6) for each in the MHI-5 (table 1). The total value (total value is from 5 to 30) was converted into a scale of 0 to 100 using a linear transformation. In this score range, 100 represents optimal mental well-being.

Total score on MHI- 5 = 100* {(score a + score b + score c + score d + score e)-5}/25.

However, there is no formal categorization scale of MHI-5 and that's why a cut-off point has to be determined. Because a cut-off point is necessary to define the condition of mental health as vulnerable or resilient in MHI-5. This cut-off determining method is

extensively used and delivers the finestSensitivity and specificity for identifying psychometrics signs.

3.3 SPSS analysis

A statistical analysis has been executed for determining the cut-off value of MHI- 5. For the statistical analysis, SPSS software has been used.

ROC curve analysis uses the following equation for calculation-

$$ROC\ (.) = \{FPR(c), TRP(c),\ c \sum(-\infty,\ +\infty)\} \quad \text{-------} \quad \text{(3.3a) [source: Calì and Longobardi, 2015]}$$

Where,

$$TRP(c) = \rho(T \geq c|E+)$$

$$FRP(c) = \rho(T \geq c|E-)$$

In the 3.3a equation, *FRP* is the specificity, specificity (negativity in the variable) is the proportion of subjects without the target condition and gives negative test results. *TRP* is the Sensitivity; Sensitivity (positivity in the variable) refers to the proportion of subjects who have the target condition (reference standard positive) and give positive test results. Positive predictive value is the proportion of positive results that are true positives, whereas negative predictive value is the proportion of negative results that are true negatives. Furthermore, *c* is the cut-off value.

4 Results

4.1 Hazard Potentiality in the study area:

Geo-tectonic vulnerability:

- Hypsometric Integral:

The difference between erosional landforms at different stages during their evolution can be assessed by hypsometric analysis (Strahler, 1957; Schumm, 1956).The calculated value of Hypsometric Integral for the study area is **0.56, indicating that the watershed is matur**e and susceptible to erosion.

Table 2: Value of Geomorphic Indices to identify Geo-tectonic vulnerability

Geomorphic Indices	Calculated Value	Standard
HypsometricIntegral	**0.56**	<0.5 means relatively stable land

- Mountain Front Sinuosity

The mountain front sinuosity index is a measure of the equilibriumamong the trend of stream and slope processes to create an uneven mountain front and active upright tectonics to generate a distinctive straight front (Bull and Fadden, 1977). For the study area,the mountain front sinuosity index value is **1,** which means that the land is decreasing the levels of tectonic activity and is susceptible to erosion.

Table 3: Value of Geomorphic Indices to identify Geo-tectonic vulnerability

Geomorphic Indices	Calculated Value	Standard
Mountain Front Sinuosity	1	> 1 means that the land decreasing the level of tectonic activity

Landslide Vulnerability:

Landslide sites in Bangladesh have a natural slope angle of 34 to 84 degrees. Nonetheless, most slopes are greater than 40 degrees, which is higher than the typical angle of internal friction of slope materials (26–34 degrees). As a result, slopes are more unstable (Ali, et. al., 2018; Islam,et.al., 2014; Tabassum, Sharmin and Chowdhury, 2019). Moreover, several settlements in the study area are built near the hills, creating vulnerable conditions for the studied community.

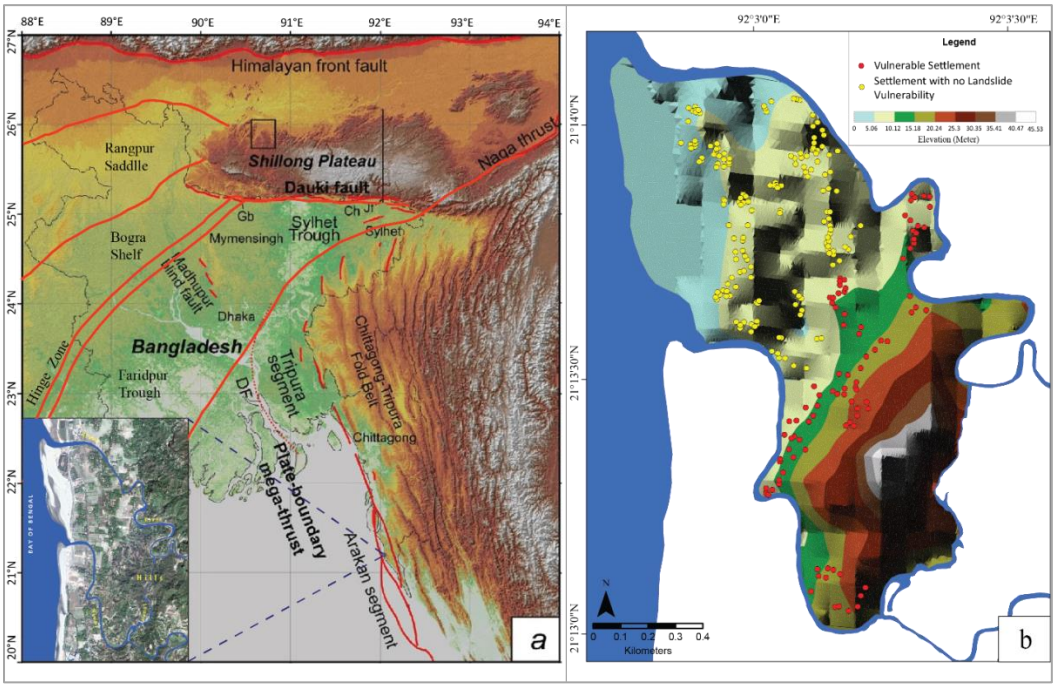


Figure 4: Lithospheric Vulnerability in Study Area; A (left pane): Geo-tectonic vulnerability (Source: Compiled by Author, 2019 after Morino et al., 2018), B (right pane): Landslide vulnerability

Cyclone Vulnerability:

Researchers have reviewed the published map, documents, articles of cyclone events (1965 to 2017) from various sources and produced a cyclone vulnerability map of the study area. The map clearly represents that the study area has witnessed several major cyclones and is affected by them. Also,the study area is situated in a high-risk area for the cyclone.

Tidal flood, Flash flood and Storm surge vulnerability:

For the study area, flash flood due to excessive rainfall, tidal floods due to the rise of water in the ocean, and excessive rainfall and storm surge due to cyclone caused damage in previous years. This area is highly vulnerable to these hazards. Storm Surge vulnerable area marked with red dotted line, whereas flash flood vulnerable area marked with red arrow. Tidal flood vulnerable area has been marked with a purple dotted line.

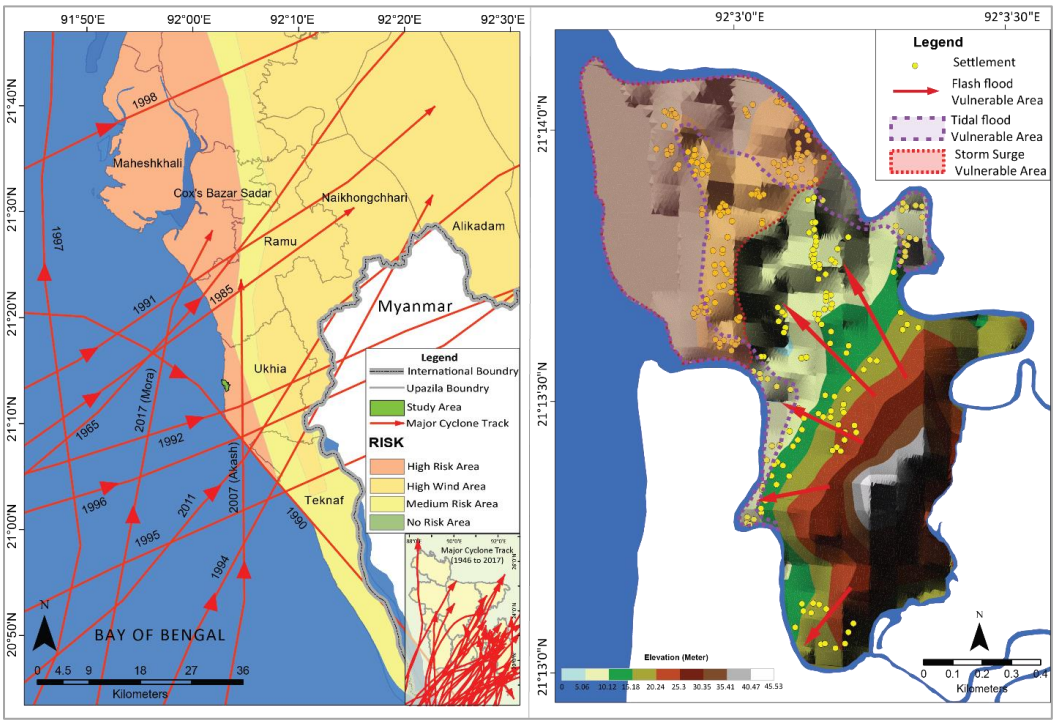


Figure 5: Left pane: Cyclone vulnerability (1965- 2017), Right pane: Flash flood, Tidal flood and storm surge vulnerability

4.2 Level of Psychological Vulnerability:

After the proper execution of the selected method, the psychological vulnerability value has been estimated. But there is no formal scalethat can distinguish between vulnerable and resilient individuals. That's why researchers worldwide in this sector usually calculate a cut-off point to conclude the results. Because cut off point divide the test results into two category allowing to differenciate the outcomes. A simultaneous assessment of sensitivity and specificity is required to determine the cut-point value. When a cut-point correctly classifies the majority of the people, it is said to be efficient finding. For that reason, researchers have calculated a cut-off point for the psychological vulnerability for this research work.

Area Under the Curve

Test Result Variable(s): CalculatedValue

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.951	.026	.000	.901	1.000

The test result variable(s): CalculatedValue has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

Case Processing Summary

	Valid N (listwise)
Overall	
Positive[a]	16
Negative	43

Larger values of the test result variable(s) indicate stronger evidence for a positive actual state.

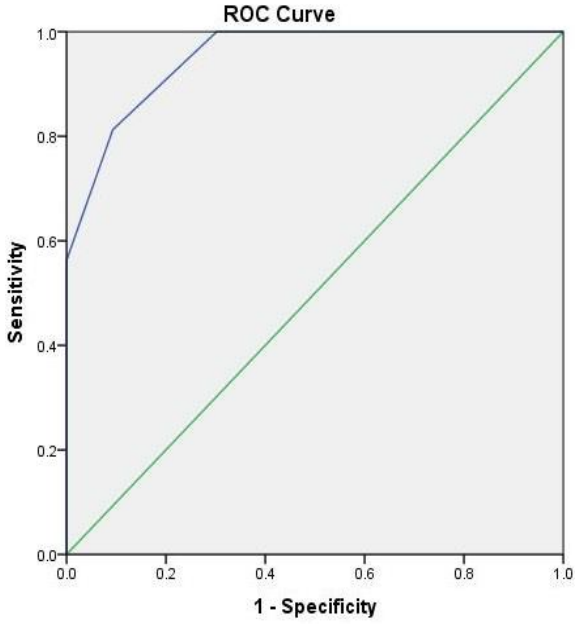
a. The positive actual state is 1.0.

Coordinates of the Curve

Test Result Variable(s): CalculatedValue

Positive if Greater Than or Equal To[a]	Sensitivity	1 - Specificity
27.000	1.000	1.000
30.000	1.000	.953
34.000	1.000	.837
38.000	1.000	.674
42.000	1.000	.581
46.000	1.000	.302
50.000	.813	.093
54.000	.563	.000
58.000	.313	.000
62.000	.125	.000
66.000	.063	.000
69.000	.000	.000

The test result variable(s): CalculatedValue has at least one tie between the positive actual state group and the negative actual state group.



Diagonal segments are produced by ties.

a. The smallest cutoff value is the minimum observed test value minus 1, and the largest cutoff value is the maximum observed test value plus 1. All the other cutoff values are the averages of two consecutive ordered observed test values.

Figure 6: Cut-off value of psychological vulnerability

Additionally, the AUC (area under the curve) is a useful criterion for evaluating a test's overall accuracy rate. It allows numbers between 0 and 1, with 0 indicating a completely inaccurate test and 1 indicating a completely accurate test. The trapezoidal rule can be used to compute AUC. In general, an AUC of 0.5 indicates no discrimination, 0.7 to 0.8 is acceptable, 0.8 to 0.9 is excellent, and greater than 0.9 is excellent. The AUC value for this test is 0.951 which indicates the significance of this test.

Researchers have identified the cut-off point considering sensitivity and specificity and figure 6 presents the cut-off value of psychological vulnerability which is 46. This value indicates that the lower range of it will be considered psychological vulnerability (actual negative state) and the upper range will be considered psychological resilience (actual positive state).

All the values collected from the field to estimate psychological vulnerability ranges from 28 to 68. Considering the cut-off points researchers have differentiate the vulnerable

psychological state from resilient state. People who present values lower than 46 are considered to be psychologically vulnerable, while people with greater value than 46 are psychologically resilient.

In Figure 7, the red line marked as cut-off point and the left section marked with orange color represents the value of psychologically vulnerable people. Whereas on the right side of the cut-off value, marked with green color, represent the value of psychological resilience.

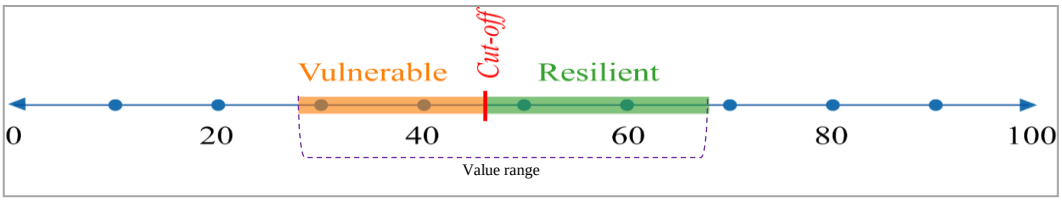


Figure 7: Graphical representation of the cut-off point, indicating psychological resilience and psychological vulnerability

Based on this cut-off value researchers were able to categorize the psychological well-being of the community. The identified two categories (vulnerable and resilient) with the psychological well-being value and the percentage of peopleare given in table 4 where 71.67% people present vulnerable state and 28.33% present resilient state. This results depicts that the majority of the community are psychologically vulnerable.

Table 4: Category of Psychological well-being

Psychological Well-being Value	Category	Percentage
0 to 45	Vulnerable	71.67
46 to 100	Resilient	28.33

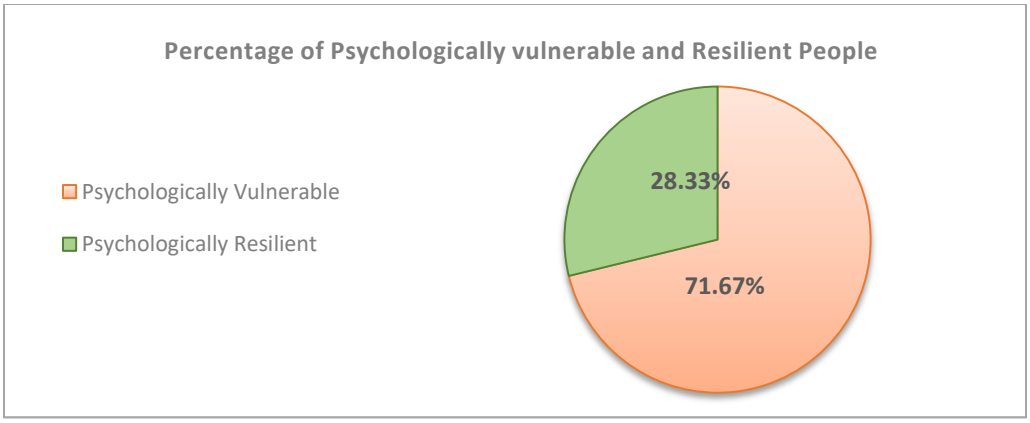


Figure 8: Percentage of psychologically resilient and vulnerable people

Figure 8 presents that psychological vulnerability holds 71.67%, and psychological resilience holds only 28.33%. This scenario indicates that more than half of the

community is psychologically vulnerable due to different kinds of hazards and only some people are resilient who can "bounce back" psychologically during or after any hazards.

5 Discussion

Hazard Potential:

Geo-tectonic vulnerability:

Bangladesh's core structural framework is referred to as the tectonic framework. The folding intensity in the eastern Chittagong hill tracts is greater, resulting in a higher topographic elevation. The research area is located between the Arakan Segment and the southern part of the Sunda megathrust's Indo-Burma segment (Sieh, 2007).

There is a piece of historical evidence that this part of Bangladesh was highly active tectonically in the past, which caused a massive earthquake in 1762 with a magnitude of 8.5 to 8.8(Cummins,2007; Wang et al., 2013).Along Myanmar's west coast and Bangladesh's southeast coast, the consequences of the 1762 Arakan earthquake were documented (Alam and Dominey-Howes, 2014). Tsunami waves killed 200 people in Bangladesh's Chittagong region and 500 people in Dhaka, mostly due to upturned boats (Mondal et al., 2018).This evidence gives us a hint that this area might be tectonically still active and vulnerable, which can cause massive damage in the near future. The calculated value of Hypsometric Integral for the study area is **0.56** indicates that the watershed is in the mature stage (stabilized) and susceptible to erosion. Here channel processes play a larger role in developing the landscape. On the other hand,the mountain front sinuosity index value is **1,** which means that the land is decreasing the levels of tectonic activity and susceptible to erosion as well as the most active mountain front.

Landslide Vulnerability:

The term "landslide" refers to the downward movement of soil, rock, and organic materials due to gravity (Highland and Bobrowsky, 2008). Generally, landslides may result from a range of causes such as weaknesses in composition or structure of the rock or soil, high precipitation, changes in groundwater level, seismic activity, over-steepening of slopes, changes in surface water runoff, and heavy loads on slopes. Besides, human impacts (e.g., construction activity) significantly influence altering natural processes in the environment (Islam,etal., 2014).

In Bangladesh, every year during the monsoon period, due to heavy rainfall Rangamati, Bandarban and the Chittagong hill tracts face huge damages and many deaths for this hazard (Mia, Sultana and Paul, 2015; Ahmed et al., 2014). The number of deaths in 2017 was 170, which is significantly high (Anas, 2019; DhakaTribune, 2019). In 2019, atleast 26 landslideswere recorded in Ukhia and 273 shelters were affected (ERCC, 2019). In the study area, many people live under potential threat.

Cyclone Vulnerability:

Communities across the Bay of Bengal have experienced some of the world's biggest weather disasters. Because of theexceptional shape of the Bay of Bengtal along with its many creeks and the level low-lying terrestrialparts, cyclones generating in this part movesdistant inland, affectingthe coastal population of the study area (Khan, 1995; Liberto, 2017; Hossain and Miah, 2011; Habib, Shahidullah and Ahmed, 2012).

These geographical characteristics are one of the reasons why the Bay of Bengal has produced some of the world's deadliest tropical cyclones.The Great Bhola Cyclone "killed 300,000 to 500,000 people in Bangladesh" in 1970, is widely regarded as the deadliest on record. In 1991, over "140,000 people were killed in Bangladesh" by nother major storm surge at the chittagong coastal belt(Liberto, 2017; Choudhury, 2001; Hossain and Miah, 2011).

In recent times, cyclone Sidr caused huge economic damage to Bangladesh. Cyclone Sidr hit Bangladesh's southwest coast in 2007, with winds of up to 240 kilometers per hour. Tidal waves up to five meters high and surges up to six meters high accompanied the category four storm, smashing coastal and river embankments, flooding low-lying areas, and causing considerable physical damage.The death toll from Sidr is estimated to be 3,406, with 1,001 people still missing and more than 55,000 people injured. The entire damage and losses inflicted by the hurricane, according to the Joint Damage, Loss, and Needs Assessment were estimated to be 1.7 billion U.S. dollars (GFDRR, 2019). Cyclone Nargis struck Bangladesh in 2008 as a Category 4 storm with a storm surge of over 10 feet.

This evidence clearly shows that the coastal area of Bangladesh is highly vulnerable to cyclones and it has a devastating impact on resources and human life (Hossain, Islam, Sakai and Ishida, 2008; Farukh, Hossen and Ahmed, 2019). Similarly, the study area is situated in a high-risk zone and witnessed several deadliest cyclone events from 1965 to 2017. The studied community faced huge damage because of these events and suffered miserably.

Tidal flood, Flash flood and Storm surge vulnerability:

Flooding is a natural phenomenon, which cannot be prevented. Whenever a flood strikes in our country, it creates a miserable situation for people and creates challenges for the government to face the damages. It damages agriculture, people's livelihood, environment, infrastructure (roads, embankment, buildings etc.) along with health conditions (both physical and mental) of the affected people (Stanke et al., 2012; Milojevic, Armstrong and Wilkinson, 2017). These damages are ongoing with the flood. Flash floods and tidal floods are common types of floods that Bangladesh faces every year. Heavy or severe rainfall, or upstream flooding, in a short period of time across a relatively small area, causes flash floods. Water levels increase and decrease quickly during flash floods, with little or no caution (ACAPS, 2019). On the other hand,the tidal flood also caused by excessive rainfall, storm surge along with natural tidal effects. Tidal floods cause salinity intrusion in the study area.

Beside flash flood and tidal flood, the study area is also vulnerable to storm surge. Storm surges, which are caused by atmospheric forces in the weather system, cause the waterline in a coastal area or in the interiorwetland to fluctuate for a time which may range between a minutes to a couple of days. Storm surges are created by pressure variances within a cyclonic storm and also by powerful winds blowing straight onto the water. As a result, a large wave of water moves at the same rate as the cyclone. A exclusive mix of high tides, a funnel shaped coastal design, low level coastal topography, and a densle populated group in the northern Bay of Bengal has resulted in some of the highest storm surge casualty rates (Flierl and Robinson, 1972; Habib, Shahidullah and Ahmed, 2012).

Psychological Vulnerability:

However, in a general sense, vulnerability emphases on the state of a system prior to a catastrophe.The "exposure and Sensitivity" are two characteristics of vulnerability. Whereas resilience is a strategy that helps to improve the system's ability to resist and recover from hazards during and post-disaster periods. (Lei, et al., 2013). A system's vulnerability is an internal characteristic that inevitably leads to the negative impacts of a hazard. It identifies the structural and functional faults that are vulnerable to external stressors. Under specific hazard intensities, vulnerability generally determines the likelihood of a disaster and the associated losses; therefore a system with a higher vulnerability may maximize its disaster risk.In the disaster risk field, resilience is frequently expressed as a reactive response to a specific catastrophe. It encapsulates the ability to resist, absorb, and recover from the effects of a hazard quickly and effectively (Berkes et al. 2003; Folke 2006). For example, when a damaging earthquake strikes, a resilient community can quickly function normally after the disruption..

Hence, "psychological vulnerability is defined as the set of cognitive schemes that increase the Sensitivity to stress" (Sinclair and Wallston 1999). It's a normal part of being human, and each of us has a level of vulnerability that might lead to psychological issues when we're exposed to stressful situations (Zubin & Spring, 1977). In contrast,psychological resilience is the ability to adapt in a certain difficult circumstances and risks (Masten et al. 1990). According to a behavioral definition, "it is the ability to go through negative situations using positive feelings and it can be used to explain the psychological state of those who can successfully deal with negativity"(Tugade et al. 2004).

Researchers have measured psychological vulnerability and a cut-off point has been determined (figure 6). Based on the cut-off point researcher categorized the psychological well-being of the studied community (table 4). The calculated data has concluded that 71.67% of people in the study area are psychologically vulnerable and 28.33% are psychologically resilient (figure-8). This percentage indicates that 71.67% of people might suffer psychologically during and after a hazard. And the psychological distress intensity will be varied with the value below 46; a lower value increases the psychological distress. Psychologically vulnerable people of the study area might develop psychological disorders over time, such as post-traumatic stress disorder (PTSD), generalized anxiety disorder (GAD), generalized depression disorder (GDD) etc. Psychological vulnerability significantly influences the loss and damage intensity of any hazards. On the other hand, only 28.33% of people are psychologically resilient, which means that this small number of people can bounce back psychologically after any hazards. These resilient people have the absorbing and adaptive capacity.

So, the studied community has a higher chance of being highly damaged by any hazards because not only being situated in a bio-physically vulnerable place and because more than 70% of people are psychologically vulnerable. These psychologically vulnerable people are affected more than those who are psychologically resilient. Psychological vulnerability is one reason why a community takes time to recover the damage, and so much research has been done to prove this statement. In 2002, Norris et al. studied 61396 hazard victims worldwide and concluded that 77% of them suffered from various psychological problems, including post-traumatic stress, depression, anxiety, and

psychiatric problems. Furthermore, even three years after the earthquakes in Turkey, a study based on a sample population found that the prevalence of PTSD was 11.7 percent (Onder et al. 2006).

6. Conclusion

Though for a long-time mental health condition have always been ignored during and aftermath of any hazards. The discussion in this research indicates that mental health conditions during and aftermath hazards can negatively impact the damage. On the other hand,psychological resilience plays a constitutional and essential part in disaster management.(Carver, 1998; Tugade, Fredrickson and Feldman., 2004; Sherrieb, Norris and Galea, 2010; McFarlane and Williams, 2012). In addition, the need for mental health services is significant before and after the disaster. That's why psychological vulnerability and psychological resilience associated with mental health during and after a hazard cannot be ignored. Government and policymakers should consider this dimension in disaster management to identify the most vulnerable individuals because only structural recovery will not be enough to reduce vulnerability in a holistic approach.

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Exploring Role of Local NGOs in Agriculture: a GIS Based study along the Jamuna River, Bangladesh

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Abstract : Agriculture is the primary source of income for Bangladesh's rural population. Non-government organizations (NGOs) are actively engaged in the improvement of Bangladesh's agriculture sector alongside government organizations (GOs). This study will provide an insight into the agricultural services provided by NGOs at the district level along the Jamuna River. Data was obtained from 533 individuals affiliated to 30 NGOs in 126 Unions using the home survey (HHS) technique and 50 Focused Group Discussions (FGD). Using GIS technology, the study also determined the optimum suited site for agricultural crops in the study region. The research's findings show that local NGOs in the study region assist farmers by providing agricultural supplies (seed, fertilizer, pesticide), agricultural tools, financial loans, agricultural training, irrigation facilities, and help for women in kitchen gardening, among other things. People in remote rural regions largely participated in farming, whilst those near Bangladesh's capital (Dhaka) or other developed areas primarily worked in industry or the service sector. According to correlation research, the number of farmers trained, access to agricultural inputs, presence of domestic animals in the family, and access to agricultural loans all enhance the income of farmers in the study region. The findings also reveal that not all of the study area's land is suited for farming. Identifying the best suited areas for agriculture might help increase agricultural production. According to the study, both the government and non-governmental organizations (NGOs) should create awareness among farmers and assist them in identifying the best suited production locations for crops in order to increase land productivity.

Keywords: Agriculture, NGOs, GIS, Rural area, Bangladesh

1.0 Introduction

Agriculture is a primary source of livelihood for people in Bangladesh (Mahjabeen, 2008; Ali et al., 1998). Like other parts of the world, rural economic activities in

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Bangladesh are largely dependent on agriculture (Bala et al., 2010; BBS, 2016; BIDS, 1981; BIDS, 2011). In Bangladesh, approximately 90% of rural workers are directly employed in the agriculture field, which employs 48% of the nation's employed population and provides for 19.3% of national GDP (Gross Domestic Product) (Bala et al., 2013; BBS, 2011; Alauddin and Biswas,2014). In Bangladesh agriculture is mainly performed through conventional outdated methods; especially in rural remote areas (Borggaard et al., 2003; Bayes and Patwary, 2012; Begum et al., 2004). Furthermore, there are several restrictions that impede the growth of Bangladesh's agriculture industry, such as the political environment, natural disasters, people's choices, modernization and globalization, and so on (Khan and Khisa 2000; Alam et al., 2009; Anonymous, 2003).

One of the major drawbacks of the agricultural activities along the river side of Jamuna is lack of capital and to some extent the environmental threats (Islam et al., 2010). The natural calamities occurred during the rainy season and miles along the river sides swept away due to extreme rise of water level (Haggblade et al., 1986; Grogan, 2012;Holloway and Richard, 1995). Crops and crop field had destroyed by the river bank erosion (Birkhaeuser et al., 1991; Christoplos and Kidd, 2000; Davis et al., 2012). Thus, rural poor people lose their crops, money, food and capital as well. Therefore, they failed to raise capital for the next year’s agricultural practice (ISPAN, 1993; Khan and Khisa, 2000). So, to practice agricultural activity they need help from different mediums (Mahjabeen, 2008; Knudsen and Khan 2002). The mediums can be Government or non-government agencies, commonly known as NGOs in Bangladesh (Khan and Khisa, 2000).

NGOs run different kind of activities to encourage and implement the government orders for the economic improvement of the poor people of the country (Mahmud, 2012; Ministry of Finance, 2015). Some NGOs are lending monetary value to the rural poor people and some are helping them by providing the seed and fertilizer, which has flourished the agricultural sector mostly (Rahman and Islam, 2014; Rahman and Islam, 2011). The NGOs run development activities on agricultural sectors along the river side of Jamuna like easy access to credit, diversified loan and savings products, client friendly door step services, right financing at the right time and quick service & response (Quazi and Rahim, 2000). As of later, some local NGOs are attracting local poor people to horticultures and timber plantations (Rahman and Sousa, 2010; Rahman et al., 2012). The NGO's major areas of interest include home-based income-generating enterprises such as cattle and poultry husbandry, food processing, apiculture, and rural handicrafts, as well as microcredit terms (Rasul et al., 2004; Robbani et al., 2007). Nearly 80% of Bangladesh's villages are projected to be housed by non-governmental organizations (NGOs), but not all of the destitute who require assistance (Roy, 2002; Saleque, 2004). Approximately 13000 non-governmental organizations (NGOs) are involved in agricultural microcredit operations (Haque, 2002; BBS, 2016; Holloway and Richard, 1995).

Farmers along the river side of Jamuna are mostly illiterate, thus they do not know how to take loans from the formal institutions or banks where proper documentation process will be needed (World Bank, 2005; Roy, 2002). Therefore, rural poor people had got the micro-credit facilities with higher interest form the local non-government institutions without major documentation processes (Robbani et al., 2007; World Bank, 1996). This easy process is making them enable to get small amount loans as they need it during their

production time (Saleque, 2004; World Bank, 2005). Agricultural extension and counseling services in rural areas are an important part of acknowledging poverty levels because such organizations are able to train farmers in agricultural practices, supporting farmers in drawback, distributing technology, as well as allowing farmers to be more actively engaged in the agricultural knowledge and information system(Christoplos and Kidd, 2000: 11 ; Davis et al., 2012).

2.0 Aim and Objectives

The broad aim of this research is to know and evaluate local NGOs agricultural services at district level along the river side of Jamuna, Bangladesh. To fulfill the aim, specific objectives are being set for this study includes; 1) to explore socioeconomic situation of the inhabitants along the river side of Jamuna; 2) to investigate agricultural facilities provided by local NGOs in the study area; 3) to analyze correlation between profit from agriculture and six dependent variables at union level along the river side of Jamuna, Bangladesh; 4) and finally, to identify agricultural cropping season and discuss the suitability of land for different crops in the study area.

3.0 Case study and methods

3.1 Study area

According to the research, there are 126 unions in 5 districts along the Jamuna River, as well as 30 non-governmental organizations (NGOs) with 175 sub branches. The districts of Sirajganj, Bogura, Jamalpur, Gaibandha, and Kurigram make up the research region. The Jamuna River is the second largest of Bangladesh's three main rivers (Figure 1). It is a notable distributary flow of the Brahmaputra River, which runs from India to Bangladesh (Rahman et al., 2012; BBS, 2011). As a result, chars play a vital role in Bangladesh in terms of supplying land for human habitation. Chars are particularly prone to erosion and floods. According to a recent study of time series satellite photos, more than 75% of the chars were removed within one and nine years, with just around 10% surviving 18 years or longer (Bayes and Patwary, 2012). Furthermore, Chars have taken up 40% of the active river floodplain, accounting for about 6% of Bangladesh's total land area (Bayes and Patwary, 2012; Bulletin of Institute of Vocational and Technical Education, 2008). Connected chars are said to be inundated more heavily than unconnected chars (Grogan et al., 2012). Every year, a large number of chars are flooded. If the flood occurs too soon, it will harm crops and people's livelihoods (Bayes and Patwary, 2012).

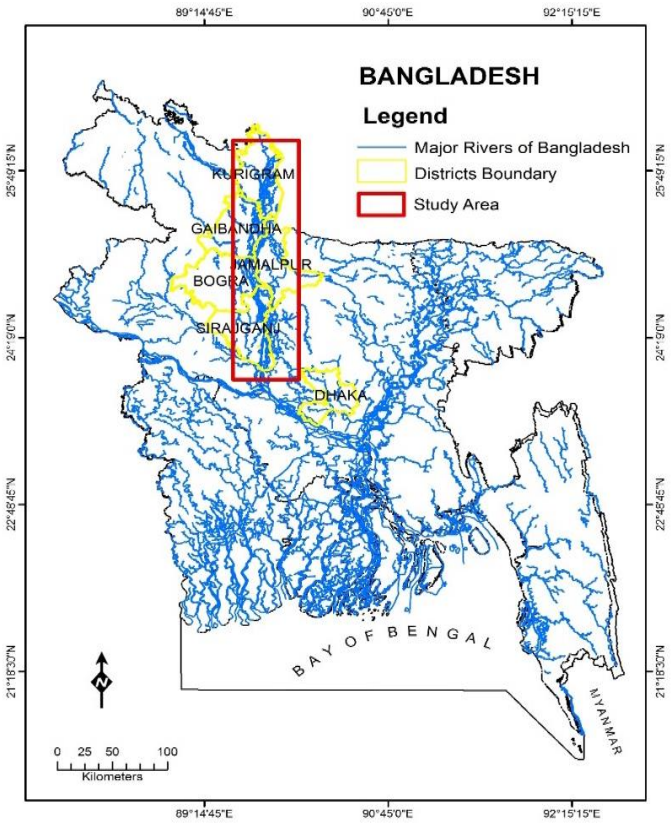


Figure 1: Study area along the river side of Jamuna, Bangladesh
Source: Made by author, 2020

3.2 Data sources and methods

Primary and secondary data were gathered from a variety of respondents as well as a few selected NGOs. Using GPS, absolute information on the locations of 30 NGOs with 175 sub-branches was gathered (Global Positioning System). A total of 533 people were interviewed using the household survey technique, and 50 focus group talks were held at the district and union council levels (comprising a few villages) along the Jamuna River in Bangladesh. The data on the respondents' age, sex, number of family members, occupation, monthly income (before and after joining the local NGOs credit program), distance from the NGOs to the respondents, distance from the growth centers/hat, bazar to the respondents, and facilities provided by the local NGOs in the agricultural sector along the river side of the Jamuna, Bangladesh, 2020 were collected through a questionnaire and analyzed by SPSS 16.0.

Secondary data were acquired from Bangladesh Bureau of Statistics (BBS),Center for Environmental and Geographic Information Services (CEGIS), Bangladesh Institute of Development Studies (BIDS) and different NGOs that supported for developing proper planning on agricultural systems. The study interviewed these following groups:

a. Local community (total 533 respondents and 50 FGDs, information gathered includes; age of the respondents, sex, number of family members, occupation, monthly income before and after joining to local NGOs credit program, distance from the NGOs to the respondents, distance from the growth centers/ hat, bazar to the respondents and facilities had provided by local NGOs).

b. Local NGOs employees who are involved in agricultural services of 126 unions (focused group discussions and interviews with 175 branches of 30 NGOs and provided services to rural poor people namely agricultural training, fertilizer, domestic animals, seeds traditional agricultural tools and agricultural loan).

Finally, Data needed for land and crop suitability along the Jamuna river was borrowed from Bangladesh Bureau of Statistics (BBS, 2011), Bangladesh Agricultural Census (2011 to 2016) and Center for Environmental and Geographic Information Services (CEGIS) and analyzed using ArcGIS 10.1.

3.3 Data analysis

ArcGIS 10.2 has been used for detailed mapping and analysis of productive area of agricultural crops in the sample sites, where the productive area has been extracted with the help of satellite images. 10 major crops were identified regarding on farmers demand. Using ArcGIS 10.2, this paper had identified the production area of each crop in different categories, i.e., very high productive, high productive, medium productive, low productive and finally very low productive based on soil nutrient data. Besides that, the rural poor people who engaged in different economic activities, i.e., agricultural, industrial, services and others were also analyzed in ArcGIS 10.2.

Statistical Package for the Social Sciences (SPSS 16.0) software was also used for Socio-economic characteristics analysis, i.e., age, sex, number of family members, occupation, monthly income, distance from the NGOs office to the respondent's home, distance from the growth centers/ hat, bazar to the respondents and facilities provided by the local NGOs in agricultural sectors of the study site. Besides that, correlation between trained farmers and their profit were also analyzed using SPSS. This paper has tried to show the relation between six dependent variables with income by the following correlation equation:

$$r = [\Sigma xy-\{(\Sigma x)\ (\Sigma y)/n\}]/[\{\Sigma x^2-(\Sigma x)^2/n\}\{\Sigma y^2-(\Sigma y)^2/n\}]^{1/2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (I)$$

WHILE, X = dependent variables, y = income, n = number of unions and results, r is between 1 and +1. The value close to 0 means that there is no correlation and about 1 and +1 means that it has lower or strong correlations between the variables with income.

4.0 Results and Discussion

4.1 Socio-economic characteristics of households

Socio-economic attributes of the households interviewed during household survey are presented in this section. The data presented here is collected through 533 household survey (HHS) questionnaire and 50 focused group discussions (FGD) in 2020. Socio-economic attributes include; age, sex, number of family members, occupation, monthly income, distance from the NGOs office to the respondent's home, distance from the

growth centers/ hat, bazar to the respondents and facilities provided by the local NGOs in agricultural sectors along the river side of Jamuna, Bangladesh.

Results reveal that most of the respondents (56.1%) were below or equal to 25 years old followed by 42.8%, in the age group of 26 to 35 years old. 36.4% of the respondents were women, while 63.6% of the male respondents were all employed in agriculture. Most of the rural poor people in the study area (90.3%) have 7 to 9 persons whilerest of the 7.7% people have more than 9 members in the household. Among the respondents most of them (36.8%) are housewife involved with kitchen gardening. There are majority respondents which is 37.1% are involved in agricultural activities and rest of the 12.4%, 7.5% and 6.2% are involved in business, daily labor and industrial services respectively.

Before joining the Micro Credit program started by NGO, most respondents (89.9%) were in a low-income group (less or equal to 63 USD), 7.7% of average income (USD 126) And the rest of 2.4% in high-income groups. (Above 126 USD). Subsequently, by combining the microcredit program, the low-income group decreased intensely from 89.9% to 41.3%, the average income group increased significantly to 55.0% benefiting from the micro-credit program. People living near NGO offices receive more benefits and vice versa. Our results show that 46.5% of the sampled respondents were living within 5 kilometers distance from the NGO office. Approximately, 74% of the respondents live near growth center where most of the facilities offered by NGOs can be accessed easily.

4.2 List of NGOs and their contribution in agricultural development at the study area

In the research region, there were several non-governmental groups functioning in nearly every field. With the sort of project for which they get money, the purpose and scope of their activity changes. NGOs such as ASA, BRAC, Grameen Bank, and RDRS Bangladesh are national NGOs that work only in Bangladesh. Table 1 contains a comprehensive list of all NGOs currently functioning in our research region, as determined by household surveys, focus group discussions (FGD), and previous government publications.

Table 1. List of NGOs in the study area

No	Branch Name	Frequency	No	Branch Name	Frequency
1	AKOTA	2	16	PRODIPON	1
2	ARBAN	1	17	PROGRESS	1
3	ARCHES	3	18	RDRS Bangladesh	22
4	ASA	35	19	RSDA	1
5	AttoMohilaUnnaionSomity	1	20	Sajida Foundation	1
6	BhomukhiMohilaUnnaionSomity	1	21	SAP	1
7	BRAC	31	22	SATU	1
8	DORP	1	23	SKS	7
9	GKS	1	24	SSS	6

No	Branch Name	Frequency	No	Branch Name	Frequency
10	Grameen Bank	31	25	Thangara Mara MohilaSabujSongo	1
11	GUK	9	26	TMSS (ThakurganMohilaSobuj Sango)	4
12	MMS	2	27	UDDIPAN	1
13	NDP	3	28	Uddog	1
14	PDBF	1	29	UDPS	2
15	Porosh	1	30	US	2
				Total	175

Source: Bangladesh Bureau of Statistics (BBS), The Center for Environmental and Geographic Information Services(CEGIS) and field survey, 2020

Local NGOs along the river side of Jamuna provided various agricultural facilities to the poor people. These facilities include; agricultural inputs (seed, fertilizer, pesticide), agricultural tools, cash loans, agricultural trainings, irrigation facility, providing helps to women in kitchen gardening etc. (Figure 2). All these facilities are given to people selected by NGO based on their socioeconomic situation, i.e., poorest people get it first. The aid included in the analysis of this paper was given in 2020. Among the 533 respondents, majority of the local respondents receive agricultural loan (63.60%), agricultural tools (64%), fertilizer (69%), seeds (77.70%), agricultural training (74.30%), livestock (74.30%) and pesticides (68.30%). Among sampled respondents', majority (71.30%) did not have access to receive handicraft training, as shown in figure below.

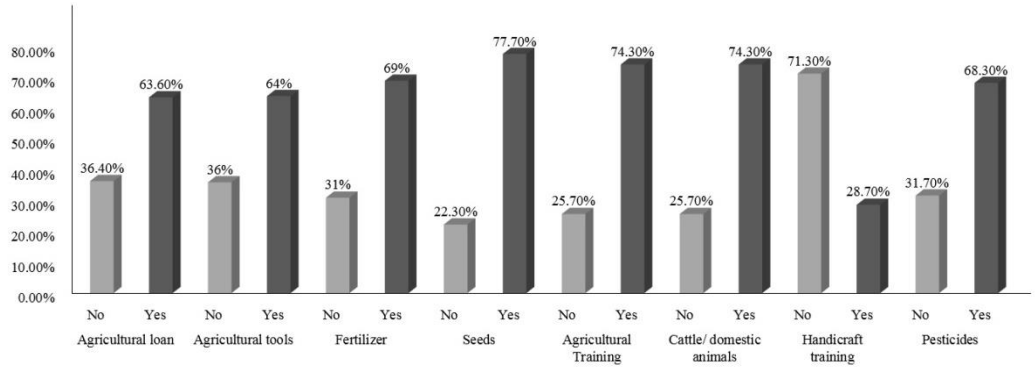


Figure 2: Facilities provided by the local NGOs in agricultural sectors along the river side of Jamuna, Bangladesh, 2020

4.3 Population engaged in agriculture, industry and services sector in the study site

In this section, we provide gender based (male/female) union council wise results on population engaged in three different sectors (agriculture, industry and services) to support to their livelihood (Figure 3a-f). The result presented in this section borrows data from Bangladesh Institute of Development Studies (BIDS), Center for Environmental and

Geographic Information Services (CEGIS) and Bangladesh Bureau of Statistics (BBS) and also includes field data in 2020.

As discussed earlier and shown in figure 3(a, b), majority of male and female respondents were involved in agriculture. Figure 3(a) shows that, upper and middle stream of Jamuna has a very high rate of male participating in agricultural activities. In some areas there are around 5,180-8,630 farmers participating in agricultural activities in some unions. In least cases, there are no less than 798 people participating in agricultural practice. The lower part of Jamuna stream has a less density of male working in agricultural sectors. The highest density found in the Jamalpur district, where most of the male take part in cultivation. The figure 3(b) indicates nearly the same proportion of women's participation in agriculture as men. Some area in Jamalpur district in the upper stream and in the middle stream which crosses the district of Bogura are mostly agriculture dominated. In some unions nearly 296-488 female participate in agricultural activities ranked very high among all the unions (Figure 3b). Kurigram and Jamalpur have the highest portion where females mostly take part in this kind of activities. Some unions in the southern part of Sirajganj are also agriculture dominant by females.

Figure 3(c, d) show that in the lower stream of Jamuna river, most of the population are engaged in industry as this area is the closest to most developed part of the country, i.e., Dhaka, the capital of Bangladesh. Both male and female were almost equally involved in industry sector. People live in Sirajganj has a high ratio of participating in industrial work than any other areas of the people living across the stream. At most over 4,000 thousand people in some unions work in industry for their livelihood and in rest of the areas have very minimum number of people who works in industry (Figure 3c). In the 3(d) figure of the series shows the females' participation in industrial sector along the Jamuna river bank. The number of female participants in industrial sector is very much limited like males. In the downstream, females of Sirajganj mostly participate in industrial work. Some other areas in Kurigram and the southern part of Bogura have some workers who choose industrial labor as their priority for livelihood. It clearly indicates that, people of these areas are not industry dominated and their economic activities are driven by other mediums.

Figure 3(e, f) shows male and female involvement in services sector. Uneven distribution of both male and female can be seen across the study area indicating that not many of the inhabitants of the region are involved in services sector compared to agriculture and industry. Compare to other parts of the study area, lower stream area has relatively more people involved in service sector. This may be due to its close proximity to the most developed part of the country, i.e., Dhaka, the capital of Bangladesh. If we look into the comparison between those three medium of livelihood; agriculture clearly lead the way. But the other two sources have also some roles to play in the livelihood pattern and economic activities alongside Jamuna riverbank districts.

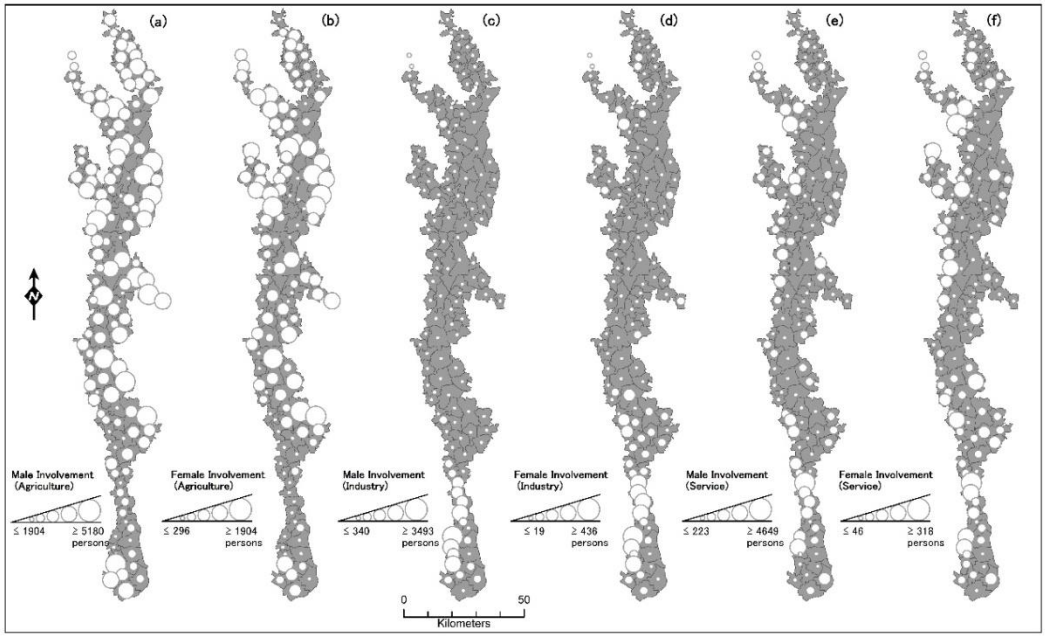


Figure 3 (a-f): Population engaged in agricultural sectors in union wise and linked to the BBS data sets along the river side of Jamuna, Bangladesh, 2020

4.4 Correlation results of profit and selected dependent variables

In this section we present a correlation analysis performed for six dependent variables, i.e., agricultural training, fertilizer, domestic animals, seeds and agricultural loan; to show how they correlate with profit farmers receive annually. Results show that, out of the total number of farmers (432,550), 3,737 were trained, selected from 126 union councils in 2020. Here union council refers to lowest administrative boundary and consist of few villages.The correlation analysis presented in Table 2 show that the correlation of coefficient for training (r) equals to 0.952, indicating a significant relationship between trained farmers and their profit per Bigha ($r = 0.952$, $p < 0.001$). This might be due to the fact that during the practical training, NGOs also advise farmers to share knowledge and resources and encourage them to cultivate same type of crops on adjacent lands so that the farmers can utilize the experiences from the trainings with each other. In total, 4,590 farmers received fertilizer. The correlation analysis between numbers of people who had received fertilizer was able to increase profit from farming. The correlation coefficient (r) equals to .250, indicating a significant relationship between increase in annual profit and access to fertilizer. This had happened because; local NGOs had provided fertilizer facility to the rural poor in proper way and time. Besides that, there were also positive correlation among the number of farmers who had gotten domestic animal, agricultural seeds and agricultural loan with an increment in annual income and their correlation of coefficient (r) equals to .270, .085 and .527 respectively as shown in Table 2. Access to agricultural training workshops, provision of livestock and agricultural loans made farmers able to improve profit from farming. Domestic animals given by NGOs are used for ploughing instead of using expensive modern technologies resulting in saving money. One of the major facilities that was provided by local NGOs is agricultural loan. In

proper time and proper way of distribution of agricultural loan to the rural poor people had made them economically self-sufficient. Traditional agricultural tools namely plough, spade, ladder were only used for producing agricultural crops. A negative correlation (r = -.046) was found between profit from farming and availability of traditional agricultural tools.

Table 2. Descriptive statistics of the selected indicators along the river side of Jamuna, Bangladesh, 2020

	TNP	PP	APY (USD)	p-value	df	Coefficient (r)
TFA and PPB						
Pearson Correlation	3,406,272	3,737	94.09	0.000	1	.952**
Sig. (2-tailed)						
FL and PPB						
Pearson Correlation	3,406,272	4,590	59.30	0.005	1	.250**
Sig. (2-tailed)						
DA and YINC						
Pearson Correlation	3,406,272	3,519	87.25	0.002	1	.270**
Sig. (2-tailed)						
TAT and PPB						
Pearson Correlation	3,406,272	3,237	18.45	0.606	1	-.046**
Sig. (2-tailed)						
AS and PPB						
Pearson Correlation	3,406,272	3,264	9.54	.346	1	.085**
Sig. (2-tailed)						
AL and PPB						
Pearson Correlation	3,406,272	2,865	69.78	0.000	1	.527**
Sig. (2-tailed)						

Source: Interview with local NGOs employee of 126 unions (focused group discussions and interviews with 175 branches of 30 NGOs

** Correlation is significant at the 0.01 level (2-tailed).

* 1 Bigha = 0.16055846 hectare

* TFA= Trained farmers in agriculture, PPB= Profit per Bigha, FL= Fertilizer, DA= Domestic animals, YINC= Yearly income, TAT= Traditional agricultural tools, AS= Agricultural seeds, AL= Agricultural loan, NU= Number of unions, TNP= Total number of populations, PP= Privileged population and APY= Average profit in yearly.

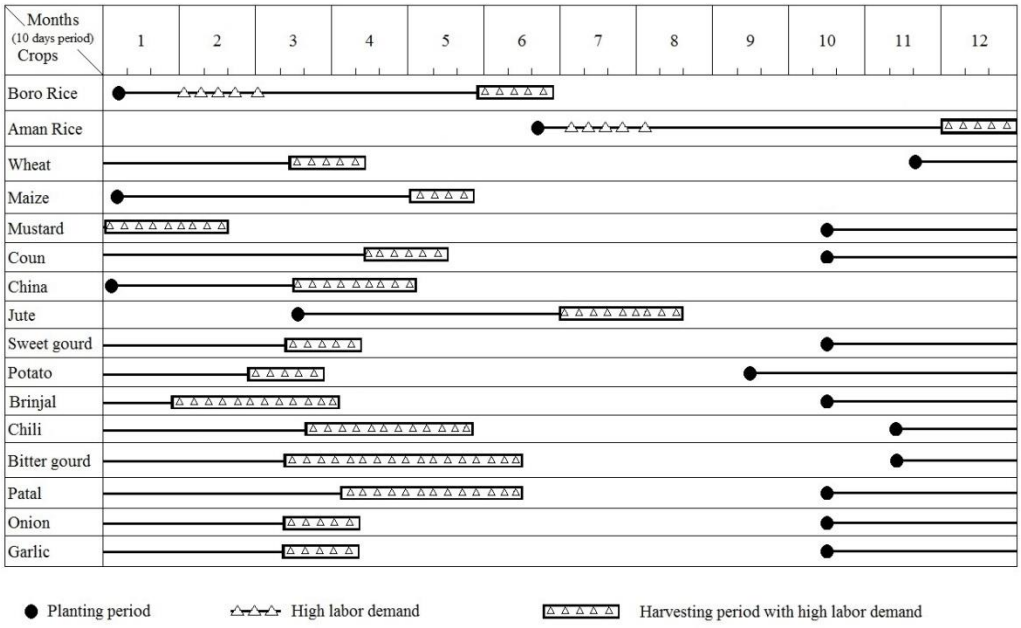
4.5 NGOs Role on Exploring Land and Crop Suitability of along the Jamuna River

NGOs are making a big contribution to agricultural development along the Jamuna River in Bangladesh. Agricultural training for the poor, agriculture services such as distribution of equipment, fertilizer, pesticides, and seeds, poverty alleviation, environment, health and population, education, and other activities are among the major activities carried out by local NGOs in an unstructured manner though at present they are trying to develop crop suitability map to find out which specific crop is appropriate for a region. At present

BARK is engaged in complying crop suitability app based on soil nutrient data and crop calendar by which farmers can get information about cropping season, suitable crop for specific areas which will help them to produce more than before.

4.5.1 Cropping season in the study area

Crop-oriented agriculture is practiced in the study communities. In different agricultural seasons and under varied physical conditions, a variety of crops are cultivated (especially rainfall and elevation of land in relation to the flood level). This article creates a crop calendar with a growth period and a high labor demand for rural farmers to pick plants and seeds at the right time to produce based on local people's opinions and information from local NGOs. The following is the crop calendar:



Note: *Aman* rice, *Boro* rice, *Coun,China are local variety of crops*

Figure 4: Suitable crop calendar along the river Jamuna, Bangladesh, 2020
Source: Field survey, 2020

As a flood plain, several types of crops have been growing along the river side of Jamuna (Nye and Greenland, 1960). Main crops are *aman* rice, *boro* rice, wheat, maize, mustard, *coun,china*, jute, sweet gourd, potato, brinjal, chili, bitter gourd, onion and garlic. *Boro* rice is planted in the month of January and harvesting and threshing is done in the month of June. It is very high labor period for harvesting *boro* rice. February is the peak time for irrigation and pesticides. There are three types of rice namely *Aus, Aman and Boro* are called major cereal crops in Bangladesh. *Aman* rice is harvested in the month of November and December. Wheat is grown under a wide range of climatic conditions and requires dry weather and bright sunlight. Depending on variety and weather conditions, it takes 100-120 days for sowing to harvest. Wheat is planted in the month of November and harvesting and threshing happens in the month of March or mid-April. Maize is

cultivated to a limited extent in Kharif and Rabi seasons along the river side of Jamuna, Bangladesh. The cultivation of maize and food prepared from it is not very familiar and extensive. Wheat is planted in the month of January and harvested and threshed in the month of mid-April or May. The large quantity of oil comes from mustard seeds. It is more expensive than soybean. Mustard seeds are sowed in the month of October and harvested and threshed in the month of February.

Jute is grown in the rainy season. Jute is known as the golden fiber of Bangladesh. It is the main source of income in the country. Jute fibers are mainly made from two major commercial types, namely white jute and tossa jute. On the banks of the Jamuna River, sowing usually begins at the end of February or March, depending on the variety, and lasts until the end of June. The best fertility clay to sandy loam is suitable for jute, and the pH of the soil is 5.08.6 (Nye et al., 1960).

Potato is the major crop in Bangladesh (Lal, 1987). Potato is needed to be cultivated in well-fertilized, sunny land along the river side of Jamuna during winter. Potato plantation is required sufficient moisture in soil. The first October is appropriate for potato plantation and March and April for harvesting. Potatoes in this country are planted manually. Generally row spacing is from 45cm. to 60 cm. The optimum depth of planting depends on moisture of the soil and temperature. Chili is cultivated in both the summer and winter seasons. Chili is widely cultivated along the river side of Jamuna during summer and winter seasons. There are various local varieties of chili like *balijuri, bona, bain, saita, suryamukhi, paba, halda, dhani, shikarpuri and patnai*(Yearbook of Agricultural Statistics of Bangladesh, 2015).

As we all know, our rural life encompasses a wide range of natural and man-made elements and components, such as population, environment, religion, culture, health, education, agriculture, economy, etc. Non-governmental organizations are committed to eliminating economic crises a well-functioning agricultural system. You have been particularly committed to the agricultural system and tried to minimize the cracking rate (Bangladesh Agricultural Statistical Yearbook, 2015; Ramesh et al., 1971).

4.5.2 Analysis of land and crop suitability along the Jamuna River

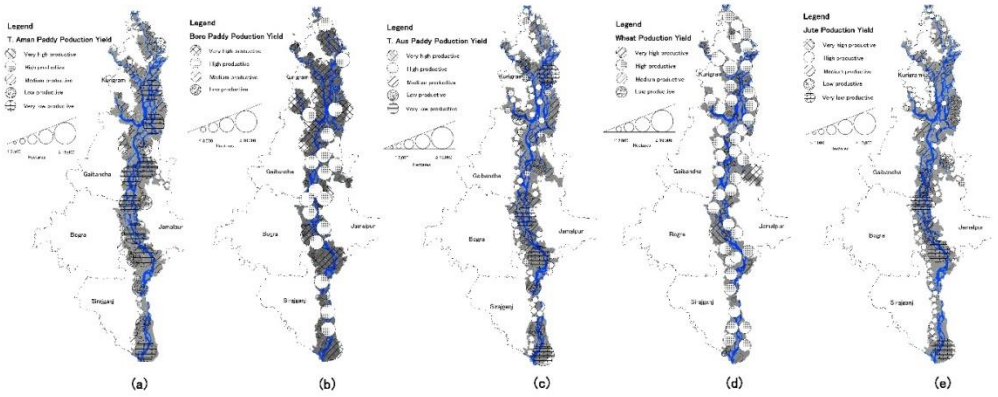
This section provides results from household surveys (533 respondents) and 50 focus group discussions (5 to 6 participants in each discussion) and reports on agricultural land suitability from Bangladesh Bureau of Statistics (BBS), Bangladesh Agricultural Census and CEGIS on the appropriateness of land for agricultural crops in our sample sites. Total area included in the analysis was 340,659.49 hectares. Results are analyzed using a five-point Likert scale, i.e., very high, high, medium, low and very low; which is summarized in Table 3. Crops being included in the analysis are; rice, wheat, Jute potato, chili, ginger and turmeric, onion and garlic, mustard and sugarcane. Results show that three varieties of rice namely; *T. Aman, Boro and T. Aus* are grown in the study area whereas *Boro* rice is the best suites for farmers of the study site. The land for jute and potato cultivation is moderately suitable. Furthermore, the production of chili, ginger and turmeric is perceived very low among sampled respondents due to unavailability of suitable land.

Table 3. Suitability of crop type and land along the river side of Jamuna River, Bangladesh

Crop Type	Very High (ha)/%	High (ha)/%	Medium (ha)/%	Low (ha)/%	Very Low (ha)/%	Comments
1. T. Aman	19,009.97 (5.58)	13,529.14 (3.97)	75,536.43 (22.17)	34,800.15 (10.22)	1,977,83.80 (58.06)	Not enough suitable for *T. Aman* rice
2. *Boro*	124,605.49 (36.58)	136,328.78 (40.02)	36,302.69 (10.66)	43,422.55 (12.75)	--	Suitable for *Boro* rice
3. *T. Aus*	3,726.54 (1.09)	73,155.10 (21.47)	68,642.28 (20.15)	66,750.88 (19.59)	128,384.70 (37.67)	Not Suitable for *T. Aus* rice
4. Wheat	24,143.73 (7.09)	250,645.53 (73.58)	11,888.80 (3.49)	53,981.43 (15.85)	--	High productive area for wheat
5. Jute	527.4 (0.15)	65,372.29 (19.19)	82,171.64 (24.12)	67,700.35 (19.87)	124,887.81 (36.66)	Moderate suitable for Jute cultivation
6. Potato	--	7,401.37 (2.17)	215,457.19 (63.25)	107,900.47 (31.67)	9,900.47 (2.91)	Moderate suitable for potato cultivation
7. Chili	18,195.51 (5.34)	61,255.73 (17.98)	8,372.28 (2.46)	252,835.99 (74.22)	--	Low productive chili yield
8. Ginger and Turmeric	--	6405.27 (1.88)	19273.3 (5.66)	6690.66 (1.96)	308290.26 (90.50)	Not Suitable for ginger and turmeric
9. Onion and Garlic	25,227.03 (7.41)	220,773.15 (64.81)	77,047.59 (22.62)	9,239.45 (2.71)	8,372.28 (2.46)	Suitable for onion and garlic cultivation
0. Mustard	243,789.45 (71.56)	65,919.89 (19.35)	22,395.15 (6.57)	182.72 (0.05)	8,372.28 (2.46)	Highly suitable for mustard cultivation

Note: T. Aman, Boro and T. Aus are the local variety of rice along the river Jamuna, Bangladesh.

Source: Bangladesh Bureau of Statistics (BBS), Bangladesh Agricultural Census, 2011, CEGIS and field survey, 2020



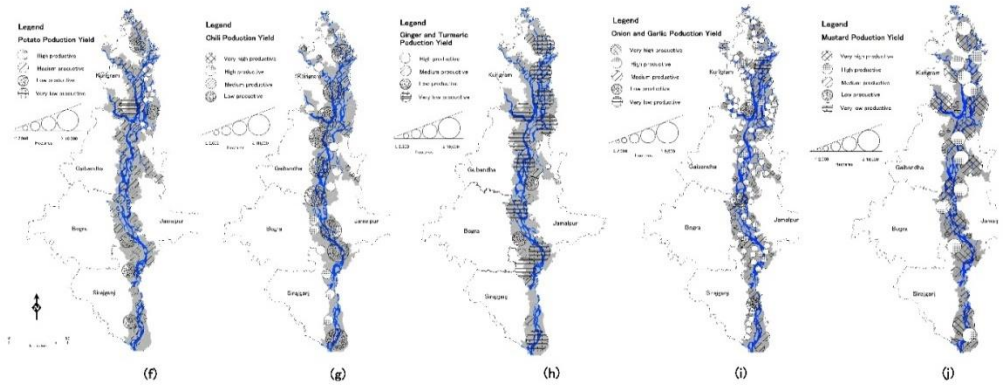


Figure 5 (a-j): Analysis of land and crop suitability along the Jamuna River, 2020

Source: Bangladesh Bureau of Statistics (BBS), Bangladesh Agricultural Census, 2011, CEGIS and field survey, 2020

(a) Production area of *T. Aman* rice (5a)

The results show that the northeastern part of Kurigram district, the western part of Jamalpur along with the river bank and the eastern part of Bogra district have very high production areas, i.e. 5.58% of the total land. The upper stream of Jamuna river, i.e., districts of Kurigram and Gaibandha have medium productive zones of *T. Aman* rice which accounts for nearly 22.17% of the total area. Low production of *T. Aman* rice was mostly noticed in the lower middle stream of Jamalpur and Sirajganj district which is almost 10.22 % of the total land. Around 58.06% of the reaming land is classified as very low productive area (Table 3). The lower part is prone to erosion causing low production of *T. Aman* rice.

(b) Production area of *Boro* rice (5b)

Boro rice production is more suitable than any other rice species along the river side of Jamuna River. Almost all the districts are very highly productive for *Boro* rice. The upper part of Jamuna is highly productive in comparison to the middle and lower part of Jamuna stream. The total area of *Boro* with very high effectiveness is almost 36.58% of the total *Boro* production area (Table 3). The eastern part of Kurigram and Jamalpur districts are highly suitable for *Boro* rice cultivation. Relatively the southern side of Jamalpur and eastern side of Sirajganj lack in very high productivity zones of *Boro* rice cultivation (Figure 5b). The middle stream of Jamuna was completely dominated with *Boro* production. The total area of high *Boro* production is around 136,328.78 hectares which is highest ratio among all types of productivity with 40.02% production area. Low productive zones (12.75%) of *Boro* rice were found to be very minimal alongside districts of Jamuna River. The effective cultivation of *Boro* rice will lead the farmer to more interest in cultivation of this species in the bank of river Jamuna.

(c) Production area of *T. Aus* rice (5c)

T. Aus rice is the one of the major cereal food grains in Bangladesh. The western side of the river is dominated mostly by very high production zones (1.09%) whereas in eastern

side of the river, some scattered distribution of *T. Aus* rice was found (Figure 3). Kurigram and Gaibandha districts are dominantly covered with high productive zones of *T. Aus* rice. In Jamalpur district, close to the main channel of Jamuna has a huge land of high productive zone which counts to nearly 21.47% of total area of *T. Aus* cultivation (Table 3). Around 20.15% of the total area in upper to middle stream is covered by medium production covering the districts of Kurigram, Gaibandha and the northern part of Jamalpur (Table 3). Around 37.67% areas of total cultivable land for the *T. Aus* rice are very low productive zones.

(d) Production area of Wheat (5d)

The second most important grain crop after rice is wheat which is most vital winter crop in Bangladesh. The northern part of Kurigram district in the upper stream, the eastern part of Jamalpur district in the middle stream and Bogra and Sirajganj in the lower middle; have the equal distribution of very high production. The total land coverage of very high production area for wheat is 7.09% of all types of land coverage. The high productive zones of wheat production area are spread all over the Jamuna channel in all districts. Approximately 73.58% of the total cultivable land is highly suitable for the cultivation of wheat. Kurigram, Gaibandha and Jamalpur districts are not suitable for wheat crop. Mostly the southeastern part of Kurigram has very limited land suitability for wheat yields, covering around 15.85% of the total wheat production in the study area (Table 3).

(e) Production area of Jute (5e)

A small portion of land in the upper stream in Kurigram district has a very high productive zone for jute production which was only 527.4 hectares covering less than 0.15% of the total jute production area. From upper to lower stream, in all districts, some areas have high Jute production (Figure 5e). The total high productive jute land is around 65,372.29 hectares (19.19% of the total productive area). Mostly Gaibandha district has the highest amount of land piece of medium production of jute which was around 82,171.64 hectares covering nearly 24.12% of the total land. The eastern most part of Kurigram in the upper stream and the western part of Jamalpur in the middle stream of Jamuna river has the highest density of low jute production area which was around 67,700.35 hectares and covering 19.87% of the total area. The southernmost part of the district and the northernmost part of Bogra has very low production areas of jute cultivation. A huge portion of around 36.66% (124,887.81 hectares) of the total area is very low productive zone for jute production.

(f) Production area of Potato (5f)

Almost 215,457.19 hectares (63.25%) of all the land along the river bank of Jamuna is medium productive zone of potato (Table 3). Only small land (7,401 hectares or 2.17% of the total land) in Kurigram district has high productive zone of potato. The total area of very low production was 9,900 hectares which is covering 2.91% of the total land of potato production. The northern and southernmost part of Kurigram, Gaibandha in the middle stream and eastern side of Bogra and Sirajganj have the highest land forms of low production of potato that are occupying 107,900.47 (31.67%) of the total productive land.

(g) Production area of Chili (5g)

Majority of the land (74.22%) is also not suitable for growing chili along the river side of Jamuna. Results show that, small portions of Jamalpur and Kurigram district in the north are highly suitable for the production of chili. Total area of very high production is only 18,195 hectares which covers only 5.34% of the total cultivable land (Table 3). The northern and western part of Kurigram in the upper stream, the northern most part of Jamalpur, parts of Bogra and Sirajganj, were highly suitable for chili production which covered 61,255.73 hectares (17.98%). A negligible portion of land in the northern most part of Kurigram to southern part along the river bank and a small part of southern Jamalpur has a medium productive zone (2.46%) for chili (Figure 5g). The cultivable land for chili with low production is very high in amount.

(h) Production area of Ginger and Turmeric (5h)

Approximately 308,290.26 hectares (90.50%) of total land is not suitable for ginger and turmeric production (Figure 5h). Only a small portion of land i.e. 6,405.27 hectares (1.88%) is highly productive and nearly 5.66% is moderately productive for ginger and turmeric cultivation (Table 3). Some areas in Kurigram and Jamalpur have highly productive zones for turmeric and ginger (Figure 5h). Throughout the whole river bank of Jamuna the production of ginger and turmeric suitable land in medium context is scattered available. In the middle stream of Jamuna there are some areas where the production of ginger and turmeric were low and it covered 6,690.66 hectares (1.96%) of the total land.

(i) Production area of Onion and Garlic (5i)

In the upper stream, northern part of Kurigram has a very high production zone for onion and garlic. Along with this in the middle part of Jamuna, Jamalpur and Bogra has a very high productivity of onion and garlic cultivation (Figure 5i). In the lower stream, i.e., Sirajganj has high productive zones. There are total of 25,227.03 hectares of land is very high productive which is almost 7.41% of the entire cultivation area. The high production area for onion and garlic is 220,773.15 hectares which is almost 64.81% of the total cultivable land (Table 3). In the lower bank of Jamuna in Sirajganj district is cultivated for medium production of garlic and onion. Total of 77,047.59 hectares of land is causing medium production of the entire land which is almost 22.62 % of the total land. Low and very low production lands are mostly situated very close to the main channel of Jamuna which is covering respectively 2.71% and 2.46% of total land (Table 3).

(j) Production area of Mustard (5j)

The river bank of Jamuna is highly suitable for mustard production. The total high productive land covered nearly 243,789.45 hectares which is nearly 71.56 % of the total cultivable land. From the upper to downstream of land are equally fertile for mustard production. In the upper stream, the district of Kurigram and the northern part of Gaibandha are very high productive zones for mustard cultivation. In the middle stream, the northern part of Jamalpur and Bogra has a very high density of mustard production (Figure 5j). In lower part of the middle stream in Bogra district, some areas have high mustard production, i.e., 65,919.89 hectares or 19.35 % of the total cultivable land. There is hardly any area found of very low mustard productive zones in the middle stream

which includes the district of Gaibandha, Jamalpur and Bogra which was 8,372.28 hectares covering nearly 2.46% of the total land for mustard production. In the lower stream, the southernmost part of Sirajganj district nearly 22,395.15 hectares which is 6.57% of the total available land, is moderately suitable for mustard. Only 82.72 hectares (0.05%) in southern Jamalpur, far away from the main river course is low productive zone for mustard cultivation (Table 3).

5.0 Conclusion

A large number of non-governmental organizations (NGOs) work in nearly every sector in the studied region. The sort of project for which they get funding determines the objective and extent of their employment.According to the findings, local NGOs in the research region have aided farmers by providing agricultural supplies (seed, fertilizer, pesticides), agricultural tools, financial loans, agricultural trainings, irrigation facilities, and kitchen gardening, among other things. Farmers are selected for aids based on their socio-economic condition, i.e., poorest people are given priority.The study shows that three varieties of rice named as; *T. Aman, Boro* and *T. Aus* are grown in the study area. *Boro* rice suites best in the soil of study site while the land for jute and potato is moderately suitable. Furthermore, the production of chili, ginger and turmeric is perceived very low among sampled respondents due to unavailability of suitable land. The research concludes that most of the farmers in the study area are from the poorest of the poor communities of the country. Regardless of the fact that NGOs are providing agricultural support to those poor farmers, it is advised that government agricultural extension institutions should also train farmers on how to improve agricultural production as well as raise awareness among the farmers to identify suitable location for crops beforehand. Besides that, setting the clear policy goals on improving farming, improving the use of advanced technology for farming, improving market access and other technical assistance will help farmers to improve crop yield.

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Enabling environment for implementing IWRM in Bangladesh: A Policy Network Perspective

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Abstract: Integrated Water Resources Management (IWRM) is being implemented since 1990 to solve the water problems of Bangladesh. However, due to the environmental, developmental, and administrative challenges, the effectiveness of IWRM implementation is hampering. Bangladesh Government has formulated the National Water Policy (NWPo, 1999) and Water Act (2013) to reduce these challenges. Although both policies are significant in this regard, some contradictions in the policy are hindering its implementation. While some administrative problems are acknowledged in the literature, little empirical research has been undertaken to provide insights into the strengths and weaknesses of the policy development processes and the implications for IRWM implementation. This paper uses Policy Network Analysis (PNA) to explore how the water policy development process affects policy implementation. This paper uses semi-structured interviews and document analysis to comprehensively understand how both policies were developed in Bangladesh, offering insights into how actor interactions support or hinder policy development and implementation. Research findings show that the policy development process is defined as flawed as some important water actors are not included in this process, and cooperation among the actors involved is not valid. There is a problem in power practice as the included actors do not have the same resource provider capacity, which has increased the interdependence of the minor actors in the policy network. Flawed policy process and the absence of local communities (women and NGOs) have blurred the rules and regulations regarding the mandate and responsibility of actors who affect the policy implementation.

In some cases, disclaimer rules and regulations limit the actor's access to the policy network processes. Findings suggest that a revision of existing policy and Act is needed to support an improved enabling environment for effective policy implementation in Bangladesh. Such an amendment needs to adequately consider the interactions, roles, and power of IWRM actors, highlighting the need for further study to identify adequate institutional arrangements.

Keywords: Water Policy, Water Act, Policy Network Analysis, IWRM, Enabling Environment

Introduction

Since independence, there has been a concern about the misuse of water resources and associated inequitable environmental and socio-economic consequences in Bangladesh (Giordano & Shah, 2014; Rasheed, 2011). Since the sustainable development of Bangladesh is involved with the water sector, a comprehensive mitigation strategy is needed for adequate water resource management (Gain et al., 2017a). For decades water experts have been attempting to implement IWRM in developing countries like Bangladesh due to its perceived capacity to address long-term water security crises (Bandaragoda & Babel, 2010; Gain et al., 2017b). Like many other developing countries, following recommendations of several summits and conferences (e.g. United Nations Water Conference, 1977; The Dublin Conference on Water and Environment, 1992; Rio Summit on Environment and Development, 1992), Bangladesh commenced Integrated Water Resources Management (IWRM) in the early 1990s with diverse outcomes

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(Biswas, 2008b; Chowdhury, 2010; Das Gupta et al., 2005; Gain et al., 2017a; Rahaman & Varis, 2009; WARPO, 2015). IWRM provides the mechanisms and drives to improve water management and water governance activities, reforming water agendas according to countries development needs (Biswas, 2004; Gain et al., 2013; Rouillard et al., 2014). However, its implementation in Bangladesh has been hampered due to environmental, developmental and administrative challenges (BIDS, 2014). As identified in the literature, an appropriate enabling environment (e.g., policies, legislative framework, and financing structures) can help address these challenges and support effective IWRM implementation (Chowdhury, 2010; Rasheed, 2011; WARPO, 2015).

The Government of Bangladesh (GoB) has developed a significant legislative environment to enable IWRM, including the National Water Policy (NWPo, 1999) and the Water Act (2013) (MoEF, 2012; MoWR, 2013; WARPO, 2015; World Bank, 2017). The NWPo sets the ground rules for water allocation to different users, water rights, pricing, and environmental safety (Gain et al., 2017b; Rasheed, 2011; WARPO, 2001). The Water Act provides integrated development, management, distribution, use, protection, and conservation of water resources (Cook, 2010; MoP, 2010; MoWR, 2013; Muller, 2010; WARPO, 2015). The NWPo is conceded as being a practical and reasonable approach to enable IWRM by considering basic IWRM principles (e.g., economic efficiency, social equity, and equilibrium of ecosystems) (Gain et al., 2017b; Rasheed, 2011; WARPO, 2001). Despite this, and the positive intentions of the GoB in developing the NWPo and Water Act, their influence on the IWRM implementation has been hindered by both the inefficient processes used to create the policy and the Act, and their content (Alam, 2014; Gain et al., 2017a; Gain et al., 2013; Rahman, 2014; Rouillard et al., 2014; WARPO, 2015; World Bank, 2017). Although the adverse impact of these public administration processes on policy implementation is acknowledged in the literature, very little is known about the details of the water policy and Act development processes and how these directly impact IWRM. This paper provides a critically analyze the methods used to develop the NWPo and Water Act to understand better the strengths and weaknesses of the policy development process (reflected in the policy contents) and how they affect IWRM implementation.

Using Policy Network Analysis (PNA), this paper focuses on a critical analysis of how actors interact within the development process, providing insights into how actors drive and limit the water policy and water Act development and consequently policy implementation in Bangladesh. The specific objectives of the paper are to:

i. Describe how the National Water Policy (NWPo, 1999) and Water Act (2013) were developed.

ii. Describe who was involved in the development of the policy and Act; were any actors or interest groups excluded from the development process, and why?

iii. Identify how the actor's interaction affect the policy development processes and, consequently, effective policy implementation.

Before critically analyzing the policy development process, the paper first briefly describes IWRM and Policy Network Analysis (PNA). Following this, document analysis and semi-structured interviews were used to explore the development of the National Water Policy (NWPo, 1999) and the Water Act (2013); and their impact on the IWRM

implementation. Actors in water policy and act development processes are described, providing insights into how their interaction assists the development process and IWRM implementation. An analysis of the consequences of interests being left out in the policy and act development process is then provided, highlighting their influences on the performance of IWRM. Improvements to water development processes are identified in the concluding remark highlighting what is necessary to improve the enabling environment within Bangladesh to support the effective and legitimate implementation of IWRM.

IWRM in Bangladesh

IWRM is best understood as an umbrella concept which encompasses many principles which enable a holistic and coordinated management approach across the different aspects of water resources systems (Foster & Ait-Kadi, 2012; Gain et al., 2013). Defined as *"a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems"* (GWP, 2000, p. 22), IWRM is an open and flexible approach that can handle multiple and cross-sectoral stakeholders to solve specific water challenges (Bandaragoda & Babel, 2010; Benson et al., 2015; Biswas & Tortajada, 2010; Biswas et al., 2005; Gain et al., 2013; Rahaman & Varis, 2009).

The IWRM definition given by the GPW highlights the three principles (economic efficiency in water use; equity and social justice; and environmental sustainability) that together act as the overall IWRM framework (Bandaragoda & Babel, 2010; Benson et al., 2015; Biswas et al., 2005; Chadwick & Datta, 2003; CSIRO, 2014). Based on these three principles, IWRM uses three 'pillars' to properly implement IWRM (Biswas, 2008a; GWP, 2000). The first pillar is the *enabling environment* which is the focus of this paper. The enabling environment includes the policies, legislative framework, and financing structures that support the implementation of IWRM. A proper enabling environment is essential to ensure the rights and assets of all stakeholders (individuals and as well as private and public sector organizations and companies), and also to protect available assets such as intrinsic environmental values (Alam & Quevauviller, 2014; Albert, 2001; Das Gupta et al., 2005). The enabling environment can create (or hinder) opportunities for the other two IWRM pillars, institutional framework, and management instruments, highlighting the importance of the enabling environment for effective IWRM. The second pillar, *institutional* structure, relates to the organizations and networks developed to implement IWRM. The third pillar, *management instruments*, capture the discrete methods, processes, and procedures that enable IWRM to be implemented, providing information to help decision-makers make rational and informed choices between alternative actions (GWP IWRM Toolbox, 2001). The purpose of the policy and Act as part of the enabling environment is to support the IWRM implementation. The problems and inconsistencies resulting from creating water policy and Act in the inefficient development process must impact IWRM.

With the future development of Bangladesh inextricably linked with the water sector, Bangladesh adopted IWRM in the early 1990s with mixed results (Biswas, 2008b; Chowdhury, 2010; Das Gupta et al., 2005; Gain et al., 2017b; Rahaman & Varis, 2005).

Recognizing the importance of IWRM, the GoB has developed many policies, programmes, and procedures to ensure enabling environment for IWRM implementation (Debnath, 2016; Dewan et al., 2015; GoB, 2013). The policy and Act's development was a significant step in providing an appropriate water governance system, with several IWRM projects completed and many ongoing (see https://www.bwdb.gov.bd; http://www.warpo.gov.bd). The Act provides a solid basis to the NWPo to support IWRM by granting water resource rights to user groups, organizations, and associations, facilitating the best possible use of water resources and nature conservation (Alam, 2014). In addition to the Act, several national development goals (e.g. poverty reduction, food security, gender equality, water pricing, access to safe water, environmental sustainability, etc.) have been considered in other substantial GoB policies, including the National Water Management Plan (NWMP), the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) and the sixth Five Year Plan (Cook, 2010; MoP, 2010; MoWR, 2013; Muller, 2010; WARPO, 2015), further strengthening the enabling environment for effective IWRM. While the collective impact of these multiple policies on IWRM is essential, this paper focuses on the NWPo and Water Act to provide a nuanced understanding of the influence of actors on the policy and act development and support improvements in the Bangladesh IWRM enabling environment. Policy network Analysis (PNA) will help explore the actor's influence in the development process of policy and Act, providing insights into how involved actors contribute to, or hinder, the development process and consequently IWRM implementation in Bangladesh.

Policy network Analysis (PNA)

A policy network is a form of interest group intermediation focusing on the relationship between the state and stakeholders (Arts & Van Tatenhove, 2006; van Tatenhove et al., 2000). PNA offers new problem definition procedures and identifies policy instruments to help manage policy networks developed to solve policy problems (Alam & Quevauviller, 2014; Benson, 1982; Chadwick & Datta, 2003; Chowdhury, 2010). The concept of policy networks was introduced to the study of public policy in the mid-1970s through the work of Scharpf (1978). Then it grew in popularity and has been used to analyze policy-making processes and implementation across various sectors and geographies (Ball, 2012; Ball & Junemann, 2012; Kikert et al., 1997; Klijn, 2009; Marsh & Rhodes, 1992). Given this, PNA provides a useful analytical tool to explain the nature of links and interactions among actors and a new technique to manage policy formulation processes within complex interactive situations (Klijn, 2005) such as IWRM.

Marsh and Rhodes (1992) argue that characteristics analysis of the policy network under PNA has an idea about the possible difficulties in implementing that policy. Three key characteristics of policy network analysis are helpful to analyze actors and how they support or hinder policy development processes: a) actors involved, b) rules and regulations; and c) power relations and resources dependencies within networks (Rhodes, 1990, 2006; Rhodes & Marsh, 1992; Rhodes, 1986; Waarden, 1992). Each of these is described in further detail below.

Actors within the policy networks

The actor's characteristics affect the policy development and implementation process (Peterson, 2003). The policy development process is better through appropriate actor

selection, which has an apparent effect on implementing that policy (Börzel, 1998). Challenges can be created during any policy development process due to the absence of actors relevant to the networks and less cooperation and unrealistic bargaining amongst actors (Klijn et al., 1995). Actor performances can be assessed at the policy outcome level by analyzing how involved actors support the development process to produce high-quality policy. Also, the development process was hampered due to left out interests (Fischer & Miller, 2006; Marsh & Smith, 2000; van Tatenhove et al., 2000). The role of the actor's in policy development has a far-reaching impact on that policy implementation (Klijn & Koppenjan, 2000). Even if there are proper rules and regulations, later, such policy output is not sound even the kind of work done following this policy.

Rules and Regulations within the policy networks

Policies are rules that an organization makes to achieve its aims and goals. Regulation is considered a restriction imposed by authorities to make people follow the desired code of conduct. Rules can be formal or informal; for example, they could be a set of guidelines with little or no consequences depending on the person enforcing them (Klijn & Koppenjan, 2000). The network rules are not fixed but can change in response to different situations (Koppenjan & Klijn, 2004). The regulation provides the frameworks agencies use when developing rulemakings by setting guidelines for developing and implementing policy or Act (Megdal et al., 2017). Rules and regulations guide the actor's behaviour, including resource distribution and interactions between actors (Klijn et al., 1995; Marsh & Smith, 2001). Klijn and colleagues (1995) argue that both rules and regulations can specify the mandate, power and responsibility of involved actors based on deciding policy development, adjustment and implementation stages (Waarden, 1992). The effectiveness of policy networks will be significantly impacted without the proper specification of actor mandate and responsibilities, which are guided by the rules and regulations (Hu et al., 2019; Tejada-Guibert et al., 2015).

Power Relations and Resource dependencies within the policy network

Typically resources include money and knowledge (Marsh & Smith, 2000), although information can also be exchanged as a vital resource. Power is a relational concept that considers the actor's ability to support a policy network from its development to implementation phases (Marsh, 1998; Peterson, 2003). Power distribution and resources within a network affect the policy outcome and influence how the policy develops. The success or failure of the policy development depends on the actor's ability to provide resources, what Rhodes (1986b) has termed 'power dependencies'. Though actors are mutually interdependent in terms of their aid exchanging capacity (Peterson, 2003; Waarden, 1992), the authority of resource providing refers to the power of an actor (Leroy & Arts, 2006). The wide variation in resource supply affects the power balance of the policy network (Klijn & Koppenjan, 1999). Usually, providers of these primary resources dominate the network, influencing network rules and behaviour; hence the distribution of resources between actors within a system affects the policy outcomes (Leroy & Arts, 2006) with power balance among actors significant when developing effective policy. At the same time, the type and size of the network, together with its administrative characteristics and the degree of centralization, also can play a vital role in shaping power relations within a network (Fischer & Miller, 2006). With this

understanding, we can better determine the resource, mandate and responsibility, and interdependency amongst actors within the policy network.

The paper recognizes the utility of policy networks better to understand the challenges within the Bangladesh water policy environment. Using the PNA framework initially developed by Marsh and Rhodes (1992), the paper focuses on the three main network characteristics: actor traits (types, numbers, interests), network rules and regulations, and actors power relations and resource distribution to develop a comprehensive and critical understanding of policy development and implementation in Bangladesh.

Data and Methods

Interviews and document analysis were both used in this study. In-depth semi-structured interviews with 30 water professionals and experts were completed, including crucial informants from government organizations (25) and NGO representatives (5). Interview respondents were asked according to the PNA framework (e.g., actor types, numbers, interests, network rules and regulations, actors power relations and resource distribution), focusing on how IWRM implementation is influenced by the policy and act development processes. Interviews were undertaken with water management professionals (BWDB and WARPO) and experts (CEGIS, IWM, BARSIK), lasted up to 45 minutes in duration and were recorded and transcribed following the approved ethical protocols (HREC-20180367).

In addition to the interviews, documents were collected from professional water management organizations, government agencies, private institutions, relevant non-governmental organizations (NGOs), and funding bodies where appropriate. Materials include government notifications, public records, various policies from the national organization in detail by referring to multiple government publications and reference books, journals, published data from time and other statistical data, media reports etc., regarding water resources management of Bangladesh. Documents were collected directly from institutions[1] that were involved in preparing both Water Policy (1999) and Water Act (2013) and currently working with IWRM implementation?

Thematic analysis of the collected transcripts and documents was guided by the PNA approach, identifying actor characteristics, impacts of rules and regulations, examples of power relations and resource distribution, and actor dependencies and their impacts on IWRM implementation. The thematic analysis enabled an exploration of the properties and dimensions of PNA categories, identifying relationships between types, and uncovering different patterns between groups. To maintain the anonymity of study participants, quotes from interviewees are attributed numerically based on their place of, e.g., WARPO 1, BWDB 1, CEGIS 1 etc.

[1] Water Resources Planning Organization (WARPO), Local Government and Engineering Department (LGED), Bangladesh Water Development Board (BWDB), Institute of Water Modelling (IWM), Ministry of Environment and Forest (MoEF), Centre for Geographic Information Systems (CEGIS), NGOs and academic institutions.

Development of the National Water Policy (1999) and the Water Act (2013)

The National Water Policy (NWPo) is the first step towards IWRM implementation in Bangladesh (Mainuddin, 2003), guiding water resource management through all relevant ministries, agencies and local bodies (WARPO, 2000). The Water Act 2013 is the latest and most crucial water policy in Bangladesh, developed by the MoWR to ensure development management, exploration, distribution, use, protection and conservation of water resources (WARPO, 2015; World Bank, 2017). The Act is applicable for the surface water, groundwater, seawater, rainwater, and water in the atmosphere in the territory of Bangladesh (Gain et al., 2017a; Pal et al., 2011). The Act absorbs contents from previous water regulations and supersedes all previous water-related policies, which is the source of some inconsistency of the Act that influences the effective IWRM implementation (Alam & Quevauviller, 2014; Chowdhury, 2010). Water Act (2013) is the latest water policy based on NWPo (1999), and the development process is the same. Therefore, for the convenience of discussion, all the analysis will be done by mentioning both policies as 'water policy'. Why and how such difficulties and inconsistencies have been created during the policy development process and their impact on the policy implementation, the purpose of this paper is to analyze these according to the PNA framework.

Discussion and analysis of the water policy and Act development process using PNA

This section discusses how the actor's interaction relationships affect policy development and implementation following the PNA framework. Here we identify which actors were included and excluded from the policy development process and the consequences of this inclusion or exclusion. Actor interactions and relationships within the policy are discussed, specifically those supporting and hindering the development process. Finally, how the policy development process affects policy implementation is addressed in the framework of the PNA.

Actor's role in water policy and water Act development

The subject matter of this section is how the actor's involvement and performance influence the development process of the water policy. First, we identify who was included or excluded from the policy development processes before critically analyzing how their interaction affects that process.

Bangladeshi officials and local experts prepared the water policy without foreign experts, operational water managers or water disaster victims (BWDB, 2016; WARPO, 2015). As water regulators, officials of the Ministry of Water Resources (MoWR) were involved in the developing process from beginning to end, where WARPO and BWDB have worked as supportive institutions. The development process used a top-down approach that prevented local actors from involving and the cost of foreign actors (World Bank, 2017). Several difficulties and inconsistencies have been created during the policy development process, as some important Bangladeshi water actors are not involved, like what Gain et al. (2017) found:

> "…BWDB and WARPO were involved with MoWR in that process as key water bodies; however, due to some important left out actors[2], The policy could not absorb multidimensional concepts that were the sources of a few inconsistencies of policy contents. It was a great mistake. After completing each project, we find some challenges that come from the development process." (WARPO 5, interview)

The opposite picture also emerges from the interview results:

> "…the policy and Act, which included all water actor's, was time-consuming and costly. Instead, I think it is better to review the policy and act based on the outcome of the implemented water projects. In this case, the experience of other countries can be taken into consideration." (CEGIS 2, interview)

The centralization of the development policy was also identified as a blockage. Despite these groups being left out, industry and community stakeholders are not commonly part of policy discussions in Bangladesh, including the water policy, though they are major impacted and impacting groups with water governance mechanisms (Rasheed, 2011). Political influences and pressure on individuals and departments created a closed policy development environment, with community groups perceiving that their views were not taken into account during policy setting processes, and complaints were not visibly dealt with (GoB, 2013):

> "…community stakeholders and industrial actors did not have the opportunity to contribute to the policy development process due to their absence. However, taking their views on the review process will make the policies much more realistic and increase the success rate of policy implementation." (BARSIC 1, interview)

An essential part of water policy development was to absorb contents from the previous water-related policy. Despite the best efforts of BWDB and WARPO, there are some contradictions in the policy content due to the absence of the representative of women and local NGOs, similar to what Rasheed (2011) found:

> "…indigenous knowledge often plays an important role in policy implementation at the local level, which can only be obtained from women and NGOs. The role of indigenous knowledge in the emergency water crisis period is much more fruitful. Due to the absence of these actors in the policy development process, indigenous knowledge could not be properly incorporated into the policy content. This should be considered very seriously in future policy reviews." (CEGIS 1, interview)

The acceptance of the policy would have increased if the important actors left out of the policy development process were included. Policy rules and regulations can play a vital role in minimizing the contradictions that result from flawed water policy development processes.

Rules and regulations to the policy and Act development

Here is a detailed discussion of how flawed policy development processes affect policy rules and regulations. Due to the poor policy development process, some rules and

[2] Bangladesh Haor & Wetland Development Board (BHWDB), Institute of Water Modelling (IWM) and Centre for Environment and Geographic Information Services (CEGIS), Department of Agricultural Extension (DoA), Bangladesh Agricultural Development Corporation (BADC), Barind Multipurpose Development Authority (BMDA), Local Government Engineering Department (LGED), Department of Public Health Engineering (DPHE); and Water and Sewerage Authority etc.

regulations remain contradictory, affecting the actor's mandate and responsibility, similar to what Alam (2014) found. The water act is broadly a firm policy; however, policy documents are sometimes unclear about the mandate of individual water institutions. There are contradictions in a scope where it is unclear which agency is responsible for implementing particular activities (Gain et al., 2017a). Waterbodies cannot function properly because the actor's responsibility and mandate are not adequately defined in the rules and regulations, even if the main waterbodies struggles to meet their responsibilities (World Bank, 2017):

> "…WARPO, as an institution, has challenges in terms of unclear mandate and responsibility. WARPO is the apex body of the water sector, and it is responsible for providing clearance to any project related to the water sector. However, the Planning Commission approves more than one thousand projects yearly, and it is difficult to call upon WARPO in every project approval meeting. WARPO is unable to properly maintain its responsibilities due to lack of workforce and resources."
>
> (WARPO 12, interview)

WARPO is facing some more difficulties in fulfilling its responsibility due to contradictions created during the policy development process (Alam, 2014):

> "…WARPO is the main body to implement the Water Act 2013, the latest water policy; however, there is no specific clause regarding the financial mechanisms for this implementation. Also, the policy has not provided any guidelines on the institutional setup of WARPO. For example, the policy does not specify which institution will ensure the Environmental Quality Standard (EQS); is it WARPO or Department of Environment (DoE)?" (WARPO 13, interview)

Water Act is the latest water policy, which absorbs content from previous water regulations and supersedes all previous water-related policies[3] (GoB, 2013). Occasionally confusion over linguistic translation leads to confusion about the responsibilities described in rules and regulations (WARPO, 2015). Due to which involved actors try to impose their duties on each other, in contrast to GoB (2013). This has adverse effects on policy implementation:

> "…there are some serious policy gaps where the policies have been translated or interpreted. For example, the Bangla version of the water act (2013) states that safe drinking water for all will get priority; however, the wording in the English version of this water act is unclear. Therefore, according to the water act, the government is not legally obligated to ensure safe drinking water in the coastal area where there is no source of drinking water." (BWDB 7, interview)

The regulations of the water policy provide the legal framework for the water-related organizations to provide essential services to the threshold area (Gain et al., 2015). In this case, the service may be interrupted due to the conflict of policy regulations with the service provider regulations. A prominent water actor can take the initiative to enhance the policy regulations based on data collected from affiliated organizations:

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[3] The Disaster Management Act 2012, Integrated Small-Scale Irrigation Policy 2011, Coastal Development Strategy 2006, the Coastal Zone Policy 2005, National Policy for Safe Water Supply & Sanitation 1998, Environment Conservation Act 1995, National Forest Policy 1994, Groundwater Management Ordinance 1985 and the Forest Act 1927 (WARPO and BWDB, 2019).

> …drinking water and water pollution provision not adequately reflected in the water Act regulations that create contradictions in Dhaka Water Supply and Sewerage Authority (DWASA) responsibilities. Consequently, DWASA cannot supply safe water in city areas where the public sector is legally responsible for drinking water. To ensure developing effective regulations, WARPO may seek necessary data and information from DWASA, DPHE, BWDB etc. Once data is collected, WARPO could decide the threshold of using surface and groundwater based on a complete situation analysis.
>
> (WARPO 11, interview)

Rules and regulations play a vital role in policy implementation. Therefore, the existing inconsistencies in the rules and regulations usually caused by the policy development process are not reduced; the policy effectiveness will decrease. The existence of contradiction rules and regulations related to the mandate and responsibility of the actors has a significant impact on the resource distribution amongst actors. This has an apparent effect on the actor's dependence and power relation.

Power relations and resource dependency on policy development

Though the latest water policy covers several key water issues very well, some critical issues, including actors power practice in terms of resource exchange and actor interdependency, were inadequate or occasionally missing due to inconsistent rules and regulations (Chan et al., 2016). The nature of the resource distribution of the actors involved is just as essential as the absence of some vital actors behind the flawed policy development process (WARPO, 2015). Funding and knowledge are considered crucial resources to the policy network. The power of actors in the policy network depends on their ability to provide. Although there is a continuous interdependence in the policy network, the power practice of actors with unequal assets creates more interdependency amongst actors within the water policy network, which has far-reaching effects on policy implementation (Gain et al., 2017a):

> "…MoWR, BWDB and WARPO were involved in the water policy development process. However, not everyone had the same resources. Due to the low resource capacity of BWDB and WARPO, in most cases, MoWR has taken important decisions in this development process. As a result, more and more interdependent tendencies are observed among the actors of water policy" (WARPO 11, interview)

It is clear that the actor's resource providing ability and interdependency are interrelated (Marsh, 1998). A few powerful actors set the rules and regulations they need to have future benefits (Marsh & Smith, 2000). This leads to increased power imbalance and the actor's interdependence within the policy network, which undermines network stability (Medema et al., 2008):

> "…GoB was the main financial resource provider in the water policy development process supervised by the MoWR, where BWDB and WARPO have acted as a supportive institution. As a key actor, MoWR has tried to create rules and regulations with emphasis on the interest of GoB so that the government can directly control other actors in the future. The effect of which can be seen in the policy implementation. For example, without the prior permission of the MoWR local actors cannot take any decision even in an emergency." (WARPO 14, interview)

However, there are contradictory views on the above comments:

> "…Although the MoWR is the dominating actor in the water policy development process, in some cases, it has made excellent decisions in favour of WARPO and BWDB. It arranges an annual budget for both organizations to make their policies as they see fit. Moreover, there are clear guidelines on how these organizations will help each other. In this sense, the policy development process can be considered as satisfactory and acceptable in a broad sense." (BWDB 3, interview)

The inclusion of international donor agencies[4] could play an important role:

> "…the technical support of the BWDB and WARPO was not adequate to the policy-making process. If international donor agencies like UNICEF, UNDP, World Bank, JICA were included, they could have made the whole effort much more effective with their financial and technical support. To increase awareness, they could play a role in incorporating some sections in rules and regulations, so that public, private, academics, NGOs and women representatives could be more involved in the policy process."
>
> (CEGIS 1, interview)

In this case, many have given alternative opinions:

> "…international donor agencies could take good initiatives but tried to control the whole processes, so it was not easy for the GoB to formulate and implement any policy in the future without their help. This would have increased the actor's reliance on international donors, which would have reduced their ability to operate policy independently."
>
> (CEGIS 1, interview)

The water policy development process has been hampered due to the absence of some important water actors. The less cooperation of included actors is also responsible for making this process flawed. MoWR is the only key actor in this process, and there is no other waterbody equal to it. The sole authority of the MoWR is seen in the policy-making decision. This has led to the conclusion of the MoWR to make policy. As a result, other actors like WARPO and BWDB become more dependent on the MoWR, which is unsuitable for the policy. The local community and NGOs have not expressed their views on the 'top-down' policy development, which has affected the rules and regulations. The local community is rich in indigenous knowledge, and local NGOs work on the life and livelihood of the local community. Moreover, any policy's effectiveness is justified by how much the local community has benefited from that policy. Due to the absence of local communities and NGOs, the policy formulation process has been deprived of indigenous knowledge and experience, which could have further enriched the policy.

Recommendations

- Policies related to the water sector need to be reviewed individually, and institutional specifications and overlaps between institutions and policies should be identified.
- Policy interactions and overlaps should be urgently reviewed to understand how all relevant policies can be optimized as an interactive and mutually supportive system of legislation.

[4] United Nations Children's Fund (UNICEF) and United Nations Development Programme (UNDP), World Bank, JICA

- A precise specification is required on the institutional setup of WARPO and BWDB within the water policy.
- A specific clause should be added in the water policy to recommend a suitable financial mechanism for implementation through WARPO.
- When specific local decisions connect to public health, livelihoods or culturally important issues, precise mechanisms need to be created to consult with local stakeholders. This could be done through empowering local decision-making bodies with a multi-stakeholder approach or perhaps by a community impact assessment similar to EIA.
- To ensure effective and practical policy documents, the number of NGO representatives with community water engagement experience could be raised, perhaps to at least two representatives in the National Water Resources Council and the Executive Committee.
- Indigenous knowledge should be incorporated in the water-related policies, and the awareness of the general people should be increased through advertisement on television, radio etc

Conclusion

Water policy development has been completed in the top-down process. It is a source of contradiction which is reflected in the rules and regulations. Actors do not have a clear idea about their mandate and responsibility, so actors have to a variety of problems in fulfilling their obligation. Actors try to impose duties on each other, or some actors take on extra responsibility, which upsets the policy balance. The rules and regulations give some actors additional responsibility beyond their means, affecting the actors' resource distribution and power practice. Some critical issues, including actors power practice in terms of resource exchange and actor interdependency, were inadequate or occasionally missing due to inconsistency of rules and regulations. Resource distribution and power balance would be excellent if some water organizations of equality were included in the water process. Some large water organizations that can provide adequate resources could be involved in this process. This would have led to a balance between power practice and resource distribution, significantly reducing the interdependence of actors in the policy network. International donors and NGOs and local and NGOs and communities could play a crucial role in this regard. Increasing the capacity of relatively small actors included in the policy development process has resulted in a balance between the existing resource supply and power practice in the policy. Since water policy has already been established, and numerous water projects are being carried out following it. So, some contradictory clauses of rules and regulations can be modified under policy review for increasing the effectiveness of the current water policy. The issues that should be considered seriously in the policy review are highlighted in recommendations in the previous section.

Further research is essential to the satisfactory completion of a policy review that can help bring out some crucial options in this policy review. An empirical study will help to properly understand the influences of the policy development process on effective IWRM implementation in Bangladesh. The findings of such research will help all water actors in

Bangladesh align on an accurate roadmap for healthy, sustainable water sector development.

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Linkage between the My Village My Town Program and National Institutional Framework of Bangladesh

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Abstract: A significant portion of the total population of Bangladesh live in rural areas with lack of various facilities, services and amenities which in turn persuade the rural urban migration, unemployment, poor socio economic condition. To reduce the disparity among the urban and rural areas as mentioned in section 16 of our nation constitution Government of Bangladesh is going to implement My Village My Town Program in rural areas. This study tried to link the different sectors of the project with the national institutional frameworks like National Agriculture Policy 2010, National Rural Development Policy 2001, 7th Five Year Plan 2016-2020, ICT Policy-2018, National Education Policy-2010, Disaster management Act 2012, BCCSA 2009 & National plan for disaster management 2021-2025. The aim of this study is to find out whether the existing national legal framework support the different issues mentioned in My Village My Town projects or any further national legal framework or policy support is needed. The result found that the current national legal framework supports the every sector of the My Village My Town program. Some important considerations need to be considered while implementing this project to get optimum result for this project.

Introduction

Rural and urban areas are intertwined economically, socially, and environmentally (Gebre & Gebremedhin, 2019). Thus, ultimate national development requires both urban and rural area development. Thousands of villages in Bangladesh that yield agrarian agriculture which supply the country's basic needs for living (Nasrullah, 2005). Therefore, development of rural area demanded crucial importance and long-term national growth necessitates attention to agricultural development (Hossain et al., 2012) with proper utilization of rural resources and bio diversity (Nasrullah, 2005). Rural development, on the other hand, remains a major problem for emerging countries. Rural poverty creates technical, financial, and other development barriers, yet 70% of the world's poor live in rural areas (World Bank, 2009). As a result, the world's urban population is growing at a rapid pace than it has ever been, necessitating more attention to urban development, particularly in developing countries. Nearly seven out of ten people in the world will live in cities by 2050 (World Bank, 2019). The main reasons of this upsurge of urban population are employment attraction, community facilities and expectation of higher quality of life. On the contrary, rural areas are suffering from lack of basic facilities for quality life. In the meantime, rapid urbanization causing lack of urban facilities and services. Thus, the quality of urban life is decreasing. This problem can be trade off by proving urban facilities in the rural area with conserving basic characteristics of rural area.

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With an average annual growth rate of 3.29 percent, Bangladesh's urban population has increased from 7.9% in 1971 to 38.2 percent in 2020 (Knoema, 2020). This increased pace of rural-urban migration causing urban deprivation and destroying traditional rural life in Bangladesh. Approximately 50.96 percent of slum dwellers has migrated from rural areas in quest of work/jobs, with poverty accounting for 28.76 percent, river erosion accounting for 7.04 percent, insecurity/disappearance accounting for 2.15 percent, and natural disasters accounting for 0.84 percent (SID, 2014). Additionally, BBS report 2017 reveals that education rate in the rural area is 65% (SID, 2017) and these people are conscious about civic facilities and the betterment of life. This factor also induced rural people to migrate in urban area. Another study reveals that in recent years, the growth rate of the population in urban and rural is 3.27% and -0.0799% respectively (Trading Economics, 2020). The disparity between rural and urban areas in terms of poverty levels, disaster vulnerability, and facilities for a better quality of life are the key drivers of this rural urban migration in Bangladesh. However, it is a hope that more than still agriculture share 40% of total labor force which contributing 13.65% of Bangladesh's gross domestic product (GDP) in 2019 (Khatun, 2020). This labor force should remain in village and development in agricultural sector should crucial issue.

Article 16 of the Constitution that the state that adopting effective measures to bring about a radical transformation in the rural areas through the provision of rural electrification, the promotion of an agricultural revolution, the development of cottage and other industries, the improvement in education, communications and public health, in those areas, so as progressively to remove the disparity in the living standards between urban and rural areas is essential part. The mentioned vision is reflected in the government undertaken initiative named “My Village, My Town” program. Additionally, Global Agenda SDG promises that no one will remain (Ahmed, 2020). Thus, rural people should be included in the urban facilities. However, implementation of such project requires legal framework, empowerment of local governance body, political support and legal support. This paper will explore the legal institutional framework which support the segments on which the my village my town project will work to diminish the disparities between urban and rural area.

Research Objective and Methodology

This study focuses on current national policies, act, plans have with a desire to explore linkage with the sectors on which my village my town program will be dealt with to eliminate the disparities between urban and rural areas.

Methodology employed in the study adopts qualitative approach for answering research question. The study is based on secondary sources. First, the details of the My Village, My Town initiative have been studied from exiting literature. Apart from that the national policies and acts -National Agricultural Policy-2010, National Rural Development Policy -2001, 8th Five Year Plan 2021-2025, ICT Policy-2018, National Education Policy-2010, Disaster management Act 2012, Bangladesh Climate Change Strategy and Action Plan 2009, National Plan for Disaster Management 2021-2025 were reviewed and tried to find out the link between the national legal frameworks and the sectors with which my village my town project will be dealt with. Some literatures from different journals were studied on strategy of rural development. Moreover this study provides some recommendations for the effective implementation of this program.

Concept of My Village My Town

This concept was firstly traced by the father of nation Banggabandhu Sheikh Mujibur Rahman which has been stated in the section 16 of our national constitution. However, this concept was formally leveled by Prime Minister Sheikh Hasinas 11th election manifesto. It reveals that urban amenities will be provided to each village to reduce the gap between the cities and the rural areas. The main aim of this concept is to fulfill the Bangabandhu's dream of Golden Bengal by providing the essential facilities to all the villages including improved roads and communications, supply of safe and pure drinking water, modern healthcare services and proper treatment, standard education, proper sanitation and waste management, social security, supply of power and minerals, setting-up of bio-gas plants and solar power panels, computers with high-speed internets, electrical equipment and standard consumer goods, growth centres and markets of commodity goods, flourish cottage and other industries, bank loan for marginal and small entrepreneurs; establish amusement parks, sports and recreation centres, libraries and community spaces, agricultural equipment servicing centers and workshops, training of rural youths and entrepreneurs, rural climate change and disaster management (Hasina, 2018). Installation of this service will play a key role in reducing the rural problems and disparity. This concept could be associated with John Friedmann model which was proposed as a way to generate economic benefits in rural areas by providing basic utilities, such as quality health care and education (Paul, 2017). However, implementation of this concept depends of socio-economic pattern of the local area (Ahmed, 2020).

A successful history of South Korea rural development reveals a lot of emphasis on its industrial sector (Hafiz Iqbal et al., 2017). The key factors of the success of Saemaul Undong are homogeneous communities with a strong tradition of cooperation, solid and consistent economic growth, national leadership and strong political commitment, incentive system and cooperation at the village level efforts and government-led policies and strategies, such as the holistic approach, vertical integration, and horizontal coordination (Rondinelli, 1991). Therefore, this concept of My Village My Town is shaded by local demand and strong local governance with legal institutional framework for laying best output. This can be best illustrated by the figure-1.

My Village My Town Program For Bangladesh: Factors and Forces

This is a huge, comprehensive, complex, and long-term national development endeavor. The government has taken several steps to implement this program, including creating a time-bound work plan, an Upazila master plan, holding national workshops to develop innovative creative working strategies to address the program's challenges, and coordinating initiatives among related organizations. The administration has been developing new plans and bolstering existing ones in order to improve local government entities and ensure openness, accountability, and increased public participation in all stages of development (Islam, 2020).

Literature reveals that diversification of weather and production are interlinked and the strength of our agrarian production-based economy (Akram et al., 2020) as well as challenging the implementation of the concept of My village my town. Implementation of rural development requires ensuring good governance at micro level, rural bias policy for

multi-dimensional facets of rural life (Nasrullah, 2005). Only the NRD 2001 enabled Union Parishad in terms of law and order within its authority among the existing laws and policies, security of the growth center and law enforcement agencies, as well as the implementation of a Community Policing System (CPS).

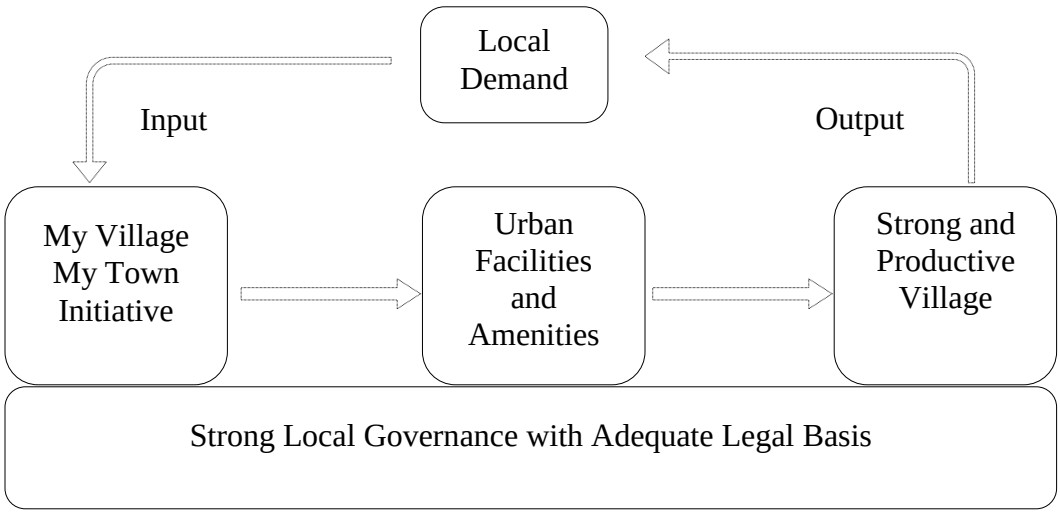


Fig-1 Concept of My Village My Town

Source: Developed by Authors, 2021

Beside, special undertaking for my village my town are:

- Zero corruption
- Empowerment of local government body (Hasina, 2018).

On the other hand, cluster-based committees, in addition to other ongoing programs by several ministries to increase civic services in villages and rural areas has been taken (Financial Express, 2021) and 25 guidelines and 13 consultants in charge of overseeing the development of standards or policies, as well as survey work has been proposed by government (Prothom Alo, 2021). Additionally, the pilot project will begin in 15 villages (Islam, 2020) and at the Local Government Division, eight villages in eight upazilas of eight divisions and seven in selected areas (of Haor, Char, Hill, Coast, Barind, Midland beels and two adjoining economic zones) has been chosen for this program (Rahman, 2021).

Therefore, factors and forces that will ensure success of this project are adequate funding, accountability, transparency, local people's participation in every development stages and support from government authorities with proper legal basis. To look at all these factors and forces while implementing the concept of my village my town, there need to examine implementing authority and policy support in Bangladesh. Table-1 illustrates the state of sectors of this concept, implementing agency and existing policy support to implement the program in Bangladesh.

My Village My Town Project Linkage with the National Frameworks

This section presents the short description of the different sectors of My village My Town project with the legal support.

Table 1: Sectors of My village My Town with legal support and respective ministries and authority

Sector of My village My Town Concept	Description	Legal Support in Bangladesh	Implementing Authority
1. Improved roads and communications	It includes road widening, fund for road maintenance, quality construction materials etc.	Provision of rural road widening of 7th Five Year Plan (2016-2020), Section 5.3.6 of National Rural Development Policy 2001 stated about measure for rural infrastructural development.	Union Parishad, LGRD&Co
2. Supply of safe and pure drinking water	Establishment of deep tubewell, drainage system and prevention of river water pollution in dry season	Less policy support only section 5.19 of NRD-2001 has stated about rural environment promotion grossly and section 5.3 for infrastructural development.	Local Government and LGRD&Co
3. Modern healthcare services and proper treatment	Establishment of modern health care facilities at village level	Section 5.6 of NRD 2001 supports rural health and nutrition improvement for both men and women including children.	Ministry of Health, LGRD&Co and Union Parishad
4. Supply of power and minerals	Construction of three phase electric line, continuous supply of electricity specially in night time and irrigation time, providing gas supply or subsidized cylinder gas supply, Subsidized solar panel, setting-up of bio-gas plants and solar power panels	Section 5.24.1 of NRD 2001 stated to rapid expansion of rural electrification. However does not stated about quality of supply.	Ministry of Power, Energy and Mineral Resources, Union Parishad, NGO Use of PPP in electrification
5. Rural information and communication	Establishment of digital center at union level, places of poster, banner at public place for announcing services, affordable mobile internet services to the youth, community radio etc.	ICT policy 2018 sction 1.3, 4.2, 8.3 may support for establishing internet service center at village level, ICT training for youth and inclusive access to internet services. Section 5.26 of NRD 2001 for information dissemination and data Base using ICT.	Ministry of Posts, Telecommunications, and Information Technology

Sector of My village My Town Concept	Description	Legal Support in Bangladesh	Implementing Authority
6. Standard education	Improvement of Educational quality in rural school, reduction of school dropout and expansion of vocational and technical education	National Education policy 2010 section 2, 5, 12, 22, 24 stresses on technical education, quality education and education for all measures.	Ministry of Education
7. Heath, Nutrition and Family planning	Health care center at village, ambulance facilities at emergency, special attention of women health, treatment at low cost, awareness on population growth	NRD 2001 in section 5.6 and 5.7 stated about rural health improvement and and rural population control.	Ministry of Health and Family Welfare, NGOs
8. Bank loan for marginal and small entrepreneurs	Introduction of agricultural loan, easy access to loan facilities etc.	No clear policy support. Only section 5.7.5 of National Agricultural Policy stated about micro credit finance for farmers.	NGOs, Government Commercial Banks
9. Rural security	Employment of police security at village level and enabling Shalish board	NRDP 2001 empowered Union Parishad in terms of law and ordered within its jurisdiction. Specifically security of growth center and law enforcing agency, Introduction of Community Policing System(CPS)	Home Ministry, Union Parishad, Ministry of Finanace
10. Growth centres and markets of commodity goods	Ensuring management of growth center and supply of quality goods at profitable price, agricultural equipment servicing centers and workshops	National Agricultural Policy 2010 fully supported for innovative process for marketing of good, equipment for agriculture specially section 10 of the policy.	Union Parishad
11. Social security	Allowance for older people, employment opportunities for widowed women	NAP 2010 stated to engage women in agriculture but not specifically in other employment for widow or olders, Section 5.14 of NRD 2001 take measure to help disadvantageous people.	Ministry of Social Welfare, NGOs
12. Proper sanitation and waste management and housing	Introduction of improved technology to the rural housing, sanitation and waste management, low interest and protracted loan facilities for housing development and public awareness for	Section-16 of our National constitution, Section 9 of 7th five year plan, Strong policy support has been stated in section 5.8 of NRD 2001.	LGRD, Housing and Public Works Department, Union Parishad

Sector of My village My Town Concept	Description	Legal Support in Bangladesh	Implementing Authority
	sanitation and waste management		
13. Flourish cottage and other industries	Establishing agro based industries at the peripheral area of the village to generate employment.	National Industrial policy 2016 stated special emphasis on small and cottage industries, section 5.10 of NRD 2001 stated measures for rural industries.	Bangladesh Small and cottage Industries corporation (BSCIC)
14. Community facilities	Establish amusement parks, sports and recreation centres, libraries and community spaces	Section 5.23 of NRD 2001 stated to take initiates for recreation.	Union Parishad
15. Rural climate change and disaster management	Curing after disaster destruction in terms of housing, crops, health etc. Taking preventive measure for disaster	Disaster Managemnt Act 2012 National Plan for disaster Management 2021-2025 Bangladesh Climate Change strategy and action plan 2009	Ministry of Disaster Management, Disaster management bureau and at the rural local level the union disaster management committee and self-help groups.
16. Improvement of rural women and child	Creating employment opportunities for women, special health facilities in community clinic for children and women.	Section 5.6 of NRD 2001, section 9 of NAP 2010 stated about health of rural people and employment of rural women	Ministry of LGRD&Co
17. Rural human resource development and rural youth development	Training of rural youths and entrepreneurs, creation of self-employment including women	Section-12 of National Agriculture Policy 2010 and NRD 2001 support this section strongly through taking measure for youth training, creating self-employment, empowering women.	Ministry of Planning, Ministry of Education

Source: (NAP-2010, NRD-2001, 7th Five Year Plan 2016-2020, ICT Policy-2018, National Education Policy-2010 & Rural Public Demand and Planning-2019, Disaster management Act 2012, BCCSA 2009, National plan for disaster management 2021-2025, Bangladesh Climate change Strategy and Action Plan 2009, compiled by authors)

From the table we can find out some Issues that the factors:

- For different sectors of the My Village My Town project several ministries and authorities are involved. It may be crucial to coordinate and interlink their functions and may create disorder.
- Implementation strategies will be very on spatial context. Based on local socio environmental context, local resources and economy the approaches should be varied and aligned with the local context.

Recommendation

For successful implementation of the My Village My Town project, participation of local people from plan preparation to execution, considering the local context, manpower and resources should be ensured. Participation of local people ensures a sense of ownership among the local people and which will be helpful for uplifting their faith upon government. The different local government authority will be engaged for different sector of My village My Town project like- rural communication, water supply, sanitation, community space and recreation centre development, capacity enhancement of union parishad to ensure the improvement of rural areas but proper coordination among the ministries and authorities must be ensured and if possible they should work under an umbrella. The 25 recommendations provided in Action plan of this project should be of the followed properly. The feedback/output from the first 25 villages in which the project will be implemented as pilot project should be seriously observed and every single shortcoming must be addressed properly.

Conclusion

The project is a highly demanded, varied and ambitious. There are challenges in developing pragmatic, appropriate and sustainable and an integrated plan for providing the urban facilities in all rural areas. It's difficult to come up with one size fits all. Among those many challenges it need to have proper legal framework and coordination among various ministries and authorities. From this study it has been revealed that every sectors of the My village My Town project are stated in different national policies and acts and several authorities are assigned to deal with different sectors. However further research should be done on how these authorities could be coordinated and work under one national plan for fulfilling the aim of the My village My Town project and remove the disparities between rural and urban areas.

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Impact of Urbanization on Life Expectancy in South Asian Countries

Mala Rani Das*

Abstract: Life expectancy is globally considered a vital health indicator and a significant weight of human development which is in fact, the key metric for the assessment of population health. Urbanization has got a longer impact on it. Life expectancy is seen higher if a nation is more urbanized. Nations with highest life expectancy are categorically urbanized whereas most of the nations with the lowest life expectancy are predominantly rural. The sole purpose of this study is to find out the effect of urbanization on life expectancy in five south Asian countries. Applying redundant Fixed Effect Model the study has identified that the fixed effect model is better than Pooled Model. Furthermore utilizing Hausman test the study also indicates that it's better to use FEM rather than REM one for five south Asian countries during the time 1969 to 2017. If urbanization increases by 1%, life expectancy increases by about 0.36% in the selected south Asian countries.

Keywords: life expectancy, urbanization, pooled regression, redundant fixed effect test, fixed effect model (FEM), random effect model (REM), hausman test.

Introduction

There have been many dramatic changes in the previous century throughout the world. Rapid expansion in urbanization and increase in life expectancy are two of those changes. Due to urbanization, agriculture faces decay and industrialization propels the habitats shifting from villages to cities and towns. Urbanization is not only an increase in the number of people living in towns or cities but also an expansion of urban areas and facilities. When people move from their pastoral homes to the cities and towns this is regarded as urbanization and most of the developing countries undergo such way of urbanization, especially when they start being industrialized. Cities and towns gradually become hubs of business and culture, education and healthcare services increase then more people rush out of the countryside to get access of those blessings of city life (www.conservationinstitute.org).Urbanization is significantly linked with economic and social transformations e.g. higher levels of literacy and quality education, better healthcare, lower fertility rate and higher child survival rate leading a longer life expectancy. Also the access to different services and opportunities for socio-cultural and political activities comparing to village life is much more available to the people in cities. In addition to this, for the density of population in urban areas it becomes easy for the authority and other service providers to keep the supply chain of essential goods and services smooth and cost effective. For example, the supply of core facilities as clean water and electricity can be achieved with less effort and cost in the cities. Renowned Schools and colleges, and the universities are preferably established in cities with a view to developing skilled human resources. A variety of subjects as well as training courses offering participants a vast choice for their future career are available in those institutions. People of all strata cohabit in towns and cities which propagates better

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understanding and symphony as well as helps kibble down various social and cultural obstacles. There is also advanced communication and transport systems in the cities. All of these benefits that *accrue* from urbanization have got positive impacts on life expectancy. Actually urbanization is an integral part of a developing society, but it has its opposite side as well. Rapid and unplanned urbanization promotes vulnerability to disaster and spells poor infrastructures such as inadequate housing, water and sanitation, transport and healthcare services which put a reverse impact on life expectancy. The relationship between urbanization and life expectancy is debatable. Researchers detected a notable distinction between life expectancy of those residing in the cities and those in other territory. The premier objective of this paper is to find out how does urbanization influence life expectancy, that is, to examine the mold of relationship between urbanization and life expectancy in south Asian countries. The study concentrate on the effect of urbanization on the life expectancy in five south Asian countries (Bangladesh, India, Nepal, Pakistan, and Sri Lanka.

South Asian Countries:



South Asia consists of eight countries termed as Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. Current south Asian population is 1.94 billion which is over 24% of total world population with a population density of 362.3 per km2 (938 people per mi). Total land area of south asia is 5,134,641 km^2 (1,982,496 sq mi). (https://en.wikipedia./South_Asia). Urban population for south Asian is 36.6 percent and median age is 27.6years.(www.worldometers.info). From 2000 to 2011 the urban population extended by 130 million leading to a rise in urbanization in south asia. Productivity associated with the increasing number of people living in towns or cities gives rise to better improvement/advancement in this region as reflected in the decline of absolute poverty and increase in GDP per capita. During 2000– 2012 per capita GDP increased by 56 percent and average growth expanded by 3.8 percent. Thereby Urbanization paves the way of transforming their economies to prosperity and livability. Eighty percent of GDP comes from manufacturing and service sector. In manufacturing and service sector firms and workers realize better productivity and impetus job creation that made structural transformation in south Asian economy. In the long run urbanization generate economic and social benefits that spread beyond urban boundaries. Thus standard of livings in rural and urban areas converges. However these positive sides can be overlooked by the pressures of urban population growth on infrastructure, basic services, housing, environment and others. South Asia is

known as the abode of most populated urban areas for the rest of the world. Urbanization in south asia has been messy and hidden as reflected in the wide presence of slums. About 130 million urban residents dwell in slums and are disproportionately bereaved of infrastructure, housing and access to basic services undermining prosperity and livability of south asia.(Ellis & Robert 2016).

Life Expectancy in South Asian Countries:

Country	Life Expectancy in Years			
	2018	2019	2020	2021
Bangladesh	72.15	72.43	72.72	73.00
India	69.27	69.50	69.73	69.96
Nepal	70.31	70.60	70.88	71.17
Pakistan	67.02	67.17	67.33	67.48
Sri Lanka	76.72	76.89	77.06	77.22

Source: (www.macrotrends.net)

In 2021 Life expectancy of Bangladesh is 73 years which was a 0.39% gradual increase from the year 2018. For India it was about 0.33% gradual increase from the year 2018. Finally for Nepal, Pakistan and Sri Lanka it was respectively 0.41%, 0.23% and 0.22% gradual increase from the year 2018 (www.macrotrends.net).

Bangladesh: After independence there was a unique health network huge change in health sector. Community clinics were established, union based health centers were introduced, district and upazila based hospitals were launched, moreover enacting medical colleges and hospitals there was a huge change in health sector. Woman empowerment along with social awareness has been identified as emphasizing factor for the enhancement of life expectancy (https://en.prothomalo.com/lifestyle).

India: Improved healthcare and low child mortality are the crucial factors for the advancement of life expectancy. Besides these factors, good sanitation and sewage system, clean drinking water, control of diseases (like smallpox, malaria, tuberculosis), immunization etc are the other distinguishing factors (www.hindustantimes.com).

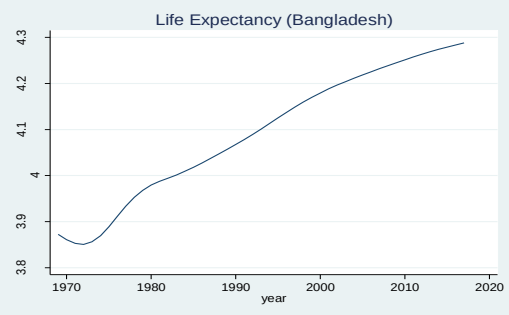
Nepal: Lower mortality rate (decreasing child and maternal mortality), better access to health care, education, nutrition, immunization, women literacy, increase in per capita income etc are the crucial factors that longer the life expectancy for Nepal (http://archive.nepalitimes.com).

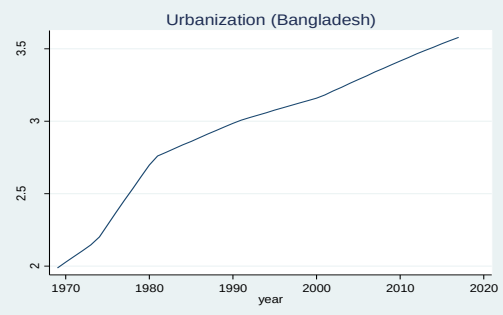
Pakistan: Improvement in health lengthened life expectancy of Pakistan (https://countryeconomy.com).

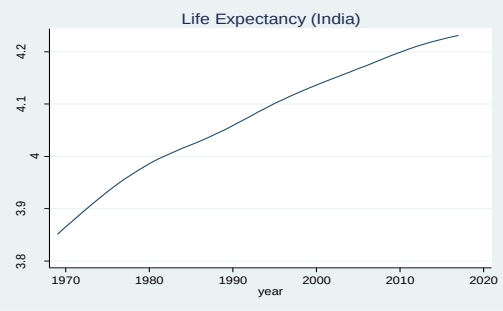
Sri Lanka: Sri Lanka has made impressive progress on its health indicators covering with a health system that involves nearly all Sri Lankans i.e with a strong public health care facilities. Furthermore poverty reduction, immunization, political stability accelerates longer lives for the people of Sri Lanka. (https://www.ha-asia.com/why-are-sri-lankans-living-longer-now)

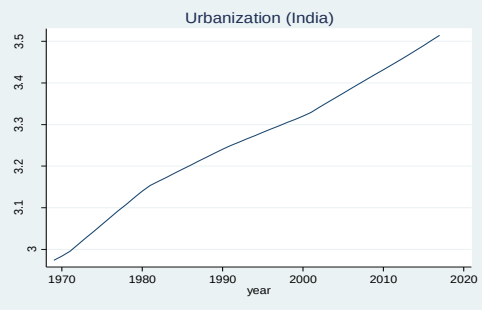
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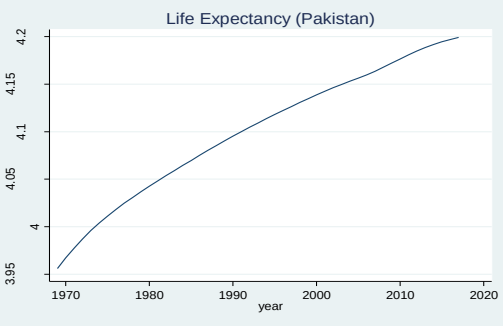
The trend of life expectancy and urbanization from 1969 to 2017 in selected five south Asian countries have been present below and it is found that each country has increasing level of urbanization as well as life expectancy.

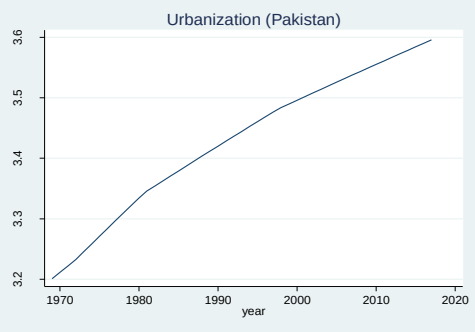


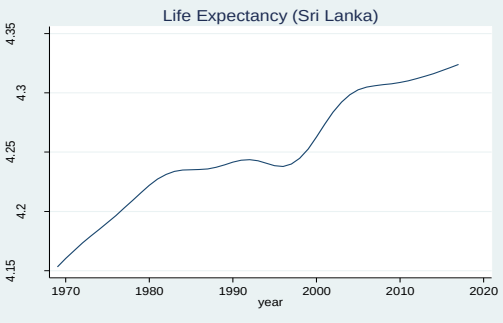


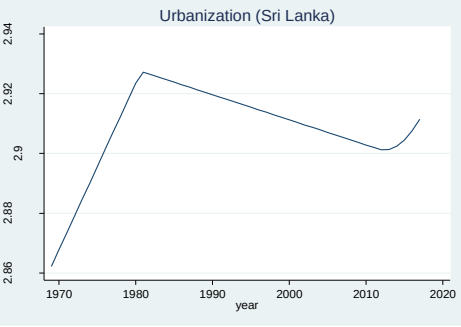


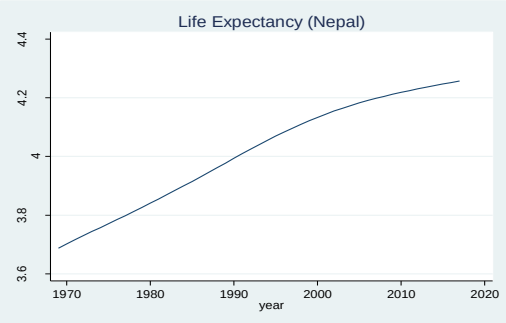


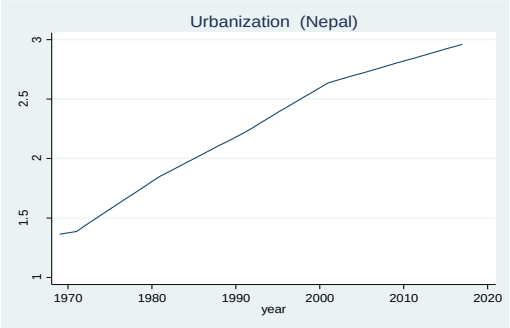












Source: author's calculation

Literature Review

This section covers some previous works related to urbanization and life expectancy. Ali and Audi (2019) concluded that food availability, environmental standards and urbanization had positive significant impact on average life expectancy in selected MENA countries whereas economic misery had negative significant impact on average life expectancy.

Applying (GARCH) model Nkalu and Edeme (2019) showed that environmental hazards decreases life expectancy in Africa, especially CO2 emission from solid fuel consumption contributed much in this regard. Where income and population growth (growth in manpower) increases life expectancy.

During 1861 to 1910 i.e. at the time of nineteenth and beginning of twentieth centuries, there was a high mortality in Europe and North America because of rapid urbanization and industrialization. Urbanization was treated as penalty, if this penalty were absent (Torres et al. 2019) showed Scottish life expectancy would be better.

Khan et al. (2016). Identified the low standard of livings, backward healthcare services, inefficient policy towards health sector, over population with terrorism, lack of standard education were the crucial factors that led to low life expectancy for developing countries. Researchers also clarified that just for the opposite reasons there is high life expectancy of the developed countries.

Using ARDL bounds testing approach Shahbaz et al.(2016) clarified a long run relationship between the variables that is the variables like health spending, urbanization and food supply increases life expectancy where economic misery and illiteracy decreases life expectancy.

Panahi & Aleemran (2016). disclosed that variables related to health expenditure and urbanization cause an increase in life expectancy in MENA countries

From 1980, compared to the rest of the world Brueckner (2016) traced negative but insignificant association between adult mortality and urbanization in sub-Saharan because of HIV pandemic. However before this pandemic there was negative significant association between adult mortality and urbanization.

Monsef and Mehrjardi (2015) identified unemployment and inflation as principal economic factors that had negative impact on life expectancy. At the same time, gross

capital formation and gross national income as another economic factor had positive impact. Moreover urbanization as socio-environmental factor had significant on life expectancy in the selected 136 countries.

Li and Liu (2015) revealed the existence of significant gap between rural and urban inhabitants in life expectancy.

Nnebue et al. (2014) expressed that the health of urban populations has changed because of urban aminities.

Using pooled-OLS, fixed effects first difference and long difference Bandyopadhyay* and Green (2013) Found negative correlation between crude death rates and urbanization. On the other hand use of Granger causality tests and instrumental variables suggested that this relationship was causal.

Idrovo (2011) pointed out that urbanization had positive impact on life expectancy along with factors like industrialization, environmental sustainability, ecological resilience which had the same impact on life expectancy. While Eckert & Kohler (2014) found a positive but insignificant association between urbanization and life expectancy. Urbanization rectify some health problem but degrade others in developing countries meaning that various health outcome is correlated with urbanization.

During the period 1978 to 2012 Apergis, N.& Li, J.(n.d.) wanted to examine the environmental sustainability in the face of change in population as well as their lifestyle using cointegration and instrumental variables methodologies and revealed that urbanisation, population changes and change in consumption patteren significantly contributed to the rise in carbon emissions in China. Reviewing the existing literature I find the gap of conducting this study as there are few works in showing the relationship between urbanization and life expectancy in South Asian countries.

Data and Methodology

To serve the purpose, the study mainly has used secondary data which has been attached in the annex. The necessary data regarding urbanization [represented by Urban population (% of total population)] and life expectancy [represented by Life expectancy at birth, total (years)] has been extracted from WDI of the World Bank from 1969 to 2017. In this study five south Asian countries has been taken into consideration - Bangladesh, India, Pakistan, Sri Lanka, and Nepal. The study is based on Panel Least Square Method i.e. it has followed the following tests- pooled regression, Redundant fixed effect test, Fixed effect model and Random effect method. Redundant fixed effect test has been applied to identify which model is better in between fixed effect model and pooled regression model. (Hunady, J.2016). Furthermore Hausman test has been prosecuted to detect whether fixed effect model is better than random effect model. The study has used statistical package Eviews 9.

Econometric model: pooling all the 245 observations (5 cross-section observation over the period 1969 to 2017) the required balanced panel equation can be written as-

$Y_{it} = \beta_1 + \beta_2 X_{it} + \varepsilon_{it}$ …….(1)

$_{i==}$ 1 to 5 and t = 1,2, 3,4,5…….49.

Where 'i' stands for the ith cross-sectional unit and't' for the tth time period. Y represents lifeexpectancy , X represents urbanization and ε_{it} = error term.

Fixed effect: when 'individuality' of each country differ for each country but if it is assumed that slope coefficients are constant we can write equation (1) as follows:

$Y_{it} = \beta_{1i} + \beta_2 X_{it} + \varepsilon_{it}$ …….(2)

Where, i = 1,2,3,4,5 and t = 1,2,…….49.

This implies that the intercept may vary across individuals (here five countries), each countries intercept does not vary over time

Random effect: From equation (2) β_{1i} is treated as fixed, instead of this, if it is treated as random variable with mean value of β_1 and the intercept value for an individual country can be written as

$\beta_{1i} = \beta_1 + u_i$; i = 1,2….5

Here u_i is a random stochastic term. Five countries lie in a common mean value for the intercept (β_1) and individual variations in the intercept values of each country are counted in the stochastic term u_i .

$Y_{it} = \beta_{1i} + \beta_2 X_{it} + u_i + \varepsilon_{it}$

$Y_{it} = \beta_{1i} + \beta_2 X_{it} + \lambda_{it}$ …….(3)

Where, $\lambda_{it} = u_i + \varepsilon_{it}$

(Gujarati: Basic Econometrics, Fourth Edition, ch 16)

Result Discussion

Pooled Regression:

Dependent variable: lnlifeexp, Sample: 1969 to 2017, period included: 49, cross-section included: 5, total panel (balanced) observations: 245.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.601605	0.042745	84.25698	0.0000
LNURBAN	0.170314	0.014230	11.96829	0.0000

R-squared	0.370857	Mean dependent var	4.105824
Adjusted R-squared	0.368268	S.D. dependent var	0.142387
S.E. of regression	0.113171	Akaike info criterion	-1.511698
Sum squared resid	3.112282	Schwarz criterion	-1.483117
Log likelihood	187.1831	Hannan-Quinn criter.	-1.500189
F-statistic	143.2399	Durbin-Watson stat	0.002551
Prob(F-statistic)	0.000000		

Although pooled regression indicates that urbanization has positive and significant impact on life expectancy but the model contains poor R-squared and adjusted R-squared value. However Redundant fixed effects test suggest that fixed effect model is better than pooled regression.

Redundant fixed effects- likelihood ratio

Null: Pooled OLS is better

Alt: fixed effect model is better

Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	456.681712	(4,239)	0.0000
Cross-section Chi-square	528.409600	4	0.0000

As p value is significant, we can reject null hypothesis and accept alternative hypothesis meaning that fixed effect model is better.

Fixed Effect :

Method: Panel Least Square

Sample: 1969 2017

Periods included: 49

Cross-sections included: 5

Total panel (balanced) observations: 245

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.037543	0.023713	128.0955	0.0000
LNURBAN	0.360842	0.007966	45.29861	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.927210	Mean dependent var	4.105824
Adjusted R-squared	0.925687	S.D. dependent var	0.142387
S.E. of regression	0.038815	Akaike info criterion	-3.635819
Sum squared resid	0.360084	Schwarz criterion	-3.550074
Log likelihood	451.3879	Hannan-Quinn criter.	-3.601290
F-statistic	608.8800	Durbin-Watson stat	0.015941
Prob(F-statistic)	0.000000		

Following fixed effect the result shows that urbanization has positive impact on life expectancy at 1% level of significance. That is if urbanization increases by 1% then life expectancy increases by about 0.36%.

Random Effect:

Method: Panel EGLS (Cross-section random effects)

Sample: 1969 2017

Periods included: 49

Cross-sections included: 5

Total panel (balanced) observations: 245

Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.042465	0.049195	61.84520	0.0000
LNURBAN	0.359179	0.007944	45.21328	0.0000
	Effects Specification			
			S.D.	Rho
Cross-section random			0.096459	0.8606
Idiosyncratic random			0.038815	0.1394
	Weighted Statistics			
R-squared	0.891034	Mean dependent var		0.235639
Adjusted R-squared	0.890586	S.D. dependent var		0.119022
S.E. of regression	0.039370	Sum squared resid		0.376645
F-statistic	1987.063	Durbin-Watson stat		0.015170
Prob(F-statistic)	0.000000			
	Unweighted Statistics			
R-squared	-0.085191	Mean dependent var		4.105824
Sum squared resid	5.368292	Durbin-Watson stat		0.001064

Following the random effect the result shows that urbanization has positive impact on life expectancy at 1% level of significance. That is if urbanization increases by 1% then life expectancy increases by about 0.35%.

Hausman Test: has been used to justify which method is appropriate.

Null: random effect model is appropriate

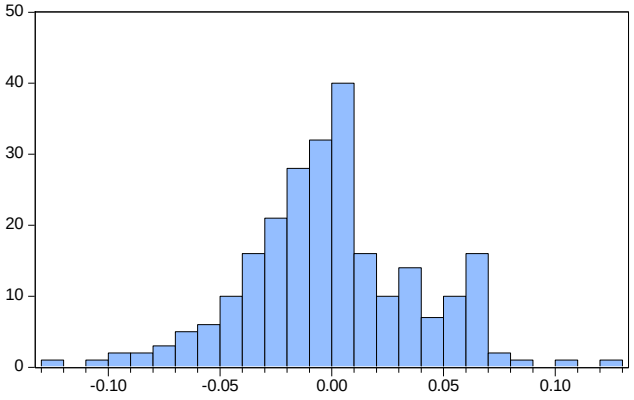
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	7.992348	1	0.0047

Following the Hausman test result shows that the null hypothesis is rejected where the chi-square statistic value is 7.992348 and the degree of freedom is 1 and the probability is less than 5%, so there is no random effect i.e. there exist fixed effect in the long run. That means following Hausman test it is also recognized that fixed effect model is appropriate in this study.

Normality test:

Following Jarque-Bera test, it is clear that there is normality in the data set.



Residual Cross-Section Dependence Test:

Null: No cross-section dependence (correlation) in residuals.

Test	Statistic	Prob.
Pesaran CD	2.642363	0.0082

As the p value is lower than 5%, we can reject null hypothesis at 1% significance level which exhibits that there exist cross sectional dependence in data set.

Conclusion and Recommendations

Rapid increase in the level of urbanization in developing countries leads to remarkable changes. Gradual increase in life expectancy is one of them. This study focuses on pointing out the key effects of urbanization on life expectancy in five south Asian countries. Average life expectancy of south Asian countries is 67 years. South Asia has carried out fascinating progress in health outcomes in last few decades. Although spending or allocation rate in health sector are not the same but each country has increased their expenditure in health sector.(chin et al. 2017). Level of urbanization has

increased in south Asian countries and health status has also improved thereby life expectancy in south Asian countries has made progress as well. So fixed effect model here in this case is better than random effect model. Applying redundant fixed effect test the study has identified that fixed effect model is better than pooled model. (Hunady, J.2016). Furthermore utilizing Hausman test the study suggest that fixed effect model is also better than random effect model for five south Asian countries. If urbanization increases by 1%, life expectancy rises by about 0.36% in the aforesaid south Asian countries. Actually urban people avail many opportunities compared to those living in the rural areas especially considering the availability of resources that support good health. With better infrastructure, quality healthcare service, advanced communication and higher educational facilities -urbanization is associated with socio-economic development that provide opportunities good enough to achieve sound health (http://www.brinknews.com). So, as per this study it is identified that urbanization has got positive impact on life expectancy in five south Asian countries. Life expectancy is affected by many factors like expenditure on health, availability of food, economic misery, literacy, income, urbanization and the like. One of the limitations of this study is that it has only considered urbanization that affect life expectancy. Life is, no doubt, invaluable and so necessary actions should be taken to obtain better health facilities and other things to have higher life expectancy not only in towns and cities but also in rural areas. Especially government of the respective countries should spend more on health sector as the more govt. spend on health, the longer people live. Govt. of selected countries should invest more on social sector advancement through social safety net programs, educational facilities, sanitation etc. urbanization has direct or indirect influence on life expectancy through rendering various urban facilities, so govt. of each country should be more careful in promoting urban infrastructure as well.

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ANNEX: data set

Annex:

code	country	year	lnlifeexp	lnurban
1	BD	1969	3.872242	1.987326
1	BD	1970	3.861214	2.027227
1	BD	1971	3.853037	2.066989
1	BD	1972	3.850807	2.106692
1	BD	1973	3.85632	2.146282
1	BD	1974	3.869637	2.200995
1	BD	1975	3.889061	2.286049
1	BD	1976	3.911643	2.370337
1	BD	1977	3.933745	2.453588
1	BD	1978	3.952819	2.535996
1	BD	1979	3.967987	2.617469
1	BD	1980	3.97927	2.698067
1	BD	1981	3.987446	2.760073
1	BD	1982	3.994377	2.785752
1	BD	1983	4.001461	2.811268
1	BD	1984	4.009186	2.836737
1	BD	1985	4.017787	2.861972
1	BD	1986	4.027171	2.887089
1	BD	1987	4.036963	2.912079
1	BD	1988	4.046903	2.93699
1	BD	1989	4.056989	2.961658
1	BD	1990	4.067333	2.986237
1	BD	1991	4.078097	3.0085
1	BD	1992	4.089332	3.025776
1	BD	1993	4.100989	3.042902
1	BD	1994	4.112954	3.060021
1	BD	1995	4.125003	3.07699
1	BD	1996	4.136925	3.093947
1	BD	1997	4.148485	3.110756
1	BD	1998	4.159477	3.12755
1	BD	1999	4.169792	3.144238
1	BD	2000	4.17936	3.160823
1	BD	2001	4.188184	3.182046
1	BD	2002	4.19642	3.209068
1	BD	2003	4.20417	3.23589
1	BD	2004	4.211535	3.262472
1	BD	2005	4.218581	3.288738
1	BD	2006	4.225417	3.314804
1	BD	2007	4.23209	3.340633
1	BD	2008	4.238618	3.366192
1	BD	2009	4.245046	3.39145
1	BD	2010	4.25132	3.41648
1	BD	2011	4.257398	3.441219
1	BD	2012	4.263229	3.465517
1	BD	2013	4.268732	3.489269
1	BD	2014	4.273926	3.51259
1	BD	2015	4.278817	3.535379
1	BD	2016	4.283435	3.557717
1	BD	2017	4.287826	3.579567
2	India	1969	3.851062	2.973589
2	India	1970	3.865372	2.98366
2	India	1971	3.879479	2.995282
2	India	1972	3.89335	3.011655
2	India	1973	3.90693	3.027861
2	India	1974	3.92009	3.044094
2	India	1975	3.932747	3.060208
2	India	1976	3.944781	3.076252
2	India	1977	3.956174	3.092224
2	India	1978	3.966871	3.108123
2	India	1979	3.976855	3.12395
2	India	1980	3.986054	3.139746
2	India	1981	3.994432	3.153462
2	India	1982	4.002065	3.163236
2	India	1983	4.009132	3.172999
2	India	1984	4.015806	3.182751
2	India	1985	4.022311	3.19245
2	India	1986	4.028935	3.202137
2	India	1987	4.035815	3.211771
2	India	1988	4.043104	3.221393
2	India	1989	4.050828	3.231002
2	India	1990	4.058976	3.24052
2	India	1991	4.06747	3.249521
2	India	1992	4.076096	3.257481
2	India	1993	4.084648	3.265416
2	India	1994	4.093027	3.273326
2	India	1995	4.101122	3.281174
2	India	1996	4.108855	3.289036
2	India	1997	4.11622	3.296873
2	India	1998	4.123272	3.304686
2	India	1999	4.130017	3.312475
2	India	2000	4.136478	3.32024
2	India	2001	4.14277	3.329272
2	India	2002	4.148959	3.340881
2	India	2003	4.15511	3.352427
2	India	2004	4.161286	3.363945
2	India	2005	4.167533	3.375367
2	India	2006	4.173864	3.386727
2	India	2007	4.180262	3.398059
2	India	2008	4.18665	3.409364
2	India	2009	4.192967	3.420575
2	India	2010	4.19908	3.431727
2	India	2011	4.204887	3.442851
2	India	2012	4.210304	3.454232
2	India	2013	4.215293	3.46583
2	India	2014	4.219816	3.477664

2	India	2015	4.223939	3.489727	3	Pakistan	2015	4.194522	3.584241
2	India	2016	4.227709	3.502008	3	Pakistan	2016	4.196916	3.589998
2	India	2017	4.231247	3.514526	3	Pakistan	2017	4.19914	3.595722
3	Pakistan	1969	3.955944	3.200793	4	sri lanka	1969	4.153148	2.862201
3	Pakistan	1970	3.967212	3.211529	4	sri lanka	1970	4.160398	2.867785
3	Pakistan	1971	3.977605	3.22223	4	sri lanka	1971	4.167099	2.873395
3	Pakistan	1972	3.987149	3.232897	4	sri lanka	1972	4.173371	2.878974
3	Pakistan	1973	3.995923	3.245362	4	sri lanka	1973	4.179314	2.884577
3	Pakistan	1974	4.003964	3.258289	4	sri lanka	1974	4.185008	2.89015
3	Pakistan	1975	4.011398	3.271127	4	sri lanka	1975	4.190669	2.895746
3	Pakistan	1976	4.018291	3.283952	4	sri lanka	1976	4.196585	2.901312
3	Pakistan	1977	4.024744	3.296688	4	sri lanka	1977	4.20281	2.906846
3	Pakistan	1978	4.03089	3.309374	4	sri lanka	1978	4.209279	2.912405
3	Pakistan	1979	4.036804	3.321974	4	sri lanka	1979	4.215839	2.917987
3	Pakistan	1980	4.04256	3.334559	4	sri lanka	1980	4.222019	2.923538
3	Pakistan	1981	4.048213	3.345685	4	sri lanka	1981	4.227257	2.927239
3	Pakistan	1982	4.053748	3.354071	4	sri lanka	1982	4.231218	2.926382
3	Pakistan	1983	4.059166	3.362422	4	sri lanka	1983	4.233744	2.925524
3	Pakistan	1984	4.064521	3.370773	4	sri lanka	1984	4.234947	2.92472
3	Pakistan	1985	4.069796	3.379088	4	sri lanka	1985	4.235251	2.92386
3	Pakistan	1986	4.075026	3.387369	4	sri lanka	1986	4.235352	2.923
3	Pakistan	1987	4.080195	3.395615	4	sri lanka	1987	4.235859	2.922193
3	Pakistan	1988	4.08527	3.40386	4	sri lanka	1988	4.237131	2.921332
3	Pakistan	1989	4.09027	3.412038	4	sri lanka	1989	4.239181	2.920524
3	Pakistan	1990	4.095178	3.420215	4	sri lanka	1990	4.241485	2.919661
3	Pakistan	1991	4.099962	3.428358	4	sri lanka	1991	4.243167	2.918851
3	Pakistan	1992	4.104641	3.436468	4	sri lanka	1992	4.243626	2.917987
3	Pakistan	1993	4.1092	3.444544	4	sri lanka	1993	4.242664	2.917176
3	Pakistan	1994	4.113641	3.452587	4	sri lanka	1994	4.240636	2.91631
3	Pakistan	1995	4.117996	3.460598	4	sri lanka	1995	4.238589	2.915498
3	Pakistan	1996	4.122284	3.468607	4	sri lanka	1996	4.237969	2.914631
3	Pakistan	1997	4.126505	3.476552	4	sri lanka	1997	4.239872	2.913817
3	Pakistan	1998	4.130676	3.483852	4	sri lanka	1998	4.244831	2.912948
3	Pakistan	1999	4.134782	3.48991	4	sri lanka	1999	4.252715	2.912133
3	Pakistan	2000	4.138792	3.495962	4	sri lanka	2000	4.262708	2.911263
3	Pakistan	2001	4.142611	3.501947	4	sri lanka	2001	4.273536	2.910447
3	Pakistan	2002	4.146241	3.507957	4	sri lanka	2002	4.283738	2.909575
3	Pakistan	2003	4.149685	3.513931	4	sri lanka	2003	4.292211	2.908757
3	Pakistan	2004	4.153006	3.519899	4	sri lanka	2004	4.29855	2.907939
3	Pakistan	2005	4.156317	3.525831	4	sri lanka	2005	4.302659	2.907065
3	Pakistan	2006	4.15982	3.531758	4	sri lanka	2006	4.304862	2.906245
3	Pakistan	2007	4.163606	3.537679	4	sri lanka	2007	4.306009	2.90537
3	Pakistan	2008	4.167672	3.543565	4	sri lanka	2008	4.306858	2.904549
3	Pakistan	2009	4.172	3.549416	4	sri lanka	2009	4.307707	2.903727
3	Pakistan	2010	4.176447	3.555262	4	sri lanka	2010	4.308811	2.902849
3	Pakistan	2011	4.180813	3.561103	4	sri lanka	2011	4.310289	2.902026
3	Pakistan	2012	4.184886	3.566938	4	sri lanka	2012	4.312047	2.901202
3	Pakistan	2013	4.188548	3.572711	4	sri lanka	2013	4.314029	2.901312
3	Pakistan	2014	4.191759	3.578478	4	sri lanka	2014	4.316234	2.90241

4	sri lanka	2015	4.318661	2.904494
4	sri lanka	2016	4.321268	2.907502
4	sri lanka	2017	4.323934	2.911481
5	Nepal	1969	3.687529	1.363793
5	Nepal	1970	3.702388	1.375233
5	Nepal	1971	3.716713	1.387544
5	Nepal	1972	3.730645	1.434608
5	Nepal	1973	3.744314	1.481377
5	Nepal	1974	3.757822	1.528228
5	Nepal	1975	3.771243	1.574846
5	Nepal	1976	3.784712	1.621564
5	Nepal	1977	3.798339	1.668084
5	Nepal	1978	3.812203	1.714338
5	Nepal	1979	3.826356	1.760613
5	Nepal	1980	3.840785	1.806812
5	Nepal	1981	3.855431	1.852541
5	Nepal	1982	3.870242	1.899491
5	Nepal	1983	3.885124	1.92629
5	Nepal	1984	3.900112	1.963048
5	Nepal	1985	3.915258	1.999586
5	Nepal	1986	3.930609	2.036012
5	Nepal	1987	3.946193	2.072417
5	Nepal	1988	3.961974	2.108758
5	Nepal	1989	3.977867	2.144878
5	Nepal	1990	3.993787	2.180869
5	Nepal	1991	4.009603	2.217027
5	Nepal	1992	4.025209	2.259886
5	Nepal	1993	4.040451	2.302485
5	Nepal	1994	4.05524	2.344974
5	Nepal	1995	4.069522	2.387202
5	Nepal	1996	4.0833	2.429218
5	Nepal	1997	4.096575	2.470977
5	Nepal	1998	4.109381	2.512522
5	Nepal	1999	4.121652	2.553888
5	Nepal	2000	4.133341	2.595031
5	Nepal	2001	4.144435	2.635264
5	Nepal	2002	4.154891	2.656055
5	Nepal	2003	4.164741	2.676766
5	Nepal	2004	4.173972	2.697394
5	Nepal	2005	4.182615	2.717935
5	Nepal	2006	4.190654	2.738385
5	Nepal	2007	4.198179	2.758807
5	Nepal	2008	4.20523	2.77913
5	Nepal	2009	4.211891	2.799352
5	Nepal	2010	4.218242	2.819472
5	Nepal	2011	4.224334	2.839546
5	Nepal	2012	4.230215	2.859798
5	Nepal	2013	4.235931	2.880041
5	Nepal	2014	4.241485	2.900432
5	Nepal	2015	4.24688	2.920847
5	Nepal	2016	4.252103	2.941382
5	Nepal	2017	4.257087	2.961969

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Inclusionary housing financial mechanisms in developing city: a case study of Dhaka

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Abstract: Inclusionary housing policy is practiced in many cities in the North in response to housing affordability. However, this policy is implemented in few cities in the South. It is needed to understand the financial approaches of this planning tool to implementing in the cities there, which is under researched. This research reviews the financial mechanisms for implementing inclusionary housing policy in a case study city Dhaka, the capital city of Bangladesh. A qualitative and thematic analysis of secondary data has been performed. This research has revealed that presently lack of financial capacity is the major challenge of implementing inclusionary housing in Dhaka. Different financial mechanisms can make it possible to introduce inclusionary housing in Dhaka, such as mobilizing revenue; mobilizing resources of the community; different types of partnerships; capturing the capital gains; cross subsidy; easy financial packages for the low-income bracket. The inclusionary housing financing mechanisms/components need to be integrated with each other for effective financial management.

Keyword: Finance, inclusionary housing, mortgage, cost recovery

Background of the research

Housing is not only a basic need; it is a right of humanity. Housing accessibility can create prosperity and social justice (De Soto, 1989) that have a snow-ball effects of well-being. However, 24 per cent of the global urban population were living in slums during 2018 (UN-Habitat, 2020). The reasons for the high occurrence of slums in developing countries are rapid urbanization; lack of affordable housing for the low-income bracket; ineffective urban planning; dysfunctional urban, land and housing policies; scarcity of housing finance, and poverty (UN-Habitat, 2020).

Implementation of effective urban planning can generate social and economic prosperity. Many local governments in the North are practicing inclusionary housing policy effectively. This planning instrument have produced wide range of affordable housing there. As a urban planning policy, inclusionary housing can produce affordable housing stock for the low-income people. After emerging inclusionary zoning policy in the USA during the 1970s, this policy implemented there extensively in developed countries. Some other developed countries like Canada, Israel, UK, Ireland, France, Spain, Italy, Netherland, New Zealand, and Australia also widely utilized inclusionary housing (Schwartz et al., 2012; Calavita and Mallach, 2010). According to Rahman (2001) 20 to 40 per cent of housing is provided to the low-income groups in Philippines, Indonesia, and Colombia through selling serviced sites at subsidized prices to the developers based on the condition that they partly build non-profit affordable housing. Basolo (2011) stated that more than hundred cities experienced a mixed record of success through adopting inclusionary housing policy.

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It is possible to strengthen the nexus between housing and urban planning (UN, 2017) through inclusionary planning. Many cities in the North are implementing inclusionary housing for producing affordable housing stock. However, this policy is hardly practiced in the cities in the South, where housing market is characterized by inadequacy, unaffordability, discrete, and exclusionary. There is a knowledge gap about determining financial techniques to introduce inclusionary housing in the cities in South. This research adopted case study approach and selected Dhaka, the capital city of Bangladesh as the case study city.

Dhaka is one of the fast-growing megacities that is rear-ground for capital accumulation and resulting dispossession of the marginalized and less-power people (Seraj, 2015). Dhaka city is the economically and administratively primate city of Bangladesh. Estimated population of this city is 16.839 million with a highest population density (Demographia World Urban Areas, 2021). 80 per cent low-income and 70 per cent of middle-income people in Dhaka cannot afford own housing (RAJUK, 2016). If the government of Bangladesh could improve mechanism for housing finance system, it might be possible to introduce inclusionary housing in Dhaka.

Aim and objectives of the research

This research aims to identify effective financial mechanisms for introducing inclusionary housing policy in Dhaka. The specific objectives are as follows:

1. To understand the housing situation, policy, and organizations in Dhaka.
2. To understand the existing housing finance systems in Dhaka.
3. To determine the effective financial mechanisms of inclusionary housing in Dhaka.

Methodology of the research

This is an exploratory and qualitative research. The research question is how an inclusionary housing policy can be financed in Dhaka? This research is divided into three phases: research problem development, data collection, and interpretation and recommendations development through a descriptive and thematic analysis of the available literature.

Theoretical background

Many cities in the North have adopted inclusionary housing policy for promoting housing affordability and social inclusion. However, this policy is rarely implemented in the cities in the South (Nahrin, 2018). Inclusionary housing (also known as inclusionary planning or inclusionary zoning) is a municipal and county planning ordinance that suggests that a given share of land will be affordable for the low- and middle-incomes (Basolo, 2011). Inclusionary policy is a component of the real estate market. Land use regulations can provide the mandate that the residential land developers will set aside a portion of the land projects for the households who cannot afford housing in the competitive market. Otherwise, the housing/land developers can choose to pay a fee or donate land in-lieu

fees[1] (Calavita and Mallach, 2010). It can be mandatory or voluntary for new housing projects. This policy generally offers the developers different incentives such as density bonuses, relaxation of development regulations, reduction or waiver of fees, and fast-tracking permits (Meda, 2010; Schwartz et al., 2012). The major principles of inclusionary housing are cross-subsidy and allowing market-driven housing. Direct subsidies are provided to increase the supply of affordable housing (Schwartz et al., 2012; Meda, 2010).

Inclusionary housing is focused to increase affordability and social-mix in the societies (Schwartz et al., 2012). Implementation of this policy creates driving forces to reduce concentration of poverty in the slum, and improves socio-economical mix in a residential project. The low-income bracket might be economically well-off (i.e., proximity of employment, getting social capital) due to residing closely with those of higher incomes. This policy encompasses socio-economic, racial, ethical integration (Nahrin, 2018).

There are controversies concerning the possibilities of achieving the purposes of inclusionary housing. Basolo (2011) mentioned that inclusionary housing is combative. Calavita et al. (2010) claims that inclusionary approach might not effective to achieve social integration, especially when substitutes of on-site constructions are utilized. On the contrary, Basolo (2011: iii) mentioned "Opponents typically claim that inclusionary housing increases the cost of housing in the regional market, chases away developers and depresses housing production. Advocates of inclusionary housing often claim it produces affordable units, has little impact on the production and price of single-family housing and allows developers to use expertise to give back to the communities from which they extract the profits". He claims that although inclusionary housing has not always become successful (because of associated legal questions, controversies, and its effects on the existing city planning), inclusionary housing policy should not be eliminated.

Some constraints and potentials of inclusionary housing were identified by Mekawy (2014). He mentioned that insufficient public finance, unsuitable market situations, regulatory barriers, incompetency of local staff, market rate buyers' opposition, and developer's opposition are the potential constraints against the success of inclusionary housing. On the contrary, he assembled the significant arguments of previous studies and experiences on the inclusionary housing policy into two major groups: housing production and social inclusion. In conclusion, he claims that this approach is effective for housing production and social inclusion.

Direct public subsidy is the primary approach of inclusionary housing (Basolo, 2011) which is typically practiced in European countries (Calavita and Mallach, 2010). However, Middleton (2011) validates that an inclusionary zoning project can produce a meaningful amount of affordable housing without the need of public subsidy, if it is well-structured and applied in a suitable context. Hughen and Read (2013) and Schuetz et al. (2007) claim that inclusionary zoning programs do not reduce the developers' profits by encompassing economic incentives (like cost offsets) provided by the public sector. Inclusionary housing do not increase housing prices in every circumstances. Nevertheless, possibility of impacts on housing prices might be lessened by density effects (Hughen and Read, 2013).

[1] [1] Cash paid by a developer to the locality to use for affordable housing activities

Housing situation and policy framework in Dhaka

It is necessary to understand the housing situation and policy practice in Dhaka to explore the finance sources of inclusionary housing policy. This discussion is divided into two parts: housing practice, and housing and planning in Dhaka.

Framework for housing and planning policy preparation and implementation in Dhaka

There are several public organizations responsible for the housing sector in Dhaka (Table 1). The organizational set up for housing promotion is not very well established and well-coordinated (Nahrin, 2018) that can be classified into four groups:

- Housing policy preparation- National Housing Authority (NHA) is responsible,
- Land acquisition for housing projects- Deputy Collector (DC) office is responsible;
- Area improvement and land development- City Development Authority (*Rajdhani Unnayan Kartipokkha* or RAJUK) is mainly responsible;
- Housing plot/flat development- Responsibilities can be divided into three groups:
    - Public housing construction-Public Works Department (PWD) is responsible;
    - Low-income housing- National Housing Authority (NHA) is responsible;
    - High- and middle -income housing – RAJUK is responsible.

Table 1: Development agencies in Dhaka responsible for housing

Function	Dhaka South City Corporation (DSCC)	Dhaka North City Corporation (DNCC)	Narayangonj City Corporation (NCC)	Gazipur City Corporation (GCC)	Savar Pourashava	Union Council area
Government housing	PWD	PWD	PWD	PWD	PWD	PWD
Mid/high income land development	RAJUK	RAJUK	RAJUK	RAJUK	RAJUK	RAJUK
Low-income land development	NHA, RAJUK	NHA, RAJUK	RAJUK	RAJUK	RAJUK	RAJUK
Area improvement and upgrading	RAJUK	RAJUK	RAJUK	RAJUK	RAJUK	NA
Land acquisition	DCS	DCS	DCS	DCS	DCS	DCS

There is no public authority with absolute responsibility for housing in Dhaka. The different public agencies such as NHA, PWD, Department of Architecture, Urban Development Directorate (UDD) and RAJUK under the Ministry of Housing and Public Works (MHPW) are involved. The responsibilities of different organizations are discussed below:

The NHA is the highest authority for housing policy preparation and implementation in Bangladesh. To implement the National Housing Policy (NHP) 2016, the NHA has constructed very limited low-income plots/ flats. Its responsibility is development of serviced residential plots as well as building houses and selling flats or nucleus houses, which is constrained due to limited resources. The NHA does not have the authority and capacity to compel other public organizations and private sectors to implement the NHP.

RAJUK is the special development agency in Dhaka metropolitan area. The organization retains the authorization power and responsibilities for physical planning and development control within its 1528 sq. km jurisdiction area. *Dhaka Metropolitan Development Plan (DMDP) 2016-2035* is the current structure plan for growth control of this city (RAJUK, 2016). The municipal organizations such as City Corporations, *Pourashavas* (local municipal governments), and utility service-providing organizations have discretionary powers of planning and housing. RAJUK has developed most of the public land as well as apartment projects in Dhaka.

The PWD is concerned with the construction and maintenance of government offices/institutional buildings and public housing. The Department of Architecture designs all government buildings and public housing. The UDD limits its role only to development programs in urban centers beyond city corporation areas. In addition, various governmental departments, autonomous bodies, sector corporations, nationalized banks and financial institutions, educational institutions have their own staff housing colonies.

Housing and urban planning situation in Dhaka

The housing market of Dhaka is characterized by ineffectively managed public land development projects, costly private housing, and insufficiency of affordable housing (Nahrin, 2018). The ownership pattern of housing is very speculative and unequal in the city (Islam, 2005; Islam, 2009). The reason is most of the housing properties are owned by the high- and higher-middle income brackets in Dhaka. About 56 per cent of the city dwellers have no land ownership in Dhaka and it is about 70 per cent if the slum and squatter dwellers are included (RAJUK, 2016). One third of the people in Dhaka live in informal settlements (Rahman, 2019). According to Islam (2009), the supply of housing is very insufficient in Dhaka although the demand for housing is excessively high. The government meets only 7 per cent of the annual housing demand and the private sector dominates to fill the giant gap (Rahman, 2019; RAJUK, 2016).

Housing and land prices have increased several times during the last five decades in Dhaka after liberation (also Seraj, 2007; Seraj, 2015). Thus, housing and land prices become unaffordable for the low- and middle-income bracket. However, the attraction of increasing housing prices could not mobilize investments of the low- and lower-middle income groups, as the inflation reduces their capacity to gain housing (Alam and Ahmad, 2010).

Housing delivery system is very fragmented (Rahman, 2019). The public housing projects (excluding limited low-income housing developed by the NHA), and private housing and/or real estate business could not produce affordable low-income housing in Dhaka. Negligible and discrete initiatives of housing units have been provided for the low-income brackets compared with the very high demand in Dhaka. The number of low-income housing stock produced by the NGOs and international donors is negligible.

RAJUK developed 13 residential projects in Dhaka for the high and middle-high incomes. The key impediments of the planning frameworks in Dhaka are excessive delays in detailed plan preparation, highly centralized institutional set-ups, lack of integration among public departments, inadequate financial resources, legal lacunas, lack of community participation, and predominantly lack of political will (Nahrin, 2018).

Housing finance systems in Bangladesh

Provision of low- and middle-income housing through urban inclusionary planning projects requires housing finance. Therefore, it is required to understand the housing finance systems in Bangladesh as well as financing housing projects and programs. Government, real estate developers as well as prospective buyers of houses/plots require housing finance. There are mainly three types of housing finance sources in Bangladesh.

1. **Informal:** Major portion of the finance for house construction/extension in Bangladesh come from informal sources that include cash savings; loans (and gifts) from relatives, moneylenders, shopkeepers, and so on. Moreover, the informal financial sources include private intermediaries and money lenders, which are completely unregulated, and sometimes from such financial transactions that are not legally permitted.
2. **The semi-formal financial institutions**: The semi-formal financial institutions do not fall into the jurisdiction of the Central Bank or any other enacted financial regulator. They are specialized financial institutions like Bangladesh House Building Finance Corporation (BHBFC), Palli Karma Sahayak Foundation (PKSF), Samabay (Cooperative) Bank, Grameen Bank, and non-governmental Microfinance Institutes (MFIs).
3. **Formal**: The formal financial institutions are regulated by the Central Bank. Financial market in Bangladesh consists of banks, non-bank financial institutions, and the stock market. This includes four State-Owned Commercial Banks (SCBs), four State-Owned Specialized Banks (SBs), 39 Private Commercial Banks (PCBs), nine Foreign Commercial Banks (FCBs), and 31 Non-Banking Financial Institutions (NBFIs). Moreover, two private housing finance companies have become public-limited-companies. They are Delta-BRAC Housing Finance Corporation Ltd. (DBH) and National Housing Finance and Investment Ltd. (NHFIL).

Housing finance organizations

The PCBs dominate in outstanding housing loans, with a market share of 75-80 per cent. They provided 47 per cent of the housing loan among the total outstanding housing loan. The SCBs have the second largest exposure. SCBs, Specialized housing finance institutions, FCBs, and MFIs provide housing loans of about 21 per cent, 19 per cent, 9

per cent and 4 per cent respectively. Banks are subject to restrictive and stringent regulations that curtail their exposure in housing finance and mortgages. Banks have large exposure in residential self-construction as opposite to purchase of apartments / land and house repair. The SCBs cater largely to the middle-income segments as compared to the private NBFIs, which are more focused on the upper-income segments. The SCBs give priority to corporate short-term lending, and a low ceiling of mortgage loans amount. The BHBFC traditionally dominated on the housing finance, but presently has a declining role because of the declining government support and operational ineffectiveness (Rahman, 2008).

Mortgage lending in Dhaka was never quite profitable for commercial and public banks. Therefore, excessive restrictions are imposed by the banks for mortgage business. As a result, housing loan is to only four per cent of their assets, though the recovery rate is approximately 70 per cent (Rahman, 2008). Housing loans are sanctioned for individual house construction, flat or land purchase, renovation, extension, and repair of housing for 10–20 years.

Micro-credit lenders

The MFIs have several comparative advantages for serving low-incomes groups. The MFIs in Bangladesh provide small, short-maturity loans (typically six months to two years) for incremental construction, home repair, and sanitation. However, they are hesitant in undertaking a new housing microfinance product. For the first, Grameen Bank introduced housing loan following a devastating flood in 1987. BRAC, Proshika and ASA Bangladesh, have launched long- and short-term credit products for housing (both in urban and rural). However, due to mixed success, some of these products have been scaled down or even discontinued. BRAC has started a sanitation loan for 6-12 months. Proshika has been accessing funding for housing loan under *Grihayan Tahbil*[2]. Interest rates for housing microfinance are often lower than income-generating loans, as internally cross-subsidized within the MFIs. Utilizing micro-credit savings deposits, ARBAN (an NGO) built an apartment complex in Mirpur and is constructing another at Rampura Banasree area for the success of the previous project (Rahman, 2019).

Government funded housing programs

Government housing finance consisted of *Grihayan Tahbil* and occasional refinance facilities, funded by the Government and/or multilateral institutions. The *Grihayan Tahbil* provides loans to NGOs and MFIs at an interest rate of 2 per cent per annum. Another government program called Asrayan, funds the construction of low-income barrack-type houses. Bangladesh Bank started a refinance scheme for the middle-income households to buy housing in cities[3] in 2007. This scheme encouraged banks and NBFIs to lower their interest rates for home loans. However, the scheme discontinued due to the long-term concessional interest rates, the huge funding gap and unmet the demand for housing finance of the target income segments.

Most of the housing projects in Dhaka are slum rehabilitation, and site and services schemes. After the independence of Bangladesh in 1971, the then government developed

[2] Housing fund of Government of Bangladesh started in 1998, administrated by Bangladesh Bank.
[3] Divisional cities and Gazipur, Narayanganj, Savar, Tongi

some housing rehabilitation projects through providing un-serviced parcels of land in Mohammadpur and Mirpur. These areas have been developed as nothing but 'slums' with large population densities and minimum utility services. In early 1975, slum dwellers in the central part of Dhaka were evicted and resettled on three unutilized government-acquired sites on the fringes of the city. However, the project failed as resettlement camps had no job opportunities or commuting facilities (Hasnath, 1977 and Ullah, 1994 cited in Rahman, 2001). The military-backed government in 1977 planned to relocate the 1975 resettlement camp to Bhasantek, Mirpur (located on the peripheries of the then city). The project was highly subsidized, and as a result strongly convicted by the sponsors, and it was argued that the project was not replicable (Rahman, 2001).

'Site and services' scheme is another government intervention strategy that developed the major public housing projects in Dhaka. The schemes developed expensive neighborhoods with high hidden subsidies (Rahman, 1991, 1996 cited in Rahman, 2001). The beneficiaries of allotted plots are mainly high- and high middle-income groups. The low-income group cannot gain access to these projects, otherwise any projects are deliberately designed for this income group. The site and service schemes in Dhaka are not inclusionary in any sense.

Financial mechanisms of inclusionary housing policy in Dhaka

Insufficient and inaccessible housing finance is one of the biggest challenges for improving the housing condition in Bangladesh. It requires effective financial mechanisms for each stage of inclusionary housing such as project planning, initiation, implementation, monitoring, and effective distribution (Nahrin, 2018). Integration of housing policies with urban planning and fiscal policy can increase housing affordability for the low-income bracket. The later part clarifies the financial constraints and mechanisms for implementing inclusionary housing policy in Dhaka.

Financial constraints of inclusionary housing policy

A major component for promotion of inclusionary housing is producing land, which is cost intensive in Dhaka due to low land ownership ratio and the increasing land price (Seraj, 2015). Lack of allocation for housing budgets/funds (approximately five to six per cent, mentioned by Rahman, 2008). Lack of public financial capacity are the major reasons for the insignificant number of low-income housing projects in Dhaka. Housing investment and subsidy for the low-income bracket in the public housing initiatives are negligible in comparison with the growing demand in Dhaka (Nahrin, 2018). Housing mortgage lending is facing challenges due to high transfer cost for mortgage, high cost of property registration, high interest rate for housing loan, and rigidities in the legal framework of mortgage (Seraj, 2015).

The NHA has very limited financial capacity. The NHA failed to execute sufficient need-based actions in accordance with the *NHP 2016* for solving the housing crisis for the low-income population. The NHA developed plots and flats were subsidized compared to the private market. Therefore, it ignites competition and power practice in order to seize the units (Nahrin, 2018). Subsidies aggravate inefficiencies and hamper the extension of sustainable housing finance in Dhaka. These are neither transparent, nor equitable.

Major financial challenges for implementing government inclusionary housing are managing finance for purchasing land, constructing housing, distribution of housing units, managing the housing market, controlling the housing price, and last, not the least-cost recovery. Cost recovery and profit making are the significant issues that might reduce the willingness of the developer for implementing a private funded inclusionary project in Dhaka.

Potential financial mechanisms for introducing inclusionary housing

Inclusionary housing projects might be developed by the government or developers in general. Even housing can be developed by the private developers under the government's facilitator role.

1. Mobilizing blending funding sources:

The public housing funds are mostly generated from foreign aid compared to national revenues (Nahrin, 2018). Therefore, government can formulate finance from diverse revenue sources like local taxes, fees, and service charges, in a socially just and equitable manner; which enables private sector investments; capacity building of the local governments; aligning macro and micro economy, and tapping private capital (UN-Habitat, 2020). It needs encouraging diverse external financial institutions to invest in affordable housing projects (UN, 2017). It requires cooperation among all actors like the public sectors, private and financial sectors, civil society, residents, and communities. Government can provide support and empower the NGOs, private sectors, private banks, and cooperatives to mobilize finance for low-income housing. For enabling inclusionary housing financing, it requires vigorous national urban policies, urban and territorial planning frameworks; and facilitating legal and regulatory systems for functioning housing finance; enforcement of mortgage laws, and a coordinated and coherent approach.

It needs incentives for housing finance providers (UN, 2017). The developers can be offered incentives for complying with inclusionary obligations such as density bonuses, relaxation of development regulations, reduction or waiver of fees, and fast-tracking permits in Dhaka. Moreover, density bonuses and the payment of in-lieu fees (Basolo, 2011) could be utilized in the city to provide flexibility to the developers. Revised legal and institutional framework can create greater transparency in Dhaka (Nahrin, 2018).

2. Community resource mobilizes

Most of the slum dwellers (both on public and private land) pay rental or subscriptions as well as pay the utility bills (Rahman, 2019; Nahrin, 2018). The house rental in slums is not lower than that of the formal housing. It requires appropriate strategies to mobilize these resources. Effective domestic resource mobilization is essential to achieve the development agendas in cities (UN-Habibat, 2020). Recently, alternative finance systems have developed by the urban poor like local savings schemes, community-based savings in developing cities, which is a potential solution in Dhaka.

3. Partnerships

The government can generate low-income housing finance using effective partnering, collaborative efforts, and Public Private Partnership (PPP) investments. As low-income

housing investments by the government is constrained for its financial capacity, the PPP could be a potential financial strategy. *Bhashantek* Rehabilitation Project (BRP) in Mirpur is a form of PPP, where the construction of apartments was done by private companies on government-owned land. Yet, the project was delayed for irregularities and mismanagement (Rahman, 2019). As the target groups are not able to repay the costs, cost recovery of the BRP became impossible. An unaffordable project can provide access housing for the low-incomes only with a subsidy, thus not replicable. If the government can take the facilitator role to reorient the priority groups of the PPP projects and access affordable financial schemes, the PPP can be successful for low-income housing provision in Dhaka.

4. Cost recovery

The cost recovery of a housing program is unavoidable for improving the capacity of the developers (both private and public) for initiating new housing enterprises. At the same time, it is required to increase the stock of affordable housing for the low-income households (Kamruzzaman and Ogura, 2012). It needs promoting strategies to capture the capital gains achieved by the owners/developers due to housing price inflation. For instance, capturing the increased value through property taxes to increase the government revenue in developed housing projects. It requires promoting effective tools to capture the share of land and property value rise, generated through urban development, infrastructure development, and public investments (UN, 2017).

Calavita and Mallach (2010) proposed a two-tiered financing system of inclusionary housing cost recovery, which could be utilized in Dhaka. The first tier is similar to existing programs that offer cost offsets (economic incentives) to the developer by the public sectors (Hughen and Read, 2013; Schuetz et al., 2007). The second tier is to recapture a share of land value uprise. The value added by the public actions is recaptured by the community in inclusionary housing units. Both of the tiers require no public expenditures, as the private sector produce affordable units (Calavita and Mallach, 2010).

5. Cross subsidy

Housing subsidies (for purchase and rental) and housing mortgage are influential tools for housing affordability. In some developed countries, the low-income groups can be able to access the affordable mortgage finance under a well-regulated and subsidized housing finance system. However, due to high number of poor people and the limited public financial capacity (Nahrin, 2018) housing subsidies is not sustainable in Dhaka. Direct subsidy programs will minimize the government financial capacity for initiating inclusionary housing. Direct subsidy of settlement projects in Mirpur for the slum dwellers became less replicable (Rahman, 2001).

Instead of direct subsidy, many developed countries are using cross-subsidies in inclusionary housing programs for cost recovery (Schwartz et al., 2012; Meda, 2010). The government in Bangladesh can adopt this policy as it is sustainable. Commercial, industrial and residential plots for higher income bracket could be a bit higher priced and the counterpart be underpriced. Cost recovery of the housing projects will be possible by this mechanism, albeit providing favorable prices for the low-income brackets. This will increase housing affordability as well as social-mix of the low-income groups. Nahrin (2018) claims it needs government commitment, transparency, and effective legal and organizational reforms to introduce this financial strategy in Dhaka.

The NHA is constructing the '*Shopnonagar Residential Project'* at Mirpur. The project delivers 2600 flats of three different sizes- in two phases. The NHA has fixed the price of the flats according to size. Larger sized flats are higher priced than the smaller sized flats. Price of 1545 sqf., 1338 sqf. and 878 sqf. flat's price is respectively 4704.39 BDT[4], 4681.66 BDT and 4524.43 BDT per square feet. Though the per square feet flat price variation for the smaller sized flat compared to the larger sized is not remarkable, this might increase the affordability of a residential flat of low-income bracket in a planned neighborhood.

6. Easy financial package for the low-income bracket

Easy financial packages such as long-term housing mortgage and rental-purchase (obtaining housing ownership by paying rentals) might be helpful for low-income people. For the first time, the NHA is constructing 533 'Rent based flats' for slum dwellers in Mirpur. However, it will be possible to evaluate sustainability of the projects after completion of the project.

Enabling inclusionary housing financial schemes

It is desirable to initiate of inclusionary housing in Dhaka through an integration between housing and urban planning policy. Effective urban governance underpinned by well-coordinated and well-managed fiscal, political, and administrative decentralizations will make it possible to generate and manage finance for inclusionary housing in Dhaka. The inclusionary housing financing mechanisms need to be integrated with each other for effective financial management (Figure 1). Based on the previous discussions, this research claims that resource generation for inclusionary housing enterprises might be possible in Dhaka though mobilizing blending funding sources, mobilizing community resources**,** and partnerships. These can create basis for cost recovery as well as providing incentives to the target groups and partners. Capital gain though cost recovery of an inclusionary housing increases project sustainability to generate finance for initiating new housing projects. Thus, it will be possible to provide easy access to the low- and middle-income brackets and incentives to partners. Providing incentives from resource generation and cost recovery to the low- and middle-income groups as well as partners will increase affordability and sustainability of inclusionary housing in Dhaka.

[4] Bangladeshi currency. 1 US Dollar = 80 BDT (approximate)

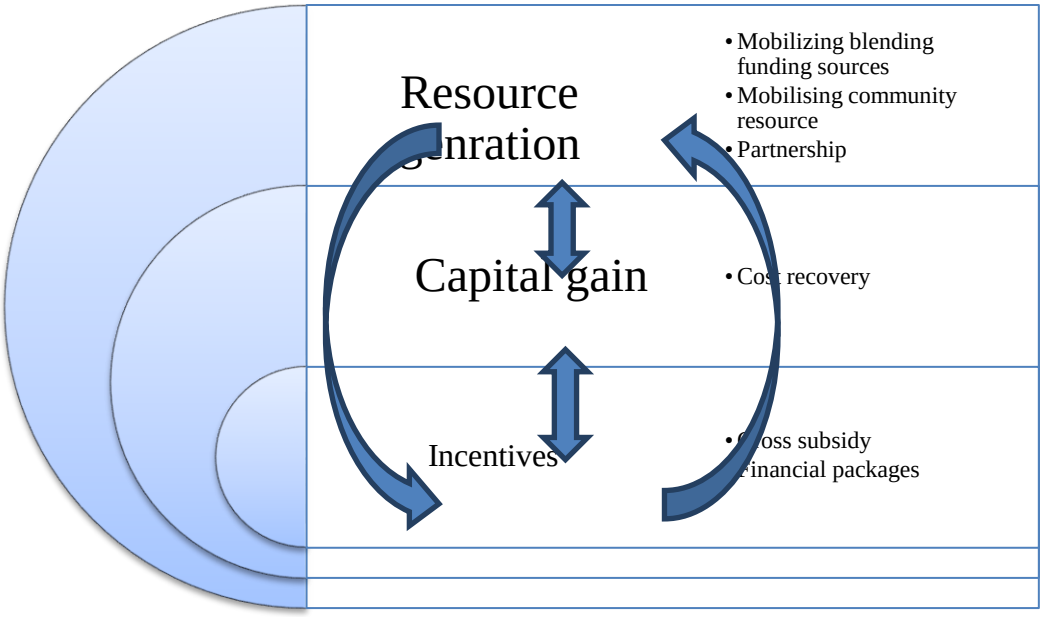


Figure 1: Integration process of inclusionary housing finance mechanisms

Conclusions

Inclusionary housing is an urban planning instrument targeting generation of housing affordability and social-mix of the low-income brackets. Housing provision in Dhaka is inadequate, discrete, unaffordable, and exclusionary. Inclusionary housing performed as an effective planning tool in the North. This can be utilized in developing cities for creating affordable housing. This research aims to determine the financial mechanisms to implement inclusionary housing in the South - with the context of Dhaka, the capital city of Bangladesh. This research has conducted a thematic and theoretical analysis of data, collected from secondary sources.

Dhaka is growing very rapidly. The city has inadequate housing facilities for the low- and middle-income bracket. This research claims that lack of financial capacity is the main constraint for implementation of inclusionary housing policy in the city. Different financial mechanisms might increase the possibility to introduce inclusionary housing in Dhaka, such as different types of partnerships; recovering capital cost; mobilizing resources of the community; cross subsidy; and easy financial package for the low-income bracket. This article explained the possibility of utilizing the ideas of financial mechanisms for promoting inclusionary housing in this city. For effective financial management of the inclusionary housing, the financing mechanisms/ components are needed to be integrated with each other.

This research could not claim applicability of inclusionary housing policy for land pricing and land supply, because the available literature of implementation of inclusionary housing explained housing supply or housing adequacy in the residential projects, not for the land prices. This research claims the suggested financial mechanisms could be taken while fixing price deliberately of public housing projects within the city. Moreover,

private housing could be facilitated by the government to provide/deliver certain units for the low- and middle- income bracket with a reduced price. However, the research has the limitation to compare the ideas of inclusionary housing finance mechanisms in the respect of other developing countries due to limited literature on the practice there. Therefore, further research is required to improve the knowledge and efficacy of inclusionary housing financial instruments in other developing cities.

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Tod for Improved Urban Livability: Opportunities for Dhaka City

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Abstract: Transportation infrastructure often shapes a city's urban form. Thus, the social, economic, and environmental elements, as well as the quality of life, are all influenced by a city's transportation infrastructure to some extent. Considering this subsequent benefit planners and policy makes around the world are adopting Transit Oriented Development (TOD) as an effective mechanism to bring the synergistic benefit to ensure improved accessibility along with improved livable environment around the stations. This study has a quest to explore the relationship between TOD and livability. Furthermore, this tried to look at the livability improvement opportunity of Dhaka through TOD planning around MRT stations. Mirpur 11 were considered as case station to explore the opportunity spatially under the mutually exclusive variables (Density, Diversity and Design) from both TOD and Livability theories. The findings revealed a huge opportunity of livability improvement if the TOD elements are crafted and planned carefully.

Keywords: TOD, Livability, Spatial analysis, Urban form.

1. Introduction

The current trend of socioeconomic development is inducing rapid world urbanization with advanced technological progress in determining the shape of today or even tomorrow cities (Newman, Beatley, & Boyer, 2009; Newman & Kenworthy, 2015). Simultaneously, creating a burden on urban sustainability and livability (Wey & Huang, 2018). As per estimation, more than 60% of the world's population is expected to reside in cities by 2030 (Zhuo et al., 2020). This upsurge of the urban population will put a huge strain on the city's infrastructure as well as the environment. The stress on urban infrastructure and the environment has a negative impact on the livability of cities (Bigio & Dahiya, 2004).

A city's transportation system has a significant impact on the social, economic, and environmental aspects as well as the quality of life (Wey & Huang, 2018). For the past few decades, urban planners have been looking for an appropriate mechanism to handle this pressure in the banner of transportation and land use coordination. (Appleyard, 2005; Moore et al., 2007; Appleyard, 2011b; Cervero, 2013). Transport land use integration is indeed a crucial component of planning strategy for assuring access to livable cities (Appleyard et al., 2014; US EPA, 2016; Moore et al., 2007). Realizing it is subsequent importance, Transit-oriented development (TOD) is creating buzz as an influential planning concept over a few decades (Haque, 2019). Several countries have adopted transit-oriented development as a long-term planning strategy for ensuring viable dense urban form with efficient growth management without sacrificing the quality of life

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(Lang et al., 2020). Transit-adapted development is a key factor for allowing livability and sustainability to grow which makes results like city transformation. By creating mixed-use neighborhoods, TOD emphasizes improving the "quality of life". It accommodates compact growth by a careful mix of housing, public spaces, commercial hubs that helps to attract social diversity and affects positively communities (Smith, 2015).

TOD has the potentiality of livability improvement in any area, whether for the residents of that specific entity or for those who are coming for the amenities being offered due to its emergence (Noland et al., 2014). An efficiently integrated transit system with land use can shape a city with well-designed pedestrian facilities and a livable environment (Calgary, 2004). Besides, TOD ensures well accessibility (Atkinson-Palombo & Kuby 2011; et al.) and a less polluted urban environment that promotes sustainable urbanism (Furlan et al., 2019). This mechanism allows individuals to be independent of the automobile inviting high-density activities around transit stations within walking distance (Furlan, 2015, 2016a; Furlan & ElGahani, 2018; Furlan & Faggion, 2017; Furlan & Petruccioli, 2016). Similarly, this development strategy reduces transportation congestion, fossil-fuel-based energy consumption, and pollution (i.e., carbon emissions and other greenhouse gases), which subsequently improves the livability of cities. Case studies of entities from USA like Cranford, Morristown, and Rahway had observed livability improvements in terms of TOD through several approaches such as- redevelopment, expansion of mixed use (Noland et al., 2014).

According to World Bank, almost 38 percent area of total Bangladesh is now having urban characteristics and right now the capital Dhaka accounts for one third of total country's population, one third of all jobs and one fifth of national GDP. Dhaka is denser than any Mumbai (310 pph) with 440 persons per hector (John et al., 2019; Ede & Mason, 2018). In case of livability of Dhaka city, recent studies of EIU reveals that Dhaka have been ranked 137th among 140 cities based on the parameters as stability, health, culture and environment, education and infrastructure (Alam, 2021). It can be more sordid if EIU added the factor housing (Khan, 2021). Unanimously, Dhaka city shows uncontrolled and spontaneous urbanization and spatial development (B. Ahmed, Hasan, & Maniruzzaman, 2014; S. Ahmed & Bramley, 2015; Kabir & Parolin, 2012; Khan & Siddiqua, 2015; Mowla, 2012). The lower livability of Dhaka is disproportionately affecting vulnerable population. Public transport and inadequate infrastructure making traffic congestion endemic and unbearable for people day by day and contributing to lower livability (John et al., 2019).

For making Dhaka more livable, there is a lot to do in terms of urban services for ensuring the quality of life. To resolve the challenges of planning as- affordable housing, inadequate public transport facility, inflexible regulation and many more, it's needed to apply new kind of approaches as well as investment techniques. TOD is being considered as one of the tremendous concepts for rebuilding the urban fabric of Dhaka (Mason, 2020).

The study is an attempt for emphasizing the potentiality of livability improvement after TOD implementation in the context of Dhaka and has tried to explore the research question; what are the opportunity of urban livability improvement through TOD planning in Dhaka?

4. Research Method

This study adopted both qualitative and quantitative approaches. Various literature on TOD and urban livability has been reviewed to explore the relation between the two. The first part of analysis is based on literature review which is a qualitative one and tried to look at theoretically how TOD can improve urban livability. For the second part of analysis, one of the MRT 6-line station "Mirpur 11" was considered as empirical case. Line 6 is selected because this is the only line under construction and Mirpur 11 is considered as case station because of data availability. This part of analysis focused on spatial elements that are theoretically connected to both TOD and livability: residential density, commercial density, building height, land use diversity, pedestrian and cycling-friendly design, public places availability, etc. to explore the potential of TOD in improving the livability of Dhaka. Spatial analysis tool of GIS 10.5 was used to analyze the data. However, the concept of TOD is very new in Bangladesh. Although the application of TOD is very context sensitive (Haque, 2019), very few studies on application of TOD in Dhaka context can be found. Therefore, lack of secondary data was a major limitation for this study.

3. Quest for Exploring the Relationship Between Tod and Livability

3.1 Concept of tod

The concept of TOD was traced firstly by John Nash in 1811 through the master plan of Blaise Hamlet for Easter worker in Bristol, England. However, Peter Calthrope formally labeled the concept as TOD in his 'the next American Metropolis'. Since then, this approach is being used for countering urban sprawl (Gihring, 2009) and integrating diverse land uses with transit system (Calgary, 2004) especially in the North American context.

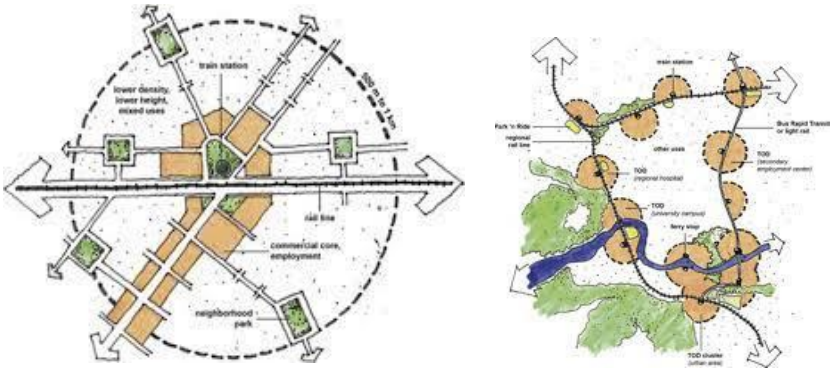


Figure 1: Example of TOD design
Source: Pojani and Stead, 2018

According to Peter Calthorpe (1993), TOD is a mixed-use community located within 2000 feet (ten minutes walking distance) around a transit stop and a core business hub. Here, the maximum distance was the distance from where most people were willing to walk to a station. This is the area where residential and other land uses have a higher chance of using transit (Calthorpe, 1993).

Later, Cervero identified variables of built environment in TOD which are potetial to embrace urban livability goals namely density, diversity and design (Pedestrian and cycling friendly) (Cervero & Kockelman, 1997). Additionally, the performance of TOD are measured in six criteria namely Locational efficiency, value recapture, livability, return on investment, variety, and efficient regional land use patterns (Belzer & Autler, 2002). Dittmar and Ohland (2004), claims that the integration of transit and surrounding development, promotes synergies among possible uses, resulting in a more comfortable community around transit stops.

Recently, definition of Suzuki, Cervero, and Iuchi (2013) explore that TOD as having two primary characteristics: closeness to transit stations and a functional relationship with them, as well as service provision by high-quality public transportation and compact, mixed-use buildings and neighborhoods. They claim that TOD planning isn't only about constructing a new transit-oriented development but also imply TOD facilities to areas where a development already exists (Suzuki et al., 2013). Thus, all definition of TOD is concerning with place making in the name of density (increasing density around stations within a 400-to-800-meter radius), diversity (mix land use, variety of housing and commuting choices) and pedestrian friendly design.

3.2. Concept and Significance of Livability

The concepts of livability, sustainability and resilience are core principles for making better living environment. While sustainability ensures a comprehensive approach to improve quality of life at all levels by maintaining holistic presence of economic, social and environmental goals, resilience comes with survival, adaptation and evolution; livability is considered a subset of sustainability and resilience which impacts the community level with more emphasis on the quality of life. Lack of interconnection among these concepts in policy making and community planning process often hinder community efforts to achieve sustainability, livability or resilience goals. Few cities have been able to ensure great livable communities but only limited to wealthy members, whether a few resilient communities do not offer livable places. Thus, a comprehensive approach is needed to combine each concept (Hamad, 2020).

Sustainability is considered to understand hardly rather than livability due to its critical operational management and implementation, whereas resilience can be accomplished only with specific mechanism. Application of sustainability or resilience is often conflicted where livability consecutively brings sustainability with time. Livability is rather a fluid concept which may bring sustainable and resilient vision with time by balancing long term social, economic, environmental concerns in community level with great values (Gough, 2015; Hamad 2020).

The basic requirement of livable cities assembles the synergy, and the considerations of multiple dimensions respective with the natural and built environment. Higher density, mixed residential tenures, the walkable urban enclosure that provides equal access to services are some pre-requisites for a better-built environment of livable urban space (Kashef, 2016).

Livability comes in modern transport policy in terms of safety, attractiveness, and a delightful environment that reflects the impacts on movement, places, and society as well. In transportation planning, the idea of livability resembles better transportation

facilities for achieving access to affordable housing, employment opportunities, advanced community facilities, etc. (Anciaes & Jones, 2020; Rue et al., 2010). The development of high-quality infrastructure contributes to fostering economic development and urban design which offers people a wide range of commuting options like public transportation, private vehicles, and many more. This attribute strategically connects several modal pieces like roadways, transit services, bikeways, and pedestrian facilities (Furlan et al., 2019).

Several scholars have considered urban livability as a unique design process. The International Making Cities Livable Conference (IMCL) focused on reviving city center with a compact form of urban neighborhood with public accessibility to every single community facility as-market, festival or much more. They have put the limelight regarding livability discussion into the necessity of functional mass transit, individual bike or bicycle lane, child friendly urban space as well as mixed use urban fabrics (IMCL, 2020). According to Economist Intelligence Unit (EIU), the concept of livability is simple which emphasize on the best and worst living condition and thus the assessment is conducted by setting benchmarks in several categories. EIU assign the rating by considering thirty qualitative and quantitative factors across five broad categories: stability, healthcare, culture and environment, education, and infrastructure. The "infrastructure" category complies the quality of road network and public transport of any city (The Global Livability Index, 2021).

The conscious development of public transport or mixed used communities within a 10-minute walking distance (2000 ft) of a transit stop is a comprehensive strategy of urban design. Through these approaches, TODs present a mixture of all types of land usage like residential, commercial, community facilities and open space in one platter with a better accessible environment. This kind of measures are an attempt of enhancing livability and quality of life. In other sense, this type of initiatives also contributes to the prevention of urban sprawl and automobile dependent cities. Thus, the thought of TOD is one of the most convenient ways for successful livable urban development (Calthrope 1993; Furlan et al., 2019). Density, mixed use developments and hierarchy of centers have been applied for sustainable techniques of ensuring livability and quality of standards in countries like Qatar (Doha), USA (Charlotte).

Zhang (2007) and Zhan et al (2016) explore safety, health and convenience as the first-class indicators for measuring livability; Wang (2010) added natural and economic environment, and Wey & Huang, (2018), added urban spatial structure, ecology, traffic system. Mowla (2004), identified pedestrian facilities, public places, affordable housing as the major indicators of urban livability. The indicators and key principles of TOD density, diversity and the pedestrian friendly design (Cervero & Kockelman, 1997) have been elaborated to show the relation between TOD and urban livability; as well as for analyzing the potentiality of livability improvement in the case of Dhaka.

3.3 Association between TOD and Urban Livability

Scholars in the field of urban planning argue that livable cities to promote a healthy environment are founded primarily on two criteria i.e., the basic need (clean air and water, energy, and waste management) needs to be met first, and then the quality of life must be ensured. In developing countries, due to the low standard of living in

metropolitan areas, better livability is a crucial issue that requires attention (Yeun B. and Ooi G.L., 2009). Common indicators of livable cities are- safety, health (Zhang 2007, & Zhan et al. 2016), spatial structure, ecology, traffic system (Huang, 2018) and economy Wang (2010). More specifically it can be said that some attributes of livability are also closely related to TOD key performance. Social interaction places, infrastructure, public services, good connectivity, natural environment, safety, education, healthcare, cultural environment, recreation, shops, housing options, cleanliness, walkability and distinct characteristics are symbol of livability for a community or city explored by the scholars (Ranson, 2013). These attributes can be divided into individuals' preferences or urban environment, but both are related to mobility. A model developed by Gyori and Barona (2019) has considered mobility as a key element that connects TOD and livability. Figure 2 is the graphical illustration of their model which reflects the relation between key principles of TOD as well as can play a role in improved urban livability.

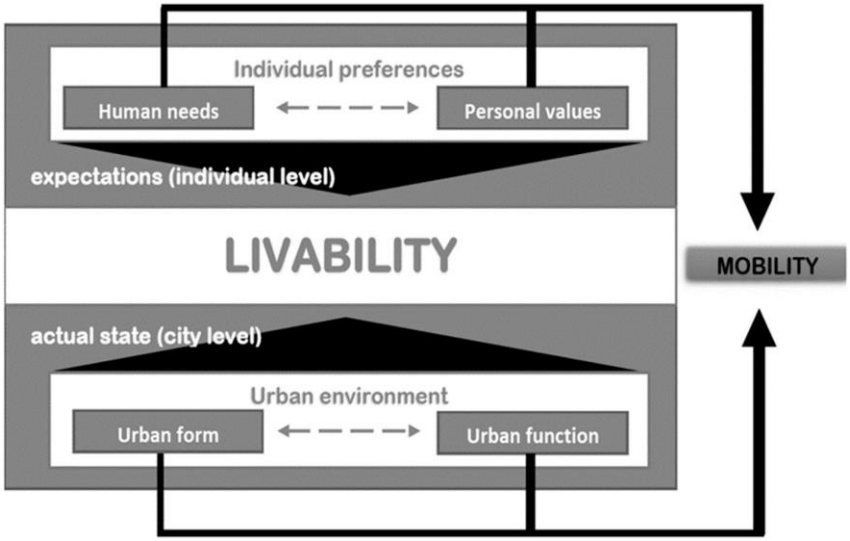


Figure 2: Connection between Urban Livability and Mobility
Source: Adopted from (Kovacs-Györi & Cabrera-Barona, 2019)

Similarly, livability measuring approaches also look at indicators like property values, number of housing units, new housing developments, and business activities which are also associated with TOD impacts. The potentiality of redevelopment characteristics like the existence of vacant plots or underused buildings is a matter of concern that needs to be dealt with carefully for urban sprawl prevention as well as for ensuring livability (Balsas, 2004). TOD also eradicates this challenge through the best usage of this type of parcel by enhancing redevelopment opportunities (Haque et al., 2019).

No matter by what means, people travel and they end up as pedestrian on urban side-walks and therefore ultimate limit on the smooth functioning of an urban area is its provision for pedestrian circulation (Bigio & Dahiya, 2004). Thus, improved livability is another meaning of improved pedestrian facilities. Bigio & Dahiya, (2004), also put strain on feel of community as an important indicator for urban livability. Livability in transportation-related studies has been also described as the introduction of pedestrian-

friendly cities. A case study of Thomas Jefferson Planning District near Virginia, USA addressed some amazing livability indicators as a part of their transportation planning initiative. Community elements like mixed use of buildings, building proximity and scale, internal path, and external connectivity have been measured for assessing the quality of the community. The concentration of new housing units within 5 minutes walking distance of transit station, percentage of commuters using public transit and number of increased pedestrians are the aspects that have been expected to ensure livability (National Research Council, 2002).

Now-a-days transportation agencies are focusing on the relation between transportation and housing in terms of affordability for following the new livability principles. The larger locational affordability thus indicates the greater livability. "The FasTracks steamed project" by the Denver council was an initiative for developing a comprehensive public transit system for promoting livability by incorporating compact, mixed-use developments with a transit-friendly environment with more affordable housing (Rue et al., 2010).

The high density of local commercial economies of scale (Haque, 2019) contributes to an affluent economy in the context of TOD. Besides, smaller blocks, buildings adjacent to the street with entrances that immediately connects to the public walkway, retail on the ground level with businesses and homes above, and easily accessible transport stops with nice waiting areas provide added convenience to pedestrians (Belzer, Autler, Espinosa, Feigon, & Ohland, 2004; Calthorpe, 1993; R. T. Dunphy et al., 2004; Goodwill & Hendricks, 2002). Simultaneously this improves the social interaction, feel of a community.

Diversity of land use increases the ease of access to schools, libraries, public spaces (Cervero & Arrington, 2008), housing affordability and transportation. A high level of variety improves the station's locational efficiency, allowing it to accommodate new development and, as a result, increase transit usage, pedestrian traffic, bicycle traffic and accessibility (Norley, 2015; Sun, Webster, & Chiaradia, 2017). Thus, accessibility to public transport increase and housing cost is offset by reducing transportation cost (Rayle, 2015). In this kind of situation, people become more inclined to walk or bicycle riding by getting a pleasant environment where they feel safe (Haque, 2019) and that is another significant aspect of TOD.

To discourage the use of automobiles or other private modes of transportation, and the potential for inner modality increases parking is typically kept limited (Black, Tara, & Pakzad, 2016) which develop ecological aspect. In a nutshell, it can be said that, in the whole process of TOD, livability around the station is most often a significant concern followed by the reduction of congestion and improved environment (Abdullah & Mazlan, 2016; Luca Bertolini, 1996; Cervero & Sullivan, 2011) as it tries not only to create a transit 'node' but also to make a 'place' to live (Haque, 2019).

4. TOD as key to urban livability of Dhaka

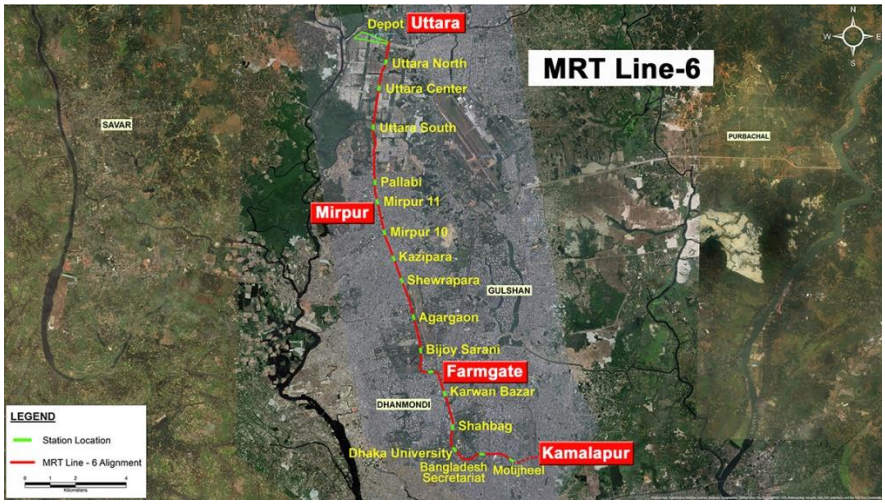
BIGD (2016) conducted a survey to identify the significant reasons behind traffic congestion of Dhaka city which outlined the causes as such- haphazard parking, private vehicle occupying pattern, and violation of enormous traffic rules. Lack of traffic

management, consecutive rising demand of private transport due to safety and comfort issue, overlapped involvement of 30 agencies for transport management has made the overall scenario critical (BIGD, 2016). This study recommended the inclusion of high-capacity public transport along with the governance of the transport sector with extensive traffic management measures for reducing the uninhabitable condition of Dhaka.

Making the streets of Dhaka "livable" is challenging due to the struggle for finding a solution that can improve space and safety, by which walkability can be enhanced for pedestrians. In an already congested traffic patterns, interim approach is essential for launching elements that would bring favorable public space and travel behavior simultaneously by not bringing any hard limits. The prevailing nature of mobility, heavy interlink with social, economic and cultural contexts forces to consider detail design and strategic approach (Belinda & Vallejo, 2018). Experiences on TOD from countries like United States reflects the inclusion of land use and transportation planning with supportive policies and funding that enabled a livability raise by ensuring sustainable growth of job, housing and transportation economically (Department of Transportation, U.S. 2009).

TOD is the kind of mechanism being suggested for solving this travel obstructions along with for safeguarding the remaining contexts. For resolving the traffic problem of Dhaka, TOD has been recognized as primary tool (STP, 2005). Dhaka can be a great context for TOD establishment due to its dense urban characteristics as more than 800 persons per acre in inner urbanized districts. Since TOD is a concept of modern urbanism for bringing residential, commercial and recreational activities in one individual platter, the very famous congested nature of Dhaka justifies the inclusion of this mechanism (RSTP, 2015).

The draft Structure Plan (2016) proposes TOD around the stations along the line 6 corridor (RAJUK, 2016). MRT line 6 will connect the northern peripheral area to the CBD through 16 stations (RSTP, 2015; STP, 2005) which is under construction. The completion of the mass transit is expected to bring a huge land use changes around the stations. Although all the 6 proposed MRT lines would be constructed as per the recommendations from RSTP (2015), MRT line 6 is comparatively the most accomplished route in terms of construction which has completed almost 88.94% of the total construction work from Uttara to Agargaon station part (DMTCL, 2021). This progress has already required appropriate planning initiatives for the completed TOD stations to avoid scattered growth or minimizing the risk of uninhabitable conditions.



Source: Dhaka Mass Rapid Transit Company Limited (DMTCL, 2020)

5. Case Study for deriving TOD as the technique of livability improvement

Empirical studies on case station (Mirpur-11) 800-meter buffer zone reveals that the major issue of livability lying in these areas is housing affordability, lack of open space and parks, lack of pedestrian facilities, absence of cycling facilities, etc. Transport and communication includes only secondary and access road with width of 3-15 meter (Haque et al., 2019) and absent of dedicated lane for cycling. Spatial analysis shows that, residential density is of these case stations are 41601 dwelling per sq.k.m (using entropy method), diversity level is 0.69 and walkable/cycle road length is 58.36 k.m., Average building height (number of floors) is 2.31. Commercial density is around 1314 which reflect a good number.

Table 2: TOD indicators value from spatial analysis

Variables	Measuring indicators	Mirpur 11
Density	Residential density (DU/km²)	41601.10
	Commercial density (number/km²)	1314
	Building height (average stories)	2.31
Diversity	Land use diversity (entropy)	0.69
	Percentage of plaza, park and open spaces/ km²	1.93
	Percentage of others facilities/ km²	3.12
Design	Total road length (in km)	65.28
	Average road width (in km)	0.00204
	Walkable and cycle able path (in km)	58.36
	Footpath length (in km)	42.07

Source: Spatial analysis based on DAP dataset, 2019

On the other hand, empirical investigation (according to RAJUK, 2016 guideline) around case station reveals that open space, health facilities, community facilities, institutional spaces and commercial spaces are respectively, 1.24%, .03%, .81%, 2.71% and 4.97% of the total area which is below the standard.

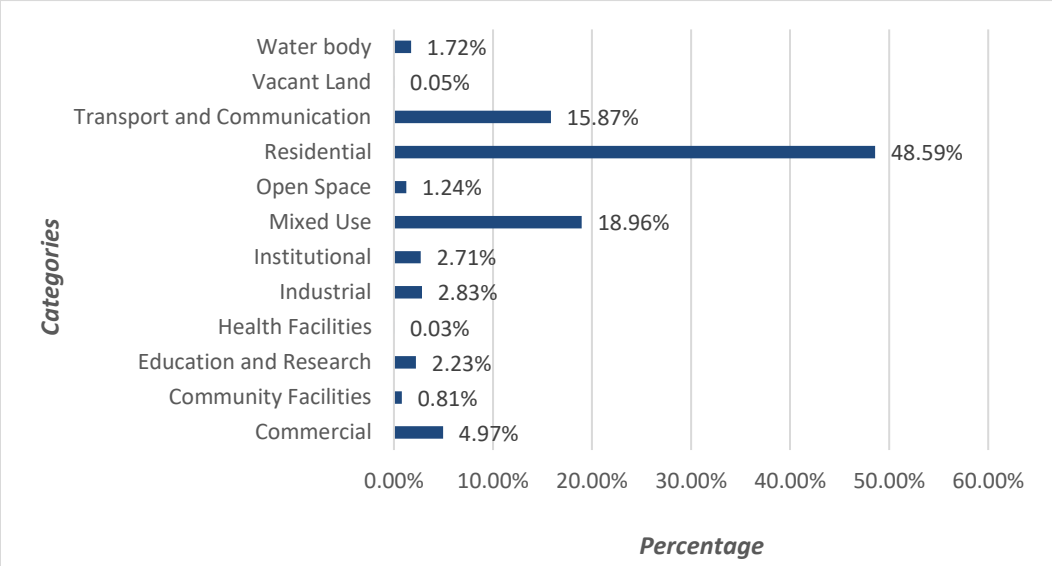


Figure 4: Percentage of Various Land use around Mirpur 11 station

Source: DAP, 2019

Low average building height, lack of walkable road, higher land use diversity, less amount of commercial, institutional, and open space in the study area shows a greater opportunity to redevelop as TOD that may further results in improved livability of the area. Housing study of the Mirpur 11 area shows the current unaffordable situation which is at the same time a good opportunity for real estate development. Detail Area Plan (2016-2035) allows flexibility for building height, land use diversity, pedestrian roads in TOD area. Haque, 2020 through 77 household interviews revealed that the study area has only 18 percent of housing ownership. The rest 78 percent lives in rented house and the average per square feet house rent is 1180 which is quite high.

Table 2: Housing scenario of Mirpur 11

Occupancy Type	In percentage
1. Owner	18
2. Rented	78
Average house/flat size (in sq. ft)	1,310.39
Average space (in sq. ft./person)	327.59
House rent per 100 sq. ft. (in BDT)	1,180

Source: Haque, 2019

Under the cultural context of Dhaka people are more likely to stay in the same neighborhood as they share a good bondage with the community or neighbors around (Satu, 2014). Transit accessibility will tend to attract more people from the other part of the city, which along with the current residents combinedly will help to achieve desirable density. Thus, could be positive sign for densification within future TOD precinct. Existing rental pattern of the study area reveal that, the share of house rent to the total household's income is more than 30 percent for 55 percent of the respondents. Therefore, 45 percent of the households within TOD precinct are within the affordable range in terms of house rent (Haque, 2019). Globally much evidence confirmed that, transit has a positive impact on land value, commercial rent and trend of development (Debrezion et al., 2007; D. B. Hess & Almeida, 2007; Kilpatrick, Throupe, Carruthers, & Krause, 2007; Olajide, 2015; Salon & Shewmake, 2011; Xue & Sun, 2018). Thus, drive the real estate market (Belzer & Autler, 2002; Curtis et al., 2009). According to the economic theory, users will be willing to pay more to locate nearer to the stations (O'Sulivan, 1996). Private real-estate developers are the primary contributors to the housing supply in Dhaka which is around 93 percent of the total (RAJUK, 2016). Unaffordable housing markets indicated huge potential for real estate development and redevelopment around case stations which may lead to the better living environment or improved livability if planned in proper way.

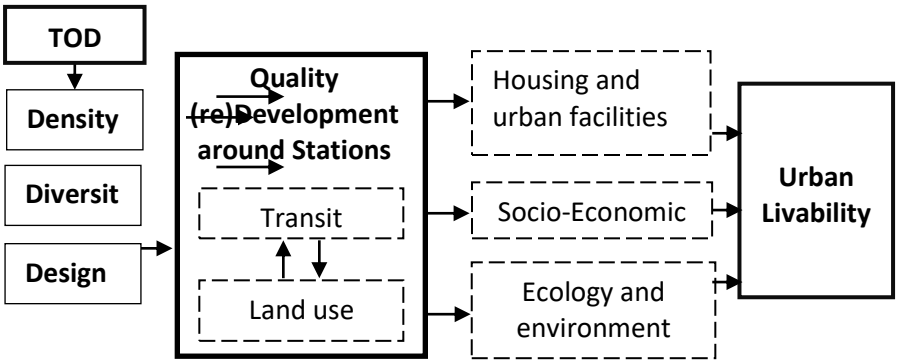


Figure 5: How TOD Embrace Livability

Source: Author adopted from literature

Planned transit projects around MRT stations and surrounding aspects like jobs, affordable housing set stable oasis which supplements public and private infrastructure and thus it supports livability. Transit station surrounding areas often offer a great variety of choices to residents like mobility needs for personal business, job and recreational purposes through TOD planning. Thus, the multi-use developments by TOD contribute to the long-term sustainability and enhance livability.

6. Conclusion

Inclusive TOD can counter poor condition of cities that are suffering from lack of greenery, ecological problems, traffic congestion, sprawling, and unaffordable housing and so on. Traffic congestion in roads significantly impedes the accessibility, resulting in

declining livability impact of land use change. Introduction on of new infrastructure through TOD may increases supply of affordable housing, optimum level of density, land use diversity with adequate park, playground, pedestrian facilities which are the core concern of TOD planning. The case station shows opportunity of TOD. Effective TOD planning will improve the density, diversity, design and housing supply. Thus, in turn will result in improved livability.

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Seismic Risk Assessment and Evacuation Preparedness: Approach of Resilient City with Evacuation Knowledge

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Abstract: Bangladesh is in a high-risk zone of seismic danger, based on historical records, geological evidence, and contemporary earthquake patterns. Earthquake is one of those natural catastrophes that has a direct and immediate impact on people's lives and communities. The procedure of the execution of the study is in three terms and they are social vulnerability/social aspects, physical vulnerability aspects and emergency response. In the social aspects some index were calculated for 5 indexes by 0 to 1 range scoring method and 380 samples were collected for that. The effectiveness of emergency evacuation level of service or virtual effectiveness analysis also conducted by consumer's contentment index and public stuffs index. The vulnerability of the buildings in the study area has been calculated with the Visual Rating (VR) method. In the result of the study total score of social awareness and emergency evacuation preparedness factors is 8.91 out of 25 which represents the poor condition of social awareness. The consumers contentment index is 47.1 and the public stuffs index is 38.89 out of 100 score in savar study area which also represent the poor condition of satisfaction level regarding earthquake preparedness. About 43% building have no damage condition and 10% buildings have lightly damaged possibility and 28% buildings have the less possibility of collapse following by the 15% buildings of moderate possibility of collapse and about 4% building have high possibility of collapse. These result is found by 100 buildings surveyed in different ward of study area. However, due to a lack of knowledge and financial support, more participants may be unable to participate in the study. This research will help with community planning and development, as well as developers' utilization of underutilized rebuilding approaches. The model employed in this study will directly contribute to the evaluation of vulnerability and will also aid in the earthquake mitigation activities of the Savar Municipality.

Keywords: Seismic risk, Evacuation preparedness, Rehabilitation Strategies, Physical Vulnerability, Visual Rating (VR) method, earthquake mitigation.

Introduction

Bangladesh is one of the most earthquake-prone countries on earth (Tuzzohora, Parvez and Rahman, 2015). Bangladesh is seismically active due to the existence of several fault lines and tectonic plate boundaries. Seismic risk is increased by previous earthquake experience, rapid urbanization, high population growth rates, high density, and the development of economic infrastructure (CDMP, 2014). Earthquakes have both direct and indirect harmful consequences for human lives and a country's socioeconomic growth (Tuzzohora, Parvez and Rahman, 2015).

As the population of cities grows, more people are exposed to natural dangers. In Bangladesh, 35.86% of total population live in the cities (Statista, 2019). Major earthquakes may occur in the Sub-Himalayan area, including Bangladesh, according to Bilham (2004). According to earthquake hazard, Bangladesh has been divided into four seismic zones on the zoning map:

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Zone-I, Zone-II, Zone-III and Zone-IV are the four zones in which Savar is located in Zone – II (BNBC, 2020). The Savar is moderate seismic intensity area with 0.20 seismic coefficient values (BNBC, 2020). The risk in Savar, like in Dhaka, is compounded by uncontrolled urbanization and growth in high-risk zones. Dhaka and Tehran are the cities with the highest danger of a seismic disaster (Rahman, 2004). Despite the fact that no moderate to major earthquakes have struck Dhaka in the past, the city suffers small tremors practically all year, indicating that the region is seismically active (Khan, 2004). So the near Dhaka city the savar urban area is very much seismically active with its unplanned building structure. The Savar municipality appeared highly vulnerable to earthquakes due to the region's physical characteristics and road conditions (Akter, Shawon and Rahman, 2021).

Many new challenges are arising as a result of rapid and unplanned urban growth and development (Briassoulis, 2009; Mahmud, Rahman and Sharmin, 2020). Every uncontrolled development has several severe social, catastrophic, and environmental consequences (Rahman, 2012; Rahman, Hossain and Miti, 2019; Ahmed and Rahman, 2020). Due to insufficient organization, preventive, and evacuation systems and/or preparedness plans, risk in urban areas is quickly growing, particularly in developing countries (Biswas, Rahman and Akther, 2016; Hasan and Rahman, 2014; Chakrabarty, Rahman and Ubaura, 2020). The urban area, Savar are growing in an unplanned manner in order to meet the population's housing needs (Rahman, et al., 2020; Rahman, Hossain and Miti, 2019). The newly constructed houses are not up to code (Rahman and Akther, 2015), while the existing houses' repair and maintenance are inadequate, resulting in disastrous outcomes in the event of a calamity such as an earthquake (Akther and Rahman, 2017; Shawon et al., 2021). Open spaces/playgrounds and wetlands are being converted to buildup areas (Rahman et al., 2020) in the form of development (Rahman, Saha and Tanvin, 2021), and the loss of open spaces and water bodies is increasing risk vulnerability such as earthquakes (Rahman, Tariq and Sharmin, 2020, 2021; Shawon et al., 2021).

Dhaka's earthquake danger is fueled by the city's vulnerability, exposure, and poor emergency response and recovery capabilities (Davidson et al., 2000). CDMP (2009a, 2009b, 2009c) estimated Dhaka's seismic risk in the event of a 7.5 Mw earthquake generated by the Madhupur fault. According to the estimate, about 270,604 structures out of a total of 3,26,000 will be moderately damaged, accounting for almost 89 percent of the entire building stock.

On 24 April, 2013, Rana Plaza collapsed in Savar (Wikipedia, 2020). Up to 13 may, total 1,134 people died (Tansy, 2015). Approximately 2,500 injured people were rescued from the building alive (Alam and Hossain, 2013). This example shows how deadly building collapse are. In April 12, 2005, a nine-story industrial building in Savar collapsed, killing 60 people and injuring about 100 workers due to poor building construction quality (The Daily Star, 2005).

The danger in urban areas is complex due to uncontrolled urbanization and development in high-risk zones. Savar, is located near Dhaka the capital of Bangladesh, is a special category pourashava with a population of 2,86,007 and the population density is 20,313 (BBS, 2011) which is very high. Because of the high population density, the ward number 3, 5 and ward 2 is more sensitive to earthquakes. The high density municipality

proves the how poor condition of the emergency preparedness during and after any disaster in this place. Apart from the main city of Dhaka, the unique category of Municipality was not previously considered for earthquake susceptibility. As a result, assessing the susceptibility to seismic hazard in this highly populated town is critical. Furthermore, the study region, Savar Municipality, is linked to several businesses, including textile manufacturers.

This research helps to find out the level of earthquake vulnerability according to disaster risk index. Furthermore, it also give the level of earthquake risk awareness and earthquake evacuation knowledge by different socio-economic background people and finally To improve the resilient plan in the perspective of emergency evacuation management for earthquake and other secondary hazard e.g. building collapse. These should optimize the time of intervention (evacuation, rescue, hospital treatment, etc.) in the most efficient way to minimize the suffering of the populations (Omar, 2018).

Considering the realities, the objectives of this study were: (1) to evaluate the level of earthquake vulnerability according to disaster risk index; (2) to determine the earthquake risk awareness and earthquake evacuation knowledge in the study area; (3) to find out the resilient plan related peoples opinion in the perspective of emergency evacuation management for earthquake.

Methodology of the Study

The procedure to execute of the study is in three terms and they are social vulnerability/social aspects, physical vulnerability and emergency response. The ***social vulnerability*** is measured by analyzing five indexes. To assess the social vulnerability aspects some variables is selected. These is demography, earthquake risk awareness, emergency evacuation knowledge, provision for elderly/disabled, self-protection ability and temporary emergency evacuation shelters. To give the final weight and rank of the above stated factors, a questionnaire survey has been conducted to quantify the relative priority of the given set according to the appropriate value scale.

Sample design

In this research survey, an “individual” has been chosen as a sampling unit. There are about 286008 people in Savar Municipality Area (BBS, 2011)

Formula:

The sample size (n) is calculated according to the formula: $n = [z^2 * p * (1 - p) / e^2] / [1 + (z^2 * p * (1 - p) / (e^2 * N))]$
Where: $z = 1.96$ for a confidence level (α) of 95%, p = proportion (expressed as a decimal), N = population size, e = margin of error.
$z = 1.96$, $p = 0.5$, $N = 286008$, $e = 0.05$
$n = [1.96^2 * 0.5 * (1 - 0.5) / 0.05^2] / [1 + (1.96^2 * 0.5 * (1 - 0.5) / (0.05^2 * 286008))]$
$n = 384.16 / 1.001343 = 383.64$
$n \approx 380$
The sample size (with finite population correction) is equal to 380

Method for Emergency Evacuation Level of Service/Virtual Effectiveness Analysts: Emergency Evacuation Level of Service has been assessed. It is develop a number of

measures or issues for a sustainable and efficient evacuation system on the basis of the shortcomings of present system. Investigation is done through Michael Patton's Utilization Focused Evaluation Model (Patton, 2014 and 1997). Consumer satisfaction index and public stuffs index are two dimensional studies that are used here to quantify and analyze the success of such efforts. ***Consumers Contentment Index:*** Direct questioning of a representative sample of the user community is used to assess stakeholders' views of and satisfaction with the quality of emergency evacuation service. A Consumers contentment index (C.C.I.) is thus defined as:

$$C.C.I = \sum_{i}^{q}(Ri)$$

In which, R_i = question i, value, and q = questions number. When all of the replies are given maximum values, the customer satisfaction index assumes maximum value (100 in this example), showing total contentment with all of the Components that make up the overall quality of service.

Public Stuffs Index: Within Study Area Overall, buildup area has been measured through visual inspection. It is based on rating of building block on a scale of 1 to 4. A Public Stuffs Index (P.S.I.) may be calculated by adding the aggregate impact of all block facts in the area and normalizing the results so that an entirely trustworthy neighborhood gets a score of 100 (this condition is all but impossible to obtain). To calculate the Public stuffs index, use:

$$PSI = 100 - \frac{100}{s}\ X\ \frac{\sum_{1}^{b}(si-1)}{b}$$

In which S_i = buildup rating of i^{th} block, b= number of block.

Physical Vulnerability Aspects/Building assessment: The Visual Rating (VR) Method was used to determine the vulnerability of the structures in the research area. For this it is calculated with an established Visual Rating (VR) Method. In this stage the simplified seismic capacity index has been calculated considering column area ratio, RC wall area ratio, masonry wall area ratio and their average shear strength. This VR method is developed specially for Bangladesh by Tohuku University - Japan, PWD and HBRI.

$$I_{VR} = \frac{1}{n.w}\left[\tau_c\left(\frac{b_c^2}{l_s^2}\right) + \tau_{inf}\left(\frac{t_{inf}}{l_s}.R_{inf}\right) + \tau_{cw}\left(\frac{t_{cw}}{l_s}.R_{cw}\right)\right] F_{IV}.\ F_{IH}.\ F_D.\ F_Y$$

Where, τ_c = The average shear strength of column, τ_{cw} =The average shear strength of shear wall, τ_{inf} = the average shear strength masonry infill, n= Number of story, w = Unit weight of buildings, t_{inf} = Thickness of masonry infill, t_{cw}= Thickness of concrete wall, Visual Rating Parameters: b_c=Average column size, l_s=Average span length, R_{inf} =Masonry infill ratio, R_{cw} =Concrete wall ratio, The reduction factors are as follows: F_{IV}=The modification factors for vertical irregularity, F_{IH} = The modification factors for horizontal irregularity, F_D = The modification factors deterioration of concrete, F_Y = The modification factors for year of construction.

The decision criteria and ranges has been obtained according to the Visual Rating Index (I_{VR}) as shown in Table 1. Market places and industries has been categorized into 5 (five) classes such as A, B, C, D, and E describing the different levels of seismic vulnerability depending on Visual Rating Index (I_{VR}).

Table 1: Categories for Visual Rating Method

Range of Each Categories	Categories	Description
$0.26 \leq I_{VR}$	A	No Damage
$0.24 \leq I_{VR} < 0.26$	B	Light Damage
$0.16 \leq I_{VR} < 0.24$	C	Less Possibility of Collapse
$0.10 \leq I_{VR} < 0.16$	D	Moderate Possibility of Collapse
$I_{VR} < 0.10$	E	High Possibility of Collapse

The first step in determining the stage's vulnerability will be to categorize the building inventory into different construction classes. Each of the construction classes for buildings in the study region will subsequently be given fragility curves. For any given damage condition, a fragility curve will offer a cumulative frequency or likelihood of reaching a specific displacement threshold (BUERP, 2014). The damage condition has been categorized into the five categories listed above. Estimates of buildings in each damage condition have been derived from the construction of the fragility curves.

Emergency Response/ Accessibility vulnerability

Emergency response/accessibility is one of the most important components of earthquake preparedness because a few minutes of delay by emergency response team may mean loss of human life. By GIS software and from the GIS database the narrow road were selected here in which there is no accessibility of fire brigade car and ambulance for the emergency rescue.

In this research the access road is identified which width is more than or equal to 10 feet. The percentage of structure that is inaccessible by each road was determined, and the results were utilized as indicators as no access of rescue facilities.

Integrating the above stated three aspects the vulnerability result in the study area is accumulated by merging this three layers.

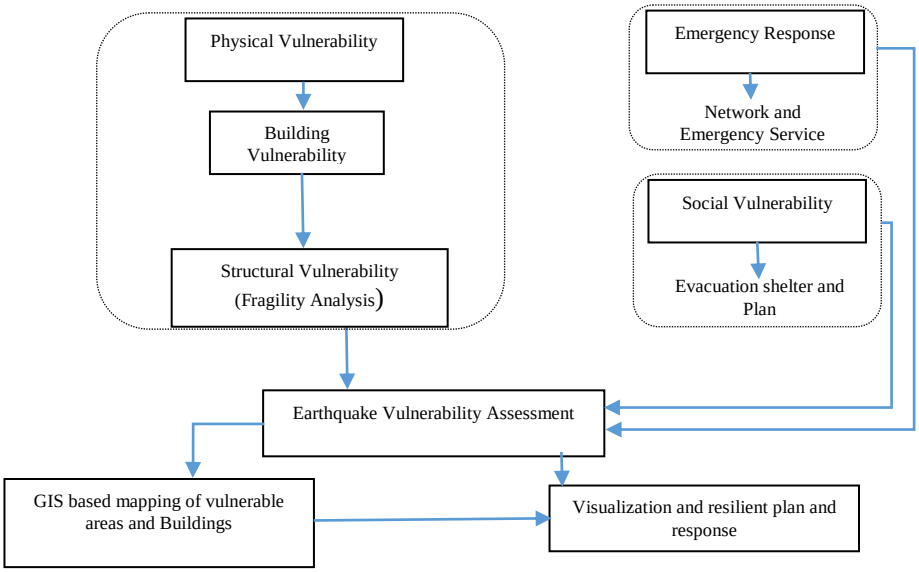


Fig 1: Methodological flow chart of the study

Resilient Cities and Seismic Risk

Tilio et al., (2011) define a resilient city as adopting an approach implies defining what aspects of a city can reflect the bare minimum necessary to ensure functionality. Paton et al., (2001) define a resilient city as a short or medium network of physical systems and human communities, the first of which includes all types of structures and infrastructures, "acting as the city's body, its bones, arteries, and muscles," and the second of which includes all types of associations and organizations, "acting as the city's brain, directing its activities, and responding to its nefarious activities."

Community seismic resilience is described as the ability of social units to avoid risks, contain the consequences of earthquakes when they occur, and carry out recovery activities in ways that minimize social disturbance and decrease the effects of future earthquakes (Bruneau et al., 2003). This may be accomplished by focusing on structural issues as well as emergency response and strategies, including institutions and organizations, especially those that conduct critical roles for community well-being, such as health care facilities (Tilio et al., 2011).

It is defined as a function of danger, exposure, and vulnerability (CDMP, 2009c) when cities are considered complex systems (Fransen, van Dijk, & Edelenbos, 2021). However, the idea of urban seismic vulnerability (CDMP, 2009c; Rahman, Ansary and Islam, 2015; Akhter, 2010 and Roy, 2014) and capacity for disaster resilience (Warrick et al., 2017; Miles et al. 2012 and Chen et al. 2008, 2009) has previously been utilized in different literature. The impacts of earthquakes are not confined to physical destruction; they also have consequences in economic, social, and political activity, and they have a significant impact on a city's ability to respond (Manyena, 2006). A strategy for reducing urban seismic risk that maximizes system resilience (Comfort, 2007). This resilience system can be used to develop strategies (Bruneau, 2003) and might improve the capacity against earthquake (Barnett, 2001).

Result and Discussion

Preparedness for an emergency evacuation and social awareness

A grading system is used to assess the level of awareness among building users and. Under the emergency evacuation readiness and awareness state in the research region, there are five factors. They are as follows:

- Awareness of Earthquake Risk
- Knowledge of Emergency Evacuation
- Provision for the Elderly/Disabled
- Vulnerability of Residential Structure
- Self-Defense Ability

Each variable is subdivided into five subvariables. The sub variables' negative and positive answers are coded from 0 to 1. The condition of each sub-variable is described by the mean values of each sub-variable. The condition of each variable is represented by the sum of sub-variable mean scores.

Earthquake risk awareness

There are five sub-variables in the earthquake risk awareness variable. The sub-variable earthquake likelihood in the area has the highest score of 0.86. The lowest score is 0.19 for having an earthquake protection strategy. The overall rating is 2.11 out of 5.

Table 2: Earthquake Risk Awareness at Home

Earthquake Risk Awareness of the Hospital Users	Frequency (N)	Minimum	Maximum	Mean	Total Score (Out of 5)
The likelihood of an earthquake in the area is high.	380	0	1	0.86	2.11
Steps have been taken to enhance seismic awareness.	380	0	1	0.17	
The building is earthquake-safe.	380	0	1	0.53	
Have an earthquake protection strategy in place.	380	0	1	0.19	
Home has taken safety precautions.	380	0	1	0.36	

Source: Field Survey, 2020

The four indexes (Emergency evacuation knowledge, Provision for the elderly/disabled, vulnerability of Residential Structure, and Self-protection capacity) were computed in the same way as in the previous example, and the total score of these four indexes is displayed in the table below.

Scores for total social awareness and emergency evacuation preparedness

The continuous values generated from the sub-variables under five variables of emergency evacuation readiness elements are added together to provide a total score with a range of 25. The total score of 8.91 out of a possible 25 indicates that inhabitants have a poor degree of social knowledge of earthquake preparation.

Table 3: Total Score of Social Awareness and Emergency Evacuation Preparedness Factors

Emergency Evacuation Preparedness Factors	Score
Earthquake Risk Awareness at Home	2.11
Emergency evacuation knowledge	2.45
Provision for elderly/disabled	0.84
Vulnerability of Structures	1.82
Self-protection ability	1.69
	Total: 8.91 (out of 25)

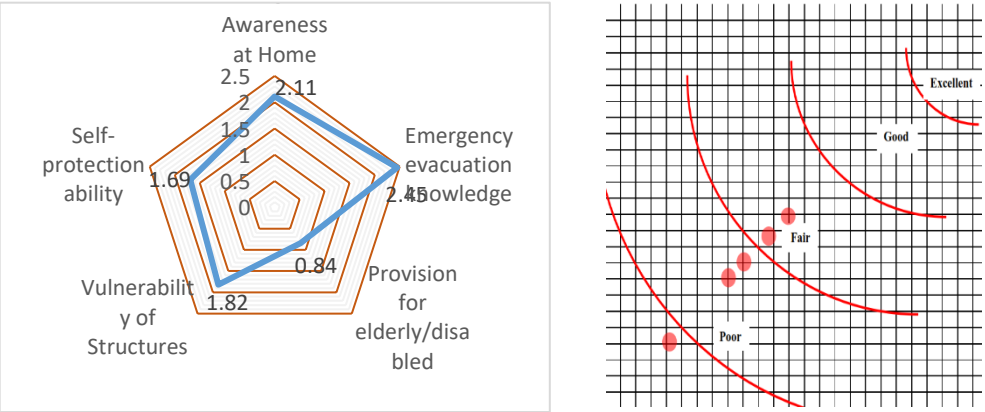


Fig 2: (a) Social Awareness Score and (b) graphical presentation of emergency evacuation preparedness factors

Emergency Evacuation Level of Service/Virtual Effectiveness Analysts

Calculation of the consumer's contentment index for households Units (HH)

The following table shows the average value of ten question related to different emergency evacuation management issues that get from the field survey.

Table 4: Average Value of Parameters for Calculating Consumers contentment Index

Primary Parameters	Secondary Parameter	Value	Frequency	Weight = Value X frequency	Total weight	Average weight, R_i
Evacuation Point	Nearby Play field	10	29	290	2272	6.0
	Out of Locality	8	57	456		
	Nearby void place	6	213	1278		
	Riverbank side	4	43	172		
	Road side	2	38	76		
Distance of Migrant Place	Below 50 m	10	46	460	1624	4.3
	50 m to 100 m	8	28	224		
	101 m to 200 m	6	41	246		
	201 m to 300 m	4	82	328		
	Above 300 m	2	183	366		
Manage	Well managed	10	12	120	1600	4.2
	Good	8	34	272		
	Medium or ok	6	58	348		
	Worse system	4	154	616		
	No system	2	122	244		

Primary Parameters	Secondary Parameter	Value	Frequency	Weight = Value X frequency	Total weight	Average weight, R_i
	available					
In this way the other parameters score are as bellow						
Management system of emergency situation					1782	4.7
Awareness Rising system					2414	6.4
Evacuation Point					1254	3.3
Distance of Migrant Place					1558	4.1
Management					1842	4.8
Management system of emergency situation					1848	4.9
Awareness Rising system					1704	4.5

Source: Field Survey, 2020

So, Consumers contentment index for Households Unit (HH) (using equation),

$C.C.I = \sum R_i$

$= 47.1$

Calculation of Public Stuffs: Table 5 shows the overall observation view of the different residential areas. The weight of buildup is given on a scale range from 1 to 4, where the lower value shows the best condition. The buildup rate of each block of the residential area is given based on the observation survey.

The overall street cleanliness for Households Units (HH)

Table 5: The Overall observation view of households Units (HH)

Area Building	Visual cleanliness rate, S_i	Area Building	Visual cleanliness rate, S_i
One Storied Building	1	Building more than 30 years old	3
Two Storied Building	2	Building For rental	2
Three Storied Building	2	Renewed single storied building	1
Four Storied Building	2	Temporary house	1
Five Storied Building	3	Building with open space	1
Six Storied Building	4	New planned Building	1

Source: Field Survey, 2020

So, Public Stuffs Index

P.S.I = 100-100/4 X (23-1)/9

= 100-61.11

= 38.89

Calculation of Consumers contentment index and Public Stuffs Index of residential buildings are calculated and shown in following graph.

Using the value of Consumers contentment index and Public Stuffs Index of the study area, the assessment of level of service is done here.

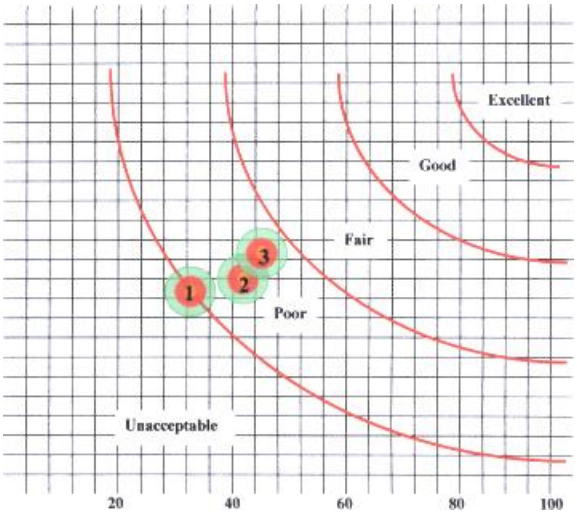


Fig 3: Emergency Evacuation Level of Service of Study area Sasvar Municipality

Source: Field Survey, 2020

Figure 3 shows a visual representation of the study area's degree of service. Each of the numbered circles on the graph reflects the average of the Consumers satisfaction and community impact indices in three distinct research units: Households are classified as having a combination of characteristics that result in an unsatisfactory quality of service. It demonstrates a low degree of service. It emphasizes the need of a well-executed Evacuation Plan for the research area.

Physical Vulnerability Aspects

Building assessment

According to the five categories listed in the methodology section, the damage condition has been categorized. Estimates of buildings in each damage condition have been derived from the construction of the fragility curves. Although just ten columns are depicted here, a total of 100 structures were examined to determine the study area's physical vulnerability.

Table 6: Damage Scenario of Buildings by Visual Rating Method

Sl. No	No of Stories	Column Size	Average span length	Concrete wall ratio	I_{VR}	Description
1	2	305	3400	0	0.278	No Damage
2	6	610	5400	0.0625	0.130	Moderate Possibility of Collapse
7	6	458	3658	0	0.226	Less Possibility of Collapse
31	5	458	3658	0	0.271	No Damage
35	6	458	4268	0	0.166	Less Possibility of Collapse
47	6	305	3658	0	0.100	Moderate Possibility of Collapse
54	5	458	4268	0.0625	0.249	Light Damage
69	5	258	3658	0	0.086	High Possibility of Collapse
76	3	258	3658	0	0.143	Moderate Possibility of Collapse
95	5	458	4268	0.0625	0.249	Light Damage

Source: Field Survey, 2020

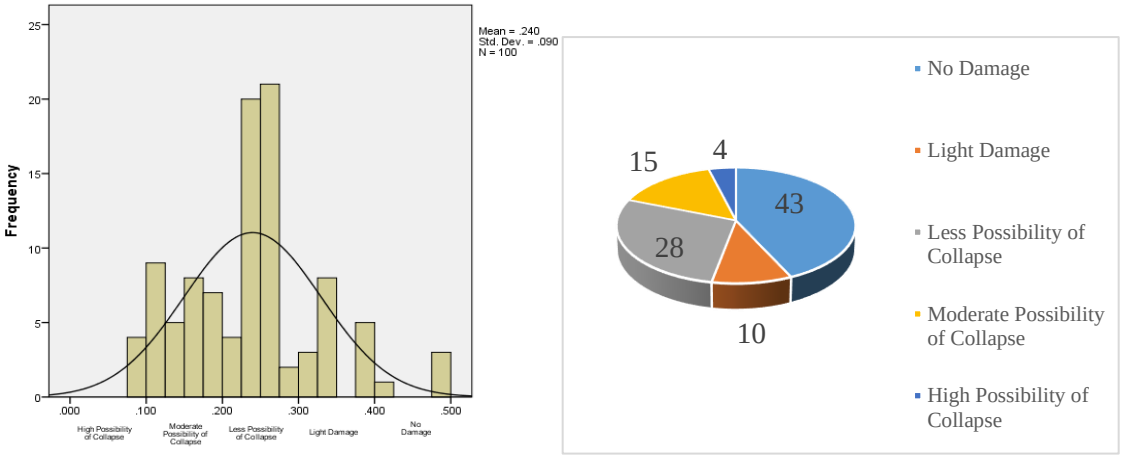


Fig 4: Damage distribution curve and percentage of damage situation by VR Method

From the above figure it is seen that about 43% building have no damage condition because these are newly developed building approving from pourashava authority and all of these are constructed following the building code. 10% building is lightly damaged if there occur any earthquake and 28% buildings have the less possibility of Collapse following by the 15% buildings of moderate possibility of collapse. In the study area about 4% building have high possibility of collapse.

Emergency Response/ Accessibility vulnerability

Rescue and evacuation are possible if the area is accessible.

A few studies have been done on the accessibility of rescue and evacuation. Hajibabaee et al. (2014) developed accessibility indicators as part of their complete seismic risk evaluation of urban structures. The accessibility indicator is created by combining the road width with the anticipated physical damage (Hajibabaee et al., 2014).

In accessible places are defined in the report (Tokyo Metropolitan Government, 2013) by the Tokyo Metropolitan Government as areas where rescuers are unable to reach people and citizens are unable to flee due to restricted roadways. The buffer area was developed for different road widths to identify those regions and GIS tools is used here (Rahman and Hosen, 2018). But in my research the access road is identified which width is more than or equal to 10 feet. The percentage of structure that is inaccessible by each road was determined, and the results were utilized as indicators as no access of rescue facilities.

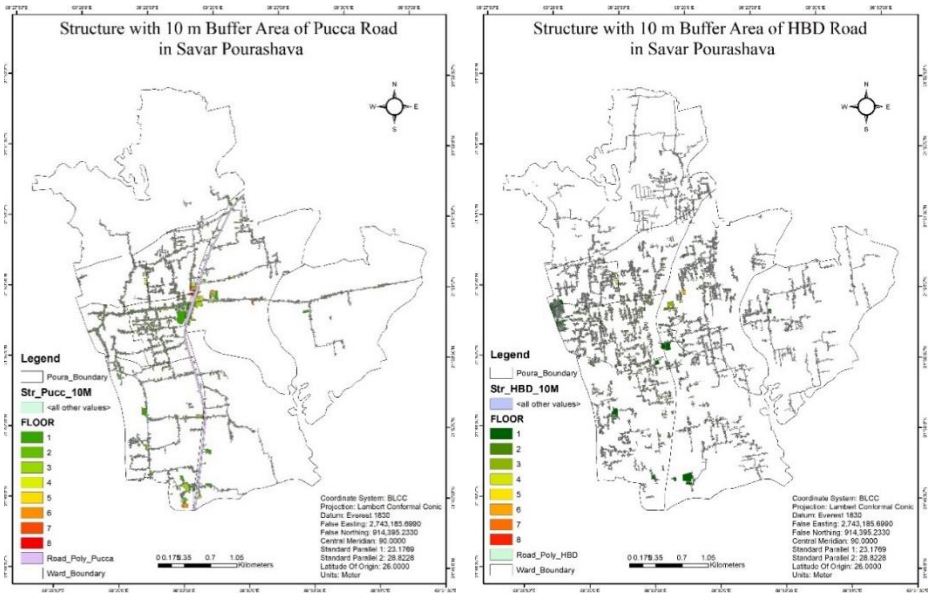


Fig 5: Structures with road access in any emergency evacuation in Savar Pourashava

Physical harm cannot be predicted in Savar because to a lack of seismic experience and study.

The buffer used in the Tokyo Metropolitan Government's report (Tokyo Metropolitan Government, 2013) is used in this study to define the inaccessible structure since there has been no assessment of physical damage at a small scale in Savar. The research excludes katcha roads. For this study, only pucca and HBD road having a width of more than 8 feet or 10 feet were chosen.

Table 7: Ward wise building number which have no emergency evacuation access/road access (road width 10 feet)

Ward No	Building No with no Road Access	Percentage %	Ranking
Ward 1	177	8.86	5
Ward 2	73	3.66	9
Ward 3	146	7.31	6
Ward 4	128	6.41	8
Ward 5	141	7.06	7
Ward 6	396	19.83	1
Ward 7	240	12.02	4
Ward 8	380	19.03	2
Ward 9	264	13.22	3
Total	1997	100.00	

Out of 1997 building more or equal to 4 stories building is about 92 and most of them are in the ward 5, ward 6, ward 8 and in ward 9.

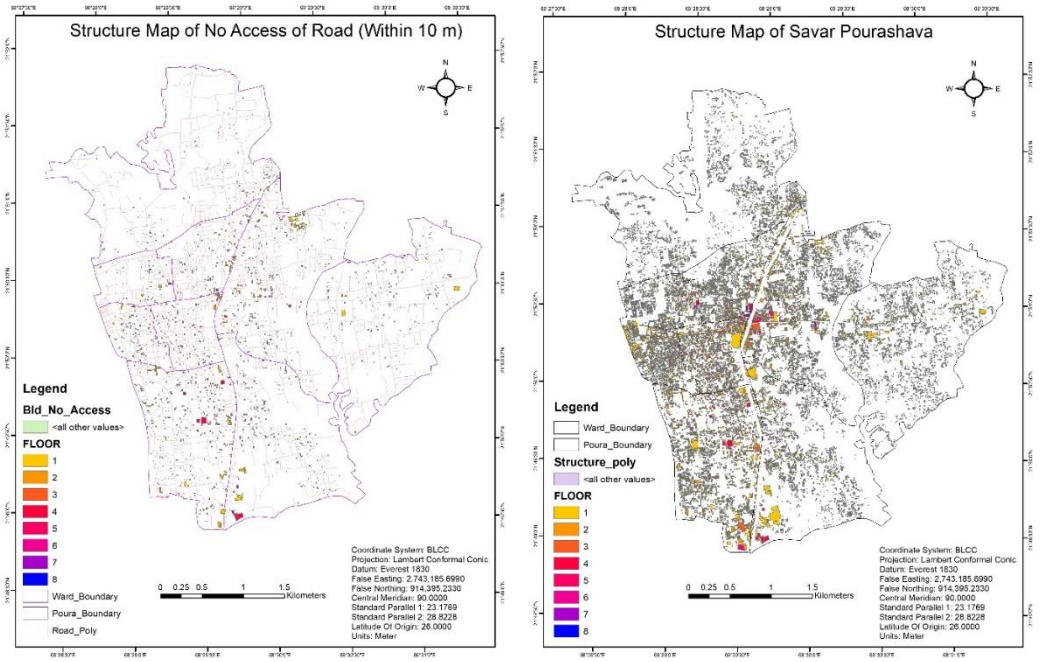


Fig 6: Map of buildings have no access from road (10 m buffer) in any emergency rescue

Table 8: Ward wise HH and density data

Ward No	Total HH/Structure	Percentage %	Population	Area_sqkm	Dens_sqkm
Ward 1	4774	14.36	34926	3.63	9625.91
Ward 2	2195	6.60	20255	0.58	34732.64
Ward 3	2168	6.52	30204	0.49	62111.67
Ward 4	2519	7.58	14628	0.79	18559.42
Ward 5	2057	6.19	28373	0.65	43978.33
Ward 6	4567	13.73	43545	2.00	21789.88
Ward 7	5090	15.31	50053	3.16	15821.54
Ward 8	5747	17.28	30904	2.67	11589.58
Ward 9	3601	10.83	33120	2.55	12993.07
Total	33254	100.00	286008	16.51	17324.68

Availability of Emergency Medical Facilities

In the study area the road is narrow and if there occur any disaster as like as earthquake then it will be difficult to reach the health services. There are some health service facilities savar pourashava but they are not well distributed to all the wards. Most of the health centers are located in ward 5, ward 6 and ward 8.

Assessment of Earthquake Risk Vulnerability

Table 9: Weighting factor of earthquake risk vulnerability

Ward No	Population	Den/sqkm	Total Empl	Residen.	Commer.	Industry	Total Weight	Ranking
1	34926	9626	4292	4669	126	6	536450	6
2	20255	34733	2569	2149	90	12	598080	5
3	30204	62112	1716	1897	333	0	962620	1
4	14628	18559	1217	2435	127	0	369660	9
5	28373	43978	1662	1887	176	4	760800	2
6	43545	21790	3824	4131	275	75	736400	4
7	50053	15822	4213	4630	326	41	750850	3
8	30904	11590	2744	5247	370	17	508720	8
9	33120	12993	2841	3391	169	41	525550	7

From the above table it is seen that ward number 3 and ward number 5 is high risk area in the study area because of their population and density. The normal weightage factor is added here to identify the vulnerability rank of the earthquake risk (Sarkar and Rahman, 2018). In the above table all the factors is multiply by 10 and total weight is obtained by 6 factors. The highest weight got the highest ranking.

Risk Reduction Strategies and Conclusion

School Orientation Program

Some non-governmental organizations (NGOs) in the study area, like as BRAC, Proshika, and Oporajeo-Bangladesh, are now doing awareness-raising efforts at a few selected schools.

They, on the other hand, have no contact with local authorities like the Ward Commissioner's Office. As a result, many community efforts are unsuccessful.

Local Residents' Opinions on Risk Reduction Strategies

It's critical to understand a community's perspectives on risk reduction before establishing a plan. Many of the ideal metrics may or may not be appropriate for the research topic. As a result, their views on their existing institutional linkages, capability and drawbacks in risky situations, and key reasons of vulnerability have been gathered using various Participatory Rural Appraisal (PRA) methodologies. Finally, they were questioned about risk-reduction techniques they would want to employ.

The Study Area's Capacity and Drawbacks

Strengths, weaknesses, opportunities, and threats of the research region have been identified through focus group discussions with local people in order to build a successful risk reduction plan using SWOT analysis. The study area's major strength is the sense of community among the locals. There have been no earthquakes in the study region. Before the fire department arrived, the majority of the flames had been put out by locals. Some female members of the world level committee focus on problems in the research field that impact women and children.

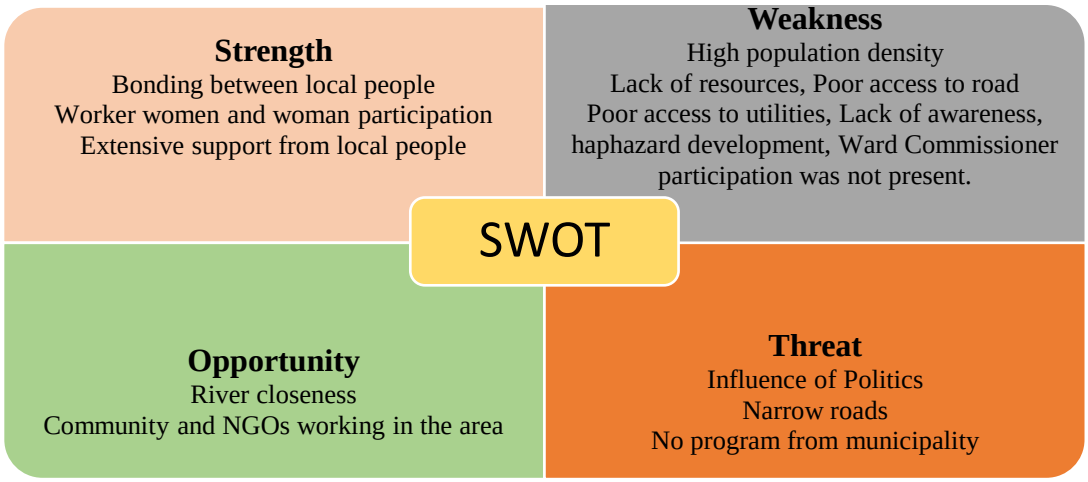


Figure 7: SWOT analysis of the study area

Source: Focus Group Discussion, 2020

According to the BBS 2011 census, savar pourashava has a total population of 2,86,007 people and 74,515 households. The population density is 20,313 which is comparatively very high to the national density of 972 per sq. km. In the event of a disaster, managing

such a large population will be extremely difficult. Aside from that, most municipal amenities such as water, electricity, and gas supply are unavailable to the locals.

After examining the community's external variables, it was discovered that the study area's river accessibility provides an opportunity for earthquake or any fire hazard. Some NGOs operating in the area may be able to assist with disaster risk reduction. Aside from opportunity, several external unfavorable factors in the research region may stymie risk reduction efforts.

Vulnerability's Major Causes

Local residents believe that the study area has several issues that make it vulnerable to earthquake in the area. These include a lack of understanding of earthquake hazards, limited road access, inadequate utility access and high population density. The study area's greatest concern, according to the pair-wise ranking matrix technique, is a lack of earthquake risk awareness, followed by high population density and limited roads. The FGD identifies the major issues, which include the following:

Problem 1: Lack of earthquake risk awareness; Prob 2: Narrow Road/Poor access; Prob 3: High population density; Prob 4: Emergency evacuation knowledge; Prob 5: Self-protection ability and Prob 6: Poor access to utilities.

Table 10: Pair-wise ranking of existing problems matrix

	Prob 1	Prob 2	Prob 3	Prob 4	Prob 5	Prob 6	Score	Rank
Prob 1	√		√	√	√	√	5	1
Prob 2		√	√	√		√	4	2 (1)
Prob 3	√	√	√			√	4	2 (2)
Prob 4	√	√		√	√		4	2 (4)
Prob 5	√			√	√		3	3
Prob 6	√	√	√			√	4	2(3)

Source: Focus Group Discussion, 2020

From the above table it is seen that the problem 1: Lack of earthquake risk awareness is the ranked one problem.

People in the area desire to adapt risk-reduction strategies

Based on the input of local inhabitants, a risk reduction strategy was established after analyzing the present level of vulnerability. Based on the assessment of those stages, a checklist has been established for the study area in order to reduce the risk of earthquake risk mitigation measures. The people, according to focus group discussions, do not currently practice any of these measures. In addition, they were asked which of these projects they would be prepared to adapt in the future. Due to financial incapacity and a lack of risk perception, the majority of these are unsuitable for them.

Table 11: Risk-reduction measures are ranked in pairs-wise matrix

	Training	Road Access/Wide	Emergency evacuation	Awareness	Structural measures	Score	Rank
Training	√		√	√		3	3
Road Access/Wide		√	√			2	4
Emergency evacuation	√	√	√	√		4	1
Awareness	√		√	√	√	4	2
Structural measures				√	√	2	5

Source: Focus Group Discussion, 2020

Besides again from five risk-reduction measures listed above, there are a few additional options. Due to a lack of resources to design risk-reduction measures for each home, all of these are inapplicable in the study area. Short-term, intermediate-term, and long-term measurements are all options for lowering the local community's risk perception.

Structural and Non-Structural Measures

- Access roads should be expanded in the short term by covering exposed drainage. Construction materials and industrial items should be stored off the road in the near future.
- The most vulnerable buildings of the study area should be retrofitted if possible. The new building should be constructed by the regulatory authority permission and by following BNBC code.
- An evacuation plan should be established and disseminated at the local level so that residents are aware of the location of evacuation shelters and the safest path to those shelters in the event of a crisis.
- When selecting evacuation centers, structural stability and road accessibility should be considered.
- Regular community group talks and meetings on earthquake and fire hazard awareness should be held with local people in schools, social clubs, and the ward office
- Volunteer teams made up of local students may be formed by social clubs.
- Educational institutions such as schools and madrashas are respected by the community, and they are thought to be in a position to lead disaster risk management in the study area.
- Religious institutions have a significant role in reducing community catastrophe risk because they affect a wide range of individuals.

Conclusion

Earthquakes may have significant loss of city’s urban features as like as physical and social damage of the communities. Some unplanned urbanization issues as like as fast

population increase and density, poor building structures, and other factors may result in an uncontrolled situation to make the municipality more vulnerable to earthquake. Besides these the poor condition of social awareness and emergency evacuation preparedness factors (8.91 out of 25) which is very low in savar municipality may increase the earthquake risk and vulnerability. Besides these in this study there have high possibility of 4% buildings to collapse in terms of their vulnerability assessment. This study is was conducted by physical vulnerability study of 100 buildings in determining the amount of damage risk. The significant issues of this study is the concept of social awareness regarding earthquake vulnerability and measuring it will help communities and people in recovering from and responding to earthquakes. This study will benefit in community planning and development, as well as in building construction with some social awareness and emergency evacuation knowledge. The model utilized in this study will directly contribute to the evaluation of vulnerability and will also support in the earthquake mitigation activities of the Savar Municipality.

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Public Bicycle Sharing Service (BSS) in Bangladesh: An Overview on Operations and Services

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Abstract: A public bicycle sharing service (BSS) is a system where bicycles are strategically placed in a network of stations and offered for public use. The users of BSS can take advantages of biking without the responsibilities of purchase and maintenance of a bicycle. This paper provides a brief history and description of BSS operation in Bangladesh, current situation of the services and the users' opinions. An in-depth discussion with BSS providers was done and the responses of 871 users were collected through online questionnaire. The results show that BSS provides an alternative travel mode which is cheaper than rickshaws. Almost 90% of the users are satisfied with the service, however, there are several problems such as problems related to the App for unlocking, locking, and vandalism of the bike. The results will be helpful for researchers and professionals understanding the issues related to BSS in Bangladesh and in similar countries as well as formulating policy actions.

Keywords: access; bicycle sharing service (BSS); transport; trip; last-mile.

1. Introduction

The public bicycle sharing service (BSS) is a system where bicycles are strategically placed in a closely spaced network of stations and offered for public use (Rahman, 2020). The BSS is also known as bicycle hire scheme (BHS) or smart bike or bike hiring. It is a contemporary concept of public transport that offers a pollution free and flexible transport system for people in urban areas. The commuters can take the bicycle whenever they need and leave the bicycle after reaching their destinations (Lin et.al, 2013). Therefore, the BSS serves as an alternate mode of public transport in which people have access to cycles (Lin et al, 2013; ITDP, 2013). Thus, the BSS system provides point to point active travel for short distance without the need to own a bicycle.

A BSS can provide many benefits to the city and people. The benefits include access to a low-cost public transport option, improved health (through increased physical activity), improved connectivity and travel experience, flexible mobility and increased convenience, reduced travel cost and fuel use, emission reduction, support for multimodal connections and reduction of congestion on roadways (Ricci, 2015; Wilmingtonde, 2019; Woodcock et al, 2014). The BSS program can also help reducing traffic congestion and pressure on motor vehicle parking supply (Voeller and Elise, 2011); to solve the 'last-mile' problems (Ma et al, 2018; Qian and Niemeier, 2019); growing awareness for bicycle use as a daily mobility option, developing tourism and meeting targeted modal

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splits of the city (Shaheen et al, 2010; ITDP, 2013). The BSS program could play an important role for social inclusion of transport in the developing countries as the cycling is cheaper than any other public transport modes and the implementation cost as well as time for BSS scheme is very low compared with other transport projects.

To tap the benefits of cyclingand also for promoting bicycle use, many cities consider public BSS scheme as a strategy to facilitate short-term bicycle rental in urban areas (Woodcock et al, 2014; Hou and Haddad, 2020). Technology-driven BSS has been developed in many countries in recent years (Rahman, 2020), though the concept of BSS has been available in different countries for the last 50 years (Meddin, 2015). Several authors (e.g. Kou and Cai, 2019; Médard de Chardon et al, 2017; Shaheen et al, 2010; Qian and Niemeier, 2019) claim that BSS is getting popular because it provides many social, economic and environmental benefits to the city and the people. Therefore, BSS has been widely adopted in many cities around the world (Chen et al, 2020).

Bicycle is one of the cheapest forms of urban transport in Bangladesh; only a quarter of the cost of bus travel per passenger per km and one-tenth of the cost of rickshaw travel (Rahman, 2013). However, transport policies in Bangladesh are more concentrated with motorized traffic, whilst NMT is often ignored or considered as hindering motorized traffic flows (Rahman, 2007). Often the minimal infrastructure required for cycling is not provided (Rahman and Timms, 2020). Rahman (2009a, 2009b, 2011) argued that such approach is inconsistent with the realities of transport situation and the policy should be directed towards promoting walking and cycling along with low-cost public transport accessible for all. Research (e.g. Rahman 2020; Rahman and Shams 2020) showed that there are potentials of BSS in Bangladesh, particularly in major cities.

The paper provides a brief history and description of BSS operations in Bangladesh, the BSS services and associated problems or issues as well as the user's opinions about the BSS service. Section 2 discusses the review of relevant literature. The methodology of this paper is explained in Section 3. Section 4provides the major features of BSS operation and services in Bangladesh while Section 5 provides the opinions of BSS users. Section 6 and 7 provides the discussion of findings and conclusions respectively.

2. Relevant Literature

The BSS usually provides opportunity to the users to pick up a bicycle from anywhere within a service area and return it to any parking point or bike station located near their destination (Rahman, 2020). The BSS differs from traditional bicycle rental services in number of ways. The most common are (Burns, 2013; ITDP, 2018):

- BSS is a short-term and one-way use such as 30 to 60 minutes rather than daily or weekly rental period.
- Bicycle can be returned to any station or parking points of the BSS scheme.
- A single style and same design for all the bicycles of the scheme. A standardized specially designed (e.g. through distinctive color and frame style) bicycle built solely for the system so that anybody can be differentiate the BSS cycles from regular bicycles in the city and the parts cannot easily be stolen and resold, one size of bicycle to fit for all with low maintenance.

- In most BSS system, bike unlocking, and depositing is automated and the financial transaction for rental or use is fully automated therefore no need for on-site staff for most of the BSS schemes.
- After finishing the trip, bicycle is parked by the user at a special docking station and the user is no more responsible for the bicycle when the trip is complete, and bike is deposited. Thus, user's liability and the responsibility for the security of bicycle is minimized.

The BSS could be of different types with distinct characteristics. Rahman (2020) provides a summary on different types and characteristics of BSS. Broadly, there are two types of BSS schemes; docked and dock-less (Rahman, 2020). A docked scheme enables to pick the bicycle form any self-serve bicycle station and return to any other bicycle station - thus makes bicycle-sharing ideal for point-to-point trips. The main advantage of a docked scheme is: bicycles are docked in convenient locations and the user knows where (s)he can find a bicycle. As the bicycles are securely parked within a docking station, this system eliminates the likelihood of theft or vandalism of bicycles (MacDonald, 2018). However, this system requires additional spaces to install the stations and additional costs for installing the docking stations.

On the other hand, in a dock-less scheme the bicycles do not need to be physically locked with a conventional chain or returned to a designated station or rack. Users register, pay, unlock the bicycle and after completing the trip can lock and park the bicycle in a suitable place within the service area through a mobile phone App. The main advantage of dock-less schemes is: more convenience with using and parking the bicycle as there is no requirement to return the bicycle to a bicycle station (MacDonald, 2018). Therefore, there is no mechanism to prevent theft of the bicycles and abuse of privileges (e.g. for personal use locking the bicycle in inaccessible locations) in dock-less system.

3. Methodology

Relevant data were collected from both primary and secondary sources. Both published and unpublished documents related to the topic were reviewed. Unpublished documents of BSS provider, their website and server data were analyzed and reviewed. The primary data were collected during October 2019. An in-depth interview with the personnel engaged in management team of BSS service providers were conducted.

A questionnaire survey of BSS users was done to explore their opinions about BSS services. The questionnaire had two major sections: demographic and trip related (e.g. BSS usage and travel pattern)questions. The questionnaire survey was conducted using an online GoogleForm. The questionnaire/GoogleForm was shared in the verified BSS user's Facebook page of the community groupand retained for a week to collect their responses. The questionnaire survey was administered in five different locations, the then existing BSS service areas, in Bangladesh. Until September 2019, there were 20,000 total registered unique users from five different locations of service areas. Of the total 20,000 unique registered BSS users, about 871 respondents (4.5% of the total responses) were received and used for the analysis.

Data collected from the in-depth interviews were transcribed and translated. The BSS users' data received from the online survey were exported from GoogleForm and

analyzed using MS Excel. As the online survey was conducted only for the BSS users, opinions of people who do not use the system are not unknown and not included in this research.

For evaluating the performance of the existing BSS system, three different measures were taken into consideration. These measures are:

(i) trips per day per bicycle (TDB);

(ii) users' satisfaction rate; and

(iii) the rate of theft or vandalism.

4. BSS Operation and Services in Bangladesh

4.1. History of BSS and Service Areas in Bangladesh

The BSS in Bangladesh, known as 'Jobike', was first introduced in June 2018 by a private company named 'Jobike Limited'. Jobikebicycles were imported from China and the technology was developed with the help of Chinese developers (Ahmed, 2019). In order to adapt the Chinese technology in the context of Bangladesh, Jobilke authority hired some Bangladeshi developers and created a new technology. Initially, it was first planned by Jobike Limited to launch the BSS operation in Jahangirnagar University (JU)campus with 20 bikes for a test run in the early 2018; with this to assess the technology/services and to fix the problems (Ahmed, 2019). Jobike authority approached to the JU administration and requested for official permission to operate BSS within the campus. The then Chairman of the Department of Urban and Regional Planning at JU Professor Dr M Shafiq-Ur Rahman discussed about the innovative idea of BSS with JU administration and convinced to permit Jobike for operating BSS. After a period of about six months, Jobike received the official permission to operate BSS in JU campus (Ahmed, 2019).

In the meantime, during the delay due to administrative procedures of JU, Jobike authority worked to provide BSS in Cox's Bazar. Jobike launched its BSS operation in Cox's Bazar city – the first BSS in Bangladesh - on 18 June 2018 with 30 bicycles. The services were available only at Kolatoli, Sugandha, and Laboni point every day between 6am and 6pm. The BSS enabled the tourists exploring the city easily and helped the city to uphold the image by making greener and healthy initiatives (Jobike Authority, 2019). Later, JobikeBSS in JU was introduced on 11 July 2018.The BSS service in JU campus was initially with 20 bikes and 10 parking points and available every day from 8am to 6pm. Later, the number of bikes were increased to 100 and the duration of service was extended up to 10pm.

Jobikestarted operating BSS in Chittagong University (CU) campus in December 2018.The BSS in CU was initially provided with 50 bikes and later increased to 80 bikes.After receiving overwhelming responses from the users in Cox's Bazar and two university campus (e.g. JU and CU), BSS was introduced in Sylhet University of Science and Technology (SUST) campus at Sylhet and in Mirpor DOHS at Dhaka both in January 2019.Initially BSS in SUST was introduced on a pilot basis with 35 bicycles and later the number of bicycles were increased to 50. Mirpur DOHS is the first residential area to have a BSS in Bangladesh which was introduced with the help and support of Mirpur

DOHS Society and there were 70 bicycles.In October 2019, JobikeBSS was introduced in Dhaka University (DU) campus in association with DU Central Students' Union (DUCSU) with 50 bicycles. During COVID-19 pandemic, JobikeBSS has been introduced in Gulshan-Banani area of Dhaka in June 2020 with the support from Dhaka North City Corporation (DNCC).Now 120 bikes are available for service in Gulshan-Banani area.

As of now, Jobike BSS was introduced in seven different places in Bangladesh, shown in Figure 1. Ride sharing services such as Uber, Pathao in recent years seem to solve the first/last mile problem in Dhaka City, however, they are very expensive compared to Jobike BSS (Fahim, 2019).

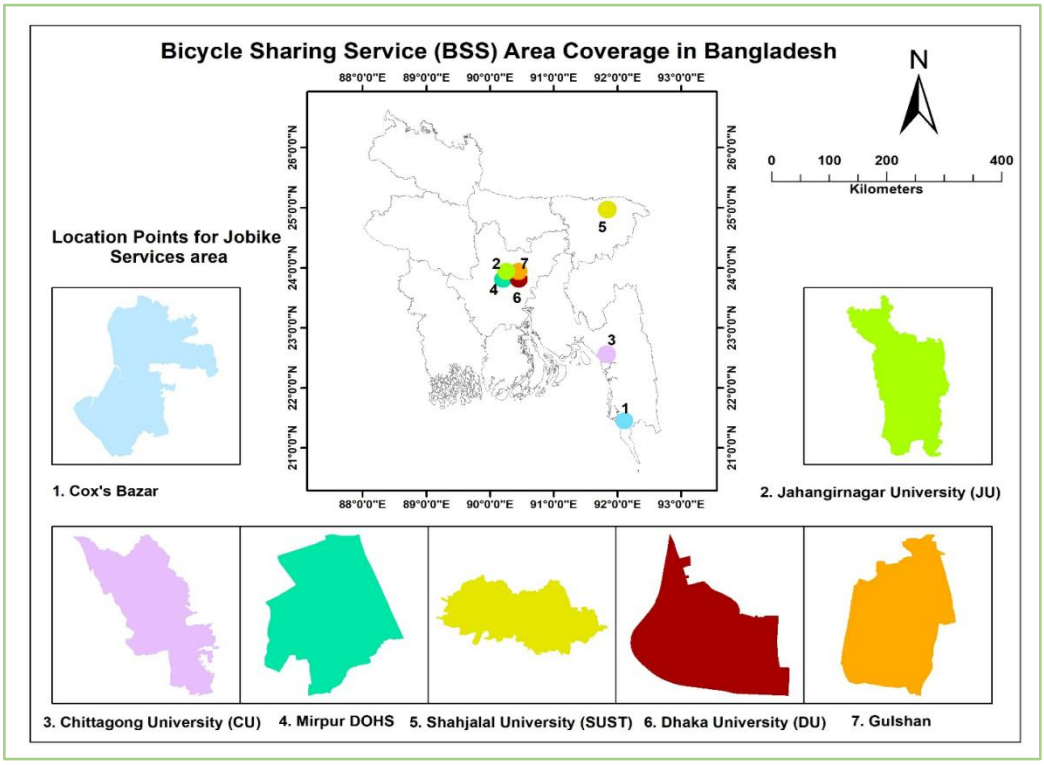


Figure 1. BSS service area locations in Bangladesh

Source: Jobike and prepared by Authors, July 2020.

The major features of Jobike BSS operations and services provided in different areas of Bangladesh are shown in Table 1. However, the service was discontinued in three locations (Cox's Bazar, JU campus, and CU campus) from June-July 2019. Moreover, due to COVID-19 pandemic, Jobike services are paused in two university campus (SUST and DU) in March 2020 as there is no student or users because of the vacation. Jobike operations in Mirpur DOHS also paused in June 2020. At present, as of July 2021, the BSS only in Gulshan-Banani area is functioning.

Table 1. Description of JobikeBSS schemes in different locations of Bangladesh

Features	Jobike BSS Locations						
	Cox's Bazar	**JU**	**CU**	**Mirpur DOHS**	**SUST**	**DU**	**Gulshan-Banani**
BSS started	11 June 2018	11 July 2018	10 Dec 2018	5 Jan 2019	27 Jan 2019	16 Oct 2019	24 June 2020
Area in BSS service	5,782 acre (23.5 sq.km)	698 acre (2.8 sq.km)	2110 acre (8.5 sq.km)	2 sq.km	320 acre (1.3 sq.km)	600 acre (2.5 sq.km)	3.5 sq.km
Population (or daily tourists)	85,000	15,000 (approx.)	20,000 (approx.)	N/A	15,000 (approx.)	N/A	N/A
Total Bikes*	50	100	80	70	50	50	120
Parking Points	3	12	6	10	8	7	14
Support staff	5	6	6	4	6	6	6
Monthly Avg. Trips	11,000	25,000	22,000	16,500	14,000	25,000	30,000
Trips per bike per day	7	12	9	10	9	10	10
Refill Point	3	6	4	6	4	2	8
Reported Vandalism	15	30	60	5	10	10	7
Theft	0	2	1	0	0	0	0
Service Status in July 2020	Stopped / discontinue July 2019	Stopped / discontinued June 2019	Stopped / discontinue June 2019	Paused June 2020 (Covid-19)	Paused March 2020 (due to Covid-19)	Paused March 2020 (Covid19)	Ongoing operation

* Total number of bikes in a particular location was increased or reduced time to time by Jobike.
Source: Jobike Authority, July 2020.

4.2. Main Features of Jobike BSS

Jobikeused the dock-less BSS system where anyone can pick up the bikes by using a smartphone App and after completing the ride (s)he can park to any designated areas for bicycle parking point or suitable place. Internet of Things (IoT) technology and smart solutions based on large data support is the main technology of this BSS system (Ahmed, 2019). The bicycle has unique design with red color, as seen in Figure 2, which is possible to recognize and distinguish very easily than the conventional bicycles. Tubeless tire, solar panel, seat adjustable systems, a small front basket, and a smart lock are the major features of the bicycle. It is flexible to use for both men and women. The smart lock includes a Global Positioning System (GPS) and telecommunication module as well as a new generation of IoT technology which keeps connecting with the central server of

Jobike. The lock is heavily built with a plastic-metal combination that cannot be broken easily.The geo-fencing technology is used to provide an alarm when the bicycle crosses the boundary (hypothetical) of the service area.



Figure 2. Jobike bicycles at parking point in JU (left), Smart lock (right)
Source: Authors, 2019

For using JobikeBSS, the user must download the mobile application from the related App store (android & iOS) and create an account using his/her valid mobile phone number. The user will be able unlocking the bicycle by scanning the QR code provided on the lock of each bike. However, to be able for unlocking the bicycle, should have sufficient credit (money) in his/her account to pay towards the cost will incur for the trip. Therefore, before taking a BSS ridethe user needs to refill the account (deposit money) from the specific recharge points for Jobike. The App shows the nearby available bikes at a given time in a map of the area. After finishing the trip, user need to leave the bicycle in one of the designated areas and lock the bicycle manually.

4.3. Costs and Fees of Jobike BSS

The average capital cost and operating cost for each bicycle of Jobike BSS is Tk 32,000 and Tk 18,000 per year respectively. Capital cost per bicycle of Jobike BSS is very low compared with the amount mentioned by Rahman and Shams (2020). Jobike BSS users are charged Tk 3 for every five minutes in the university areas (except in DU) and Tk 1 per minute in other areas. In DU campus, Tk 2.5 is charged for the initial 5 minutes and afterwards Tk 0.4 for additional each minute. Table 2 shows brief about different cost items for JobikeBSS in different locations.

Table 2. Costs and user charges of Jobike BSS

Cost items	**Cox's Bazar**	**JU**	**CU**	**Mirpur DOHS**	**SUST**	**DU**	**Gulshan-Banani**
Capital Cost (Tk/Bicycle)	32,000	32,000	32,000	32,000	32,000	32,000	32,000
Operating Cost (Tk/Bicycle/Year)	18000	18000	18000	18000	18000	18000	18000
User charge (Tk*)	Tk 1 per minute	Tk 3 (for every 5 minute)	Tk 3 (for every 5 minute)	Tk 1 per minute	Tk 3 (for every 5 minute)	Tk 2.5 initial 5 minute, afterwards Tk 0.4 per min	Tk 1 per minute
Membership fee for users	No	No	No	No	No	No	No

Source: Jobike Authority, July 2020.

4.4. Operation of Jobike BSSand Customer Service

Jobike authority has hired people in their head office as per the requirements of different department to run the BSS effectively. There are a total 35 employees working in the head office and they monitor all the activities within the BSS service area. They developed a service centreor shop (called 'JoShop' or 'Jobike Outlet') in respective service area for managing the BSS. A Lead (or in-charge),one customer manager, two re-balancer, two technicians, and two security personnel were appointed for operation in each relevant service area. Jobike management team in head office cooperates the zonal (or area) Lead.The customer manager provides solution to the problems of BSS users or recharging credits and plays an important role in answering the queries of users. A website dashboard is used to track all the records of bicycle activities such as data on daily trips or daily sales for re-charging. A central customer relationship management team also works to create a close relation between operators and users. Moreover, the online community groups of BSS users (e.g. Jobike user group of JU) play a vital role in developing good relation between BSS users and service providing authority. Several operational characteristics are discussed below.

- **Service Hours:** Initially the Jobikebicycles were available to hire from 8 am to 6 pm. Gradually the duration of service hours or Jobike operation was increased depending on the demand of users in specific service area.
- **Bike Maintenance:** Jobike zonal operation team collects the bikes for regular maintenance and repair activities and charging the locks. In each service area, every day around 20 bikes are checked for regular maintenance. A smart dashboard system in each bike shows the charge status of the lock. The maintenance team have an App on their smartphone to detect the bikes with low charge and their locations to be collected.
- **Bikes Security at Night:** Every day after the operation hour, the Jobike field authority collects the bicycles and store them in the nearest parking point. All the bicycles are kept locked by a chain to prevent theft at night.
- **Parking Points:** A service area is divided into several parking points considering the density of people or demand of users. Each parking point has a parking stand sign.
- **Refill Credits**: BSS users need to refill credit before taking a ride. Small retailer shops such as recharge points, bKash shop, etc. are the partner for Jobike refill. The refill retailers get a 4% commission of the amount recharged for Jobike. However, Jobike technology team is working to develop and build an online system for recharging.
- **Re-Balancing:** A rebalancing team with a van is vigilant in the BSS area to collect the bikes and re-balancing in different stations to ensure proper utilization of the bicycles.

4.5. Operational Challenges of Jobike BSS

Until October 2019, Jobike App has been downloaded more than 50,000 times (Daily Sun, 2019). That time BSS was not introduced DU campus and Gulshan-Banani Area. Table 3 shows some basic statistics of JobikeBSS usages in five different locations of Bangladesh.

Table 3.JobikeBSS usage statistics in Bangladesh

Features	Statistics
Total bikes in operation	280
Total number of average daily trips (ADT)	2,700
Average trips per day per bicycle (TDB)	10
Total number of unique riders (UR)	20,000
Average trip duration	15 Minutes
Total reported vandalism or bikes crashes	130
Rate of complaints from the users	20%

Source:Jobike Authority, 2019.

Table 4. SWOT analysis of Jobike BSS

Strengths	**Weakness**
● Green transportation ● Popular concept and design ● Smart technology use ● Fashionable appearance of bike ● Durable & long-lasting product ● Interest from people & society ● Low-cost public transport	● Low financial strength of service provider ● Difficulty for regular maintenance ● High cost for product development ● Operating cost ● Poor user behavior e.g. vandalism ● Lack of bicycle infrastructure ● No support from the government or other institutions
Opportunity	**Threats**
● Expanding service areas ● Average 10 trips per bike per day ● Partnering with government ● Cooperation with telecom companies	● Misuses of bikes by the users ● Vandalism and damage of bike ● Theft of bike ● Reckless driving

Source: Authors.

Major strengths, weaknesses, opportunities, and threats (SWOT) of Jobike BSS are shown in Table 4. Many problems such as lack of finance, absent of public-private partnership, lack of political will to promote bicycling, absence of relevant bicycle infrastructures, misuses of bikes by some of the users, vandalism and theft of several bicycle are the major challenges of providing BSS that Jobike authority faced. However, financial difficulties and vandalism are the main two problems the Jobike authority faced while providing BSS (Ahmed, 2019). Nevertheless, Jobike authority also had poor and inefficient management within the company. The distribution and maintenance of the bikes in respective service area are also challenging. Moreover, not receiving any support from the respective authority of the service area (e.g. university administration) is another

important drawback of Jobike BSS. After one year of operation, Jobike discontinued the services in JU mainly due to financial constraints and several incidents of vandalism whilst at CU it was mainly due to high rates of vandalism.

5. Users' Opinions about BSS in Bangladesh

5.1. Demographic Profile and Socio-economic Conditions of the Respondents

The respondents are mostly the young adults, 77.5% are in age group 16-24 years. Only 4% of the respondents are from the residential areas while 96% are from different university campus. In terms of occupation, almost 93.5% are students. It is not unlikely that most of the respondents are students or young because three of the then five BSS service areas were the university campus. Moreover, anybody wanting to use Jobike bicycles would require a smartphone and many students have one. Furthermore, the students may have greater interest and time for using high-techbased services and filling out the online questionnaire.

Almost 80% of the respondents who used JobikeBSS have no personal vehicle or a bicycle. Therefore, they are interested and willing to use BSS. However, 20% of the respondents mentioned that despite owning a personal bicycle (s)he had Jobikeridesjust to have an experience about the BSS. The BSS users mostly used it because of money and time saving alternative mode of rickshaws. For instance, almost 68% of the respondents previously travelled by rickshawswhile 12% walked and the remaining 20% used other travel modes. Figure 3 shows that a large portion of the respondents consider 'travel cost' (62%) and 'travel time' (44%) as the main influencing factors for selecting a travel mode.

The usual travel frequency of the respondents per week are: 20-30 trips (28%), 15-20 trips (24%), 10-15 trips (25%), and below 10 trips (23%). Travel cost of a person usually depends on the number of trips (s)he makes and the travel mode being used. The average weekly travel cost for the respondents are: below Tk 50 for 16%, Tk 51-100 for 32%, Tk 101-150for 24.5%, andTk 151-200+ for 27.5%.

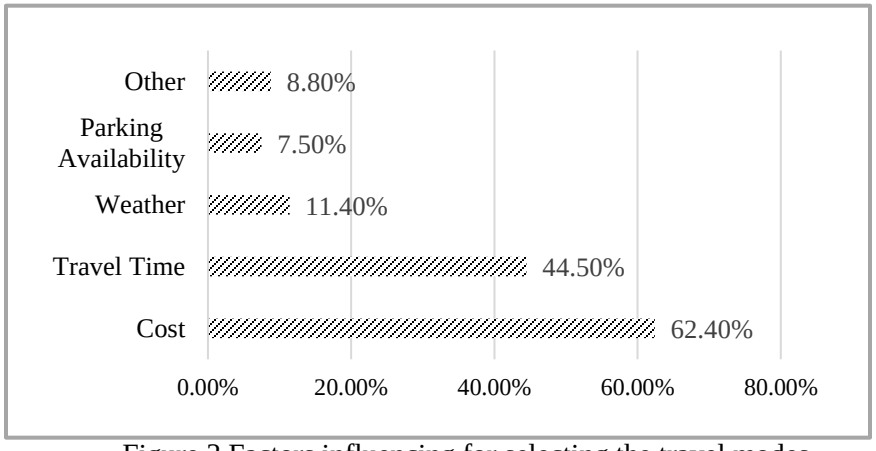


Figure 3.Factors influencing for selecting the travel modes

Source: Online Survey, 2019.

5.2. Respondents' Opinions about Jobike BSS Service

Almost half of the respondents (43.5%) are not the frequent user of BSS who use it 'sometimes' but not in a regular basis. The remaining are frequent users of Jobike BSS. Their weekly frequency of using BSS are: less than 6 trips for 15.5%, 6-10 trips for 21%, and more than 10 tripsfor 20% of the respondents. Availability of a bicycle in a desired station is the very important aspect for BSS users. Almost half of the respondents (50%) consider that finding a bicycle of JobikeBSS is often easy though 18% mentioned difficult.The design of Jobike bicycles is smartly made and both men and women can ride them comfortably. These bicycles require very low paddling pressure as the weight of bicycle is low. In terms of comfortof Jobike bicycles, more than 81% of the respondents feel 'very comfortable' or 'comfortable', as shown in Figure 4.

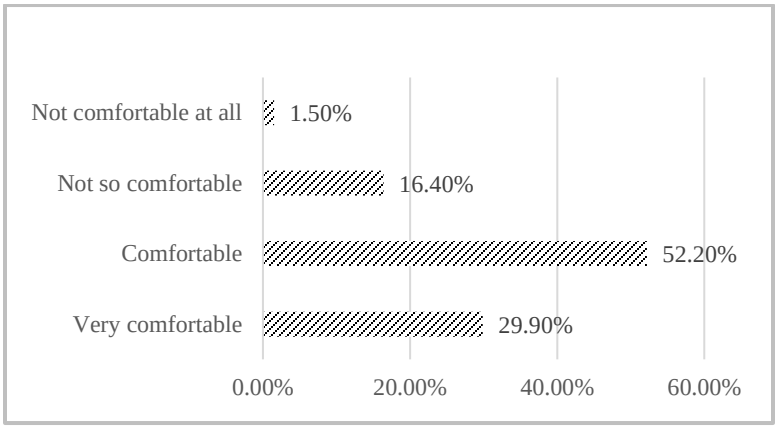


Figure 4.Users' opinions about comfort of Jobike bicycles

Source: Online Survey, 2019.

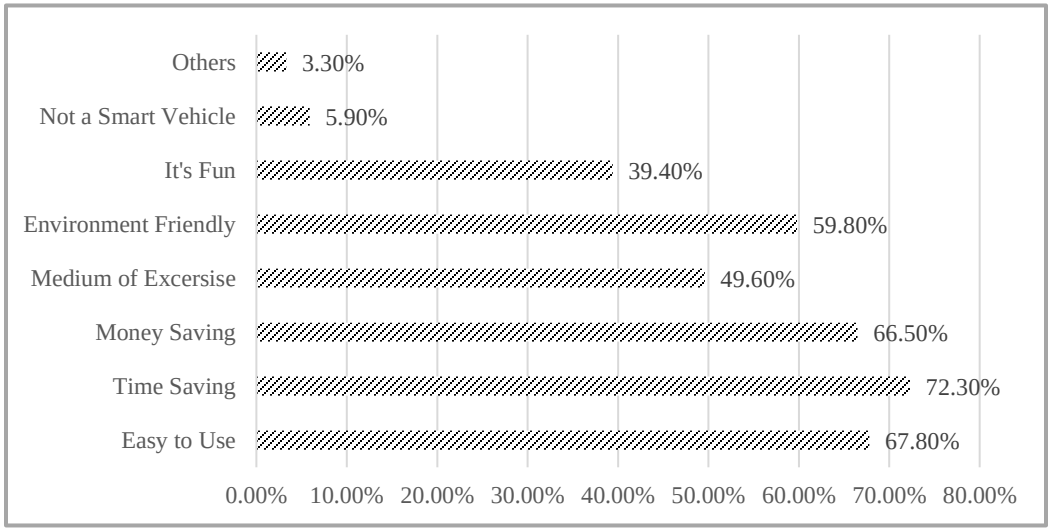


Figure 5.User's Perception about JobikeBSS service

Source: Online Survey, 2019.

About the existing pricing (cost for using BSS) of Jobike, almost 76% of the respondents are satisfied and the remaining 24% are not satisfied. The BSS users' have developed their own perception bout the different aspects of Jobike BSS after riding/using them. The results are shown in Figure 5. Almost three-quarter of the respondents consider that using Jobike is easy and saves their time to reach in destinations. Almost half of the respondents (49%) claimed that they are using BSS for physical exercise and usually do it in the morning or evening. More than half (59%) of the respondents consider that BSS is an environment friendly mode of transport. Surprisingly almost 40% of the respondents mentioned that they had BSS ride just for having fun.

Acceptability of Jobike BSSis good among the respondents. About the overall services, the proportion of the respondents mentioned 'satisfactory', 'good', and 'excellent' are 41%, 37%, and 13% respectively whilst 'poor' and 'very poor' are mentioned by 7.5% and 1.5% respectively as the services do not match with their expectations. More than half of the respondents consider the BSS as a 'low-cost' travel mode. Almost a-third of the respondents (29%) think that the availability of bicycles in BSS stations are scared though more than a third (39%) mentioned it is good or sufficient. Nevertheless, the problems with smartphone App and problems of bicycle lock are the major issueas almost 50% mentioned that there are problems with the smart lock system. Unlocking problem of the locks could be due to network issues and low charge in locks. Figure 6 shows some other problems are: bad quality of bicycles, overcharging, and refill problems.



Figure 6.Users' opinions about the problems of Jobike BSS

Source: Online Survey, 2019.

6. Discussion

The JobikeBSS is a very new concept of transport system and service in Bangladesh. After launching the JobikeBSS, it was widely accepted by people in all the service areas. People were curious and interested in using BSS. Within a few days of inauguration, it become a popular mode for short trips. Jobike bikes are equally popular to both male and female users for their unique design, light weight, and comfort. It was found that many

respondents use BSS as an alternative of rickshaw tripsbecause of reduced travel cost and time on BSS. Though a portion of BSS users in Bangladesh are occasional users, about 20% of the respondents have more than two rides per day. Many people consider BSS as environment friendly travel mode as well as a form of physical exercise. A few students also consider riding BSS for fun. However, almost 60% of the respondents reported that the bike was not available when it was in need. Several respondents also reported the problems in smart lock for unlocking the bicycle with the smartphone App or locking.

JobikeBSS in Bangladesh was widely accepted among the users of the service area. Only 11% of the respondents mentioned that the BSS do not match with their expectations though 89% are satisfied. However, despite their satisfaction, one-third suggested that the BSS service need to be improved in order to address the issues and problems of users such as hardware problems of the bike, technical improvement of the App, the system of rebalancing the bikes. Increasing the number of bikes may improve the availability of bikes. Developing an online system to refill money and introducing different pricing strategies are required to satisfy the users who are not satisfied with the existing service and fare rates. Preparing local transport plan will help to develop BSS considering the local contexts and culture or expectations of users.

The trips per day per bicycle (TDB) is one of the important factors or criteria to assess the performance of BSS system (Médard de Chardon, et al. 2017). The higher the TDB, the more effective the system is. This is the most common measure for performance of BSSsystem and widely used across the globe. The average TDB for Jobike BSS is 7 to 10 (as seen in Table 1), which is higher (better) than other BSS in other countries where TDB is usually 4 to 8.

Nevertheless, a total more than 130 incidents of vandalism were reported and 6 bikes were stolen in different JobikeBSS areas. Jobike service was discontinued in several locations due to financial crisis of the organization and thus difficulty in maintainingthe operating costs, and the vandalism. Raising awareness about green transport and introducing registration using valid National ID or Student Card may help reducing theft, vandalism and parking in wrong places.

The service area of JobikeBSS for all the locations is either a very small and confined area (e.g. university campus) or a small portion of the city (e.g. Mirpur DOHS or Gulshan-Banani in Dhaka). However, the small BSS systems do not work efficiently (Burden and Barth, 2009). The coverage area for a BSS system should be the whole city or 10 sq. km area with around 10-30 bikes for every 1,000 residents, as suggested by ITDP (2013) planning and design guidelines. Even though the capital cost and operating cost of Jobike is very less compared with other BSS in Europe or in other Asian countries, the cost could be further reduced if the bicycles are produced in mass scale and the BSS is in city wide. Moreover, the BSS may provide better services to more people if they are integrated with public transport system.

Support from the government agencies responsible for providing transport infrastructure and services, local governments, and private organizations would help to overcome financial constraints ofBSS operation. For example, partnering with the telecom companies may provide opportunity for BSS providers to use/receive free internet (for BSS App)as well as big data for their strategic planning or service provision. Moreover,

enhancing political will and collaboration with local government authority will facilitate to develop proper and safe infrastructure for cycling, such as integrated network of bicycle lanes and bicycle parking points.

7. Conclusions

The BSS is an alternative mode of transport which can help solving last-mile problems, reducing transport-induced pollution in built-up areas, and minimizing travel cost and time. Jobike is the first BSS provided in several areas in Bangladesh. This paper provides a brief background about Jobike BSS, their operations and services as well as the users' opinions about the BSS.

BSS operation in Bangladesh began in 2018 and since then, over the last several years,they have launched BSS in seven different locations. Most of the JobikeBSS users have a positive response towards the BSS scheme. However, there are some challenges for BSS operations. After about a year of operation, BSS services in Cox's Bazar, JU and CU campus were discontinued mainly due to financial difficulties and vandalism. To make BSS scheme successful it is very important to prevent vandalism and theft of bicycle. Public-private partnership may help to overcome the financial constraints. Thoughmostof the users are satisfied with the available BSS services, the system needs some improvements to overcome the problems. Generating awareness among the users and community participation could be helpful for the BSS system.

This paper will be helpful for researchers and transport professionals to know and understand about the overall BSS operations and services in Bangladesh. The service providers would be able to improve the BSS system by knowing users' opinions and addressing the issues. The results will be very helpful for the professionals or organizations who are planning to introduce/operate BSS in Bangladesh or in similar countries. This paper provides an avenue for further research on public-private partnership in BSS, detailed cost-benefit analysis of BSS, integration of BSS with mass transit, electric bicycle use in BSS, potentials and opportunities of BSS during COVID-19 pandemic in providing transport services.

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Assessment of Road Network Accessibility in Savar Upazila: A Geospatial Approach

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Abstract: Transport network plays a vital role in sustainable development and provide access to people, places, goods and services. The transport network analysis provides a complete scenario of a region's transportation facility with geographical distribution pattern. The purpose of this research is to conduct a structural examination of the road network of Savar Upazila, the outskirts of Dhaka city, where traversed by a prominent national highway (Dhaka-Aricha, N5) that also passes the concentric industrial export processing zone surrounding Dhaka. The research has applied road network connectivity and accessibility analysis according to graph theory. The various indices of connectivity and accessibility were accomplished in Microsoft Excel. Google Earth Pro has been used for road database extraction. Nodes and Arcs have been assessed and identified by using ArcGIS tools. Although, database conversion, assessment and representation of maps were conducted with ArcGIS. This research reveals the most accessible zone is Savar Paurashava and the significantly less accessible zone is Amin Bazar, Yearpur, and Shimulia in Savar Upazila. The low road network connectivity indices of α, β, γ of Savar Upazila chronologically 0.026, 0.94, 31% which indicates the road network system is inferior and not well connected. However, the connectivity and accessibility indices have mostly remained consistent, showing that this study area's physiographic circumstances are nearly identical and that road connectivity is inadequate. In this circumstance, the road network structure needs to be enhancement of existing linkages reflected in variations in nodal accessibility in Savar Upazila.

Keywords: Transport network, Topology, Connectivity, Accessibility, Structural Analysis.

1. Introduction

Enhanced communication and transportation infrastructure encourages economic development (Rodrigue, 2016). Network analysis could be used to understand several types of development, in addition to endogenous and exogenous development (Tomasello et al., 2014). The network comprises nodes or vertices connected by edges, with vertices being specific locations in space and edges in transportation networks being genuine physical constructs like roads or train lines (Lin and Ban, 2013; Rodrigue and Ducruet, 2021). Road networks have a significant impact on social and economic development, and they are an essential component of public infrastructure. When new roads are built, or old roads are enlarged and repaired, the travel time is reduced, which enhances the accessibility of the zones. As a result of increased accessibility, changes in the population

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and employment distribution occur (Gibbons et al., 2019). The transportation network is a crucial medium for human civilization since it allows people to operate in different areas. At both the national and international levels, enhanced transportation infrastructure directly positively impacts spatial accessibility. One of the essential features of assessing accessibility in a given location is that it determines the performance of the road network (Lv et al., 2021). The expansion of transportation networks is necessary for areas to achieve better mobility and economic growth opportunities. Although economic and social growth in a given region is typically concentrated in the large city and its agglomeration, a fair accessibility aim is to reach this center from the farthest settlement in a reasonable length of time (Gao and Sun, 2021). A modern World's economic, social, and political life is based on a well-functioning transport system. People need transportation to get to services, whether it's to our community centers or work. Many emerging states' economic backwardness is due to a lack of modern transportation systems. The transportation infrastructure plays a vital role in essential determinants of a country's achievement (Rodrigue and Notteboom, 2020). The reputation of transportation cannot be overstated, and it is sometimes referred to as the nation's "lifeline" despite Bangladesh's broad transportation industry. The importance of road transport in the growth and development of cities cannot be overstated. However, the proper growth of a region is dependent on the transport network. The transport network analysis provides a broad scenario of the geographical distribution pattern of transportation facilities in a given region. It is an essential part of transport geography since it entails describing the location of nodes, their interactions, and the distribution line or linkage. (Rodrigue and Ducruet, 2020). It is useful in advancing transport planning in the region in order to improve transportation productivity. More physical infrastructure investment, particularly in the road transport network, will bring the interior regions closer to the markets and minimize regional disparities (Amin, 2009). In this research, Savar Upazila has been considered to analyze the accessibility of transport networks. Savar Upazila is a prominent periphery region of Dhaka, which is works as connectivity and linkage to the Dhaka headquarters, where it is crossed by a major national highway (Dhaka-Aricha N5) that also travels through the concentric industrial export processing zone that surrounds Dhaka. As a result, this Upazila is connected to a complex transport network that supports a diverse range of economic activity (Mahmud et al., 2021). This region's transport is a vital human activity with a high spatial component that influences the geographic variance in other social and economic activities. The ‘quantitative revolution' of the 1960s provided transport geographers with valuable new approaches and strategies for studying networks and effectively articulating their form and degree of complexity (Taaffe and Gauthier, 1973). However, no extensive study has been undertaken to determine the connectivity and accessibility of sites in the region, despite the fact that it is reasonable to conclude that the region has low connectivity and accessibility compared to international levels and indices. Generally, road network plays a vital role in bringing about sustainable growth (ESCAP, 2016). Structural analysis of transport systems is essential to evaluate the transport network. The study has applied road network connectivity and accessibility analysis according to graph theory which is explained with various indices and accomplished.

2. Aim and Objectives

The board aim of this research is to conduct a structural examination of the road network of Savar Upazila in the Dhaka District. The study accomplished two objectives that contributed to the achievement of the research goal.

I. To illustrate the existing road topological network of Savar Upazila; and

II. To examine the connectivity and accessibility of road network systems in the Savar Upazila.

3. Study Area

Savar Upazila is located between 23°44'and 24°02' North latitudes and in between 90°11' and 90°22' East longitudes. The Upazila occupies an area of 280.12 sq. km, including 20 sq. km of river and 8 sq. km of the forested area (Banglapedia, 2015). The population of Savar Upazila was 1,385,910, where the population density was 4948 person/km (BBS, 2011). It has a fast-rising population and has seen a shift in its traditional agrarian land usage in recent decades as a result of rapid urbanization and industrialization. The study area has been under the administration of the RAJUK since 1995. The Dhaka-Aricha highway in Savar's principal transit route, covering around 30 km through the Upazila. The development has resulted in a significant change in the landscape in this study area due to the transport network accessibility (Amin, 2009). Shimulia, Dhamsona, Yearpur, Ashulia, Birulia, Bhakurta, Pathalia, Banagram, Kaundia, Tetuljhora, and Amin Bazar are among the 11 unions that make up Savar Upazila. The highway (Dhaka-Aricha, N5) crossed the Savar Paurashava, Pathalia, Banagram, Kaundia, Tetuljhora, and Amin Bazar (Figure-1). As a result, all of the unions' growth and development fluctuated due to the road network accessibility. In these unions, a lot of infrastructures have been built along this highway. The most important landmarks in the Pathalia union at Savar include Jahangirnagar University, National Memorial, Savar Cantonment, Savar dairy farm, Radio station, and Bank colony established along the highway. However, the roadway had little impact on urban development in the Banagram, Tetuljhora, and Amin Bazar unions, which are still characterized by agrarian culture and rural villages. The Dhaka-Aricha highway, one of Bangladesh's essential highways that connects numerous divisions, runs through Savar Upazila's urban center and acts as the main artery of vehicle transportation. The Upazila's terrain is made up of alluvium dirt from the Pleistocene epoch. From east to west, the elevation of the ground progressively rises. The alluvium soil of the Bangshi and Dhalashwari rivers makes up the Southern section of the Upazila (Sultana et al., 2017). Bangshi, Turag, Buriganga, and Karnatali are the major rivers. There are 62 kilometers of first-class pucca, 56 kilometers of semi-pucca, 562 kilometers of mud road, and 50 kilometers of highway (Banglapedia, 2015).

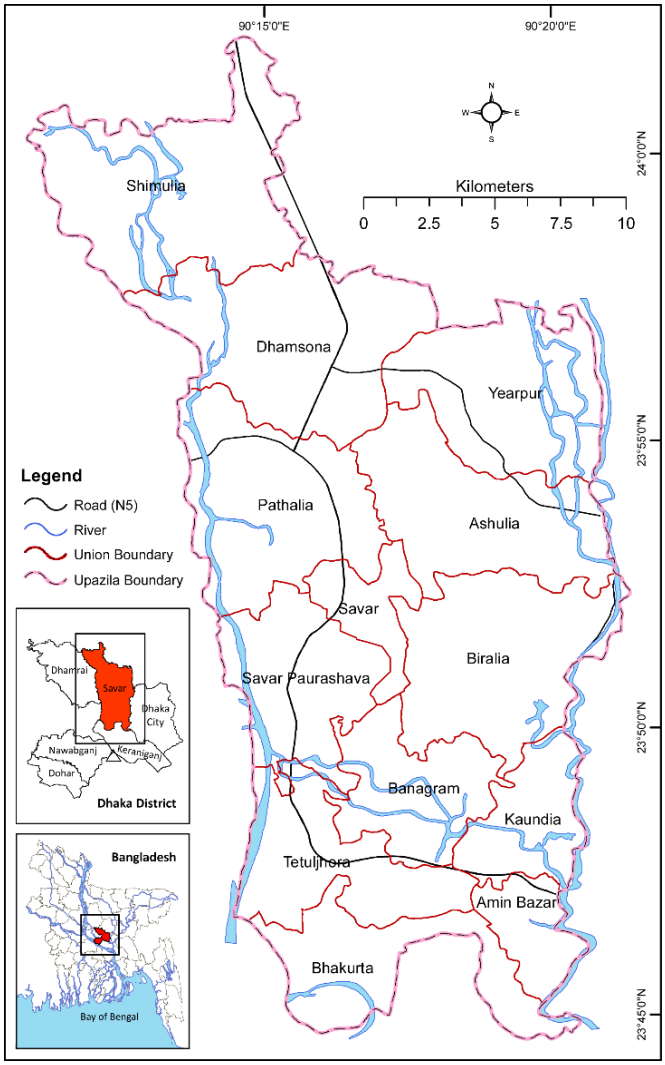


Figure 1: Study area in this research.

4. Materials and Methods

The transport system is heavily reliant on the flow of products and services and as a result, it promotes economic and social growth. Although, transport is essential in any part of the world. The improved road networks accessibility and mobility, resulting in considerable reductions in travel time and expenses. The strengthening of the road network is linked to socioeconomic changes such as access to education, health care, employment possibilities, household income, and poverty reduction. The essential components that demonstrate the degree of accessibility are nodes, vertices, and edges. This research has been conducted with secondary databases that were collected and extracted from various sources. The road database has been extracted from Google earth pro, which was conducted with digitization techniques. The extracted road file has been converted to Geodatabase using ArcGIS. Although, the quantifications of network

topology line segments and points in the study area as a Geodatabase. The assessment of road network accessibility, road nodes and arc has been calculated and identified using the network dataset tools under the network analyst tools in ArcGIS. The road network spatial organization has been identified based on the graph theory. The Alpha Index, Beta Index, and Gamma Index have been used for assessing the connectivity of transport road networks in this study area. The level of road network accessibility was assessed with the shortest path matrix, associate number, and shimbel index. Microsoft Excel has been used for conducting the calculation of accessibility indices. The research of abstract arrangements made up of points and lines is known as graph theory. If a real-world system is idealized as a set of points (vertices) connected by a set of line segments, it can provide certain metrics of its structural features (edges). The study applied road network connectivity and accessibility analysis according to graph theory which explained various indices. The research methods of this study are illustrated extensively in Figure-2.



Figure-2: Pipeline of this research.

4.1 **Application of network indices based on graph theory**

Various network indices based on graph theory are used to evaluate the accessibility and performance of the network analysis. A graph is a collection of points known as nodes or vertices that are linked together by a network of lines known as edges. Vertices are dots that appear at the intersection of two or more edges, while edges are lines that link two vertices. Garrison and Marble (1962, 1964, 1965) made significant contributions to this discipline by developing the Alpha (α), Beta (β), and Gamma (γ) Indexes. This research revel is based on a few selected graph theory metrics that determine network indices.

4.2 **Connectivity Indices**

Connectivity refers to the density of connections in a pathway or road network and the directness of interconnections. Many short links, multiple intersections, and few dead ends characterize a well-connected road or path network. Connectivity of the roadway network is achieved by providing connections within individual developments, between developments, and by having a well-planned collector road network to supplement the arterial highway network (Qian et al., 2012). A connectivity index, generally defined as the ratio of links to nodes, can assess the study area's connectivity. As for connectivity increases, travel distances decrease, and route alternatives expand, allowing for more direct travel between destinations and a more efficient transportation system. To assess the connectivity of the present network system following indices have been used.

Alpha Index (α) is one of the essential network connection indicators. Alpha's value ranges from 0 to 1. The number 0 denotes the lowest level of connection, while 1 denotes the highest level. This metric is also given in percentiles.

$$\alpha = \boldsymbol{e}-\boldsymbol{v}+\mathbf{1}/\mathbf{2}\boldsymbol{v}-\mathbf{5} \quad \text{.....1}$$

Where, α indicates the Alpha Index, $\boldsymbol{e}$ means numbers of edges, and $\boldsymbol{v}$ means numbers of vertices.

Another basic network connection metric is the Beta Index (b). The number of links divided by the number of nodes is known as the link-to-node ratio. This index has a range of 0 to 1 as a value. Where 0 denotes the least amount of connectedness and 1 denotes the most. When the graph is complicated, the beta index surpasses one. The following formula is used to compute the Beta Index (β):

$$\beta = \boldsymbol{e}/\boldsymbol{v} \quad \text{.....2}$$

Where, β indicates Beta Index, $\boldsymbol{e}$ means the numbers of edges, and $\boldsymbol{v}$ means the numbers of vertices.

The connection between the number of observed and potential linkages in a graph is known as the Gamma Index (c). The gamma index ranges from 0 to 1 in value. The more the connectedness, the greater the value, and vice versa. The following is how you calculate the Gamma Index (c):

$$\gamma = \boldsymbol{e}/3(\boldsymbol{v}-\mathbf{2}) \quad \text{.....3}$$

Where, γ indicates the Gamma Index, $\boldsymbol{e}$ means numbers of edges and $\boldsymbol{v}$ means numbers of vertices.

4.3 **Accessibility Indices**

The structure of the transportation network determines accessibility. The most fundamental metric of accessibility is network connectivity. As a result, a connection matrix is generated to display the amount of accessibility. Because they are well linked, places with excellent connectivity are considered the finest location (Pearce et al., 2021). Weaker connection index values imply lower connectedness and vice versa. In this research, accessibility indices have been analyzed with the shortest path matrix, associated number, and shimbel index.

i. Shortest Path Matrix (SPM)

The Shortest Path Matrix (SPM) is a measure of the road network's efficiency. The computation of SPM takes a long time. It's the average number of steps taken along the shortest pathways for all feasible pairs of node networks. The higher the SPM value indicates, the lower the efficiency, and vice versa, which is calculated as:

$$SPM = \frac{\sum_{ij}^{n} d(vij)}{\sum_{ij}^{n} h(vij)} \text{……………………………………………..4}$$

Where, SPM indicates the Shortest Path Matrix, $d(vij)$ represents all the pairs' shortest path lengths of the graph, $h(vij)$ represents the number of paths in the graph and n indicates the number of nodes.

ii. Associated number

Another metric for network accessibility is the associated number. Koning proposed it for the first time in 1936. It may be defined as the greatest distance between any two points. The associated number is the number of arcs required to link it to the furthest node. The highest number in each row is the related number. Lower accessibility is indicated by a higher value of the accompanying number and vice versa. The Centrality index is another name for a related number.

iii. Shimbel index

The Shimbel index is often used to assess the network's accessibility, and it is the total of all the shortest path lengths between all points (edges and nodes) in a circuit. A lower shimbel index number suggests more accessibility and vice versa. The Shimbel index is calculated as follows:

$$SI = \sum_{(i=1)}^{n} dij \text{…………………………………………………5}$$

Where, SI is for the Shimbel index, dij stands for the shortest distance between nodes i and j, and n stands for the number of nodes.

5. Result and Discussion

When new roads are built or old roads are enlarged and repaired, the travel time is reduced, which enhances the accessibility of the zones. As a result of increased accessibility, changes in the population and employment distribution occur. The transportation network is a crucial medium for human civilization since it allows people to operate in different areas. At both the national and international levels, enhanced transportation infrastructure directly positively impacts spatial accessibility. One of the essential features of assessing accessibility in a given location is that it determines the performance of the road network. The Dhaka-Aricha Highway (N-5) runs through the Savar Upazila, connecting Dhaka with Bangladesh's northern region. Improving living standards and making the most use of existing transport networks are critical for the growth of this research area. Network analysis is widely used to comprehend a region's network infrastructure. The network analysis is a complicated process.

5.1 Structural Transport Network of Savar Upazila

Transport networks are extremely complicated spatial systems, and graph theory is used to analyze them. All types of flows are based on point-to-point movement, which is also responsible for spatial arrangements. A topological map or graph simplifies a transportation network to its most basic form, making it easier to comprehend the properties of transportation networks (Kansky, 1963). The topological transformation of actual routes of the study area is depicted in Figure-3. It is crucial to idealize the network into the form of a graph in order to apply graph theory to the analysis of a transportation network. It serves as the foundation for determining the structural features of a transportation system. These elements have been identified in topological networks, i.e., Nodes or vertices (v), Edges or links (e). The Nodes points that make up the fundamental constituents are known as vertices, referred to as nodes. Nodes or vertices are located at the junctions of two or more areas where a node at the end of an arc is known as an end node. On the other hand, the Edges or link lines connecting the vertices or nodes are called edges or links. Arcs are lines representing routes that link nodes. One arc only may link two nodes. The essential measures of transport networks are accessibility and connectivity of networks. Shows the structural network of the study area union wise (Figure-3):

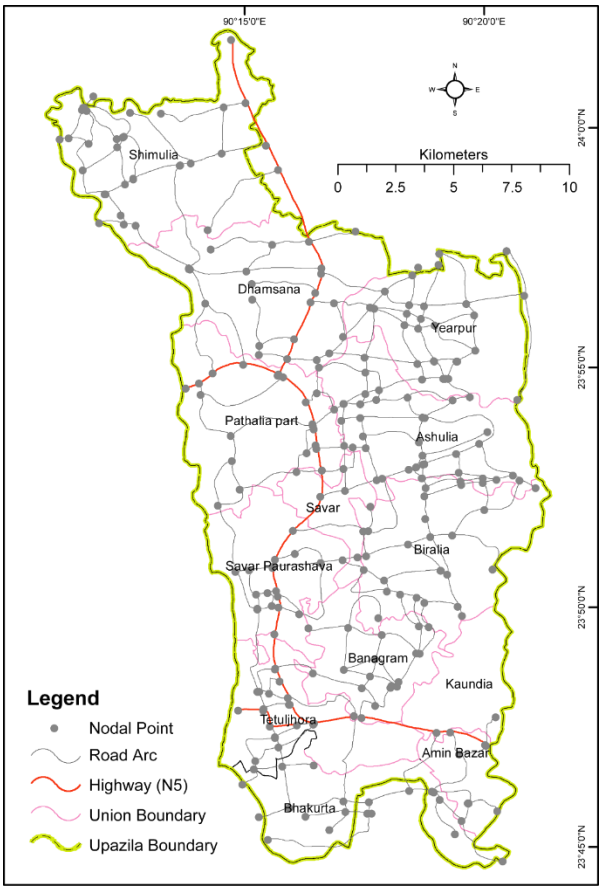


Figure-3: Structural network of the study area by union wise.

In this research, Ashulia occupied a significant number of nodal points and road arcs due to industrialization and structural development within the whole of Upazila. On the other hand, Kaundia engaged the lowest number of nodal points and road arc due to their low accessibility and development (Table-1).

Table-1: Structural network of the study area by union wise.

Union Name	No. of Nodal Point (v)	No. of Road Arc (e)
Amin Bazar	17	15
Ashulia	74	79
Banagram	41	33
Bhakurta	37	23
Biralia	60	46
Dhamsona	36	43
Kaundia	6	4
Pathalia	44	43
Savar	26	21
Savar Paurashava	36	36
Shimulia	37	44
Tatuljhora	42	38
Yearpur	44	48

5.2 Connectivity of Savar Upazila

According to Taaffe and Gauthier, 1973 “The degree of connection between all vertices is defined as the connectivity of the networks.” The higher the level of connectivity inside a transport network, the more efficient that system will be. Kansky (1963) researched the topology of transport networks and established several indices for assessing network connection. The *alpha, beta*, and *gamma* indices were used to quantify the connectivity of the transport network in this study.

5.2.1 Alpha index (α): One of the most features is available of network connectivity. The alpha index is the proportion of a network's actual number of circuits to its maximum feasible number of circuits. The Alpha index is a number that ranges from 0 to 100. The greater the degree of network connectivity, the higher the index. If the value approaches 100, it indicates that the network is increasingly connected (Saxena, 2010). In the Yearpur road network system, the value of Alpha index is 0.60 or 60% (0.60*100=60%). So, this network cycle is 60% of the maximum (Table-2). That means the connectivity of this network is good. This union road network system is better than any other union. It has a higher number of cycles than any other union road network.

5.2.2 Beta index (β): The Beta index is a simple computation that quantifies the connectivity of a network by dividing the total number of arcs by the total number of

nodes. The Beta index varies from 0 for networks consisting solely of nodes with no arcs to 1 and larger for well-connected networks. The following are some of the properties of the index:

- β value for three types of structures and disconnected networks, the value is always smaller than 1. When the network has no edges, this will provide zero values. This study area has 8 unions which a β index of less than 1 (0.062-0.97), such as; Bhakurta, Kaundia, Biralia, Banagram, Savar, Amin Bazar, Tatuljhora, Pathalia.
- β value for any network configuration with only one circuit is always 1. This study Savar Paurashava where β index is 1.
- For a complex network configuration with several circuits, the β value exceeds 1 circuit (Saxena, 2010). This study has four unions which a β index of more than 1 (table: 4). This value represents that this network is more connected compared to the others 9 union network systems.

5.2.3 Gamma index (γ): The gamma index is the ratio between a transport network's observed number of edges and vertices. The gamma index has a range of 0 to 1 as a numerical value. As defined by the index, the degree of connectivity ranges from no interconnectivity to every node in the graph having an edge connected to every other node (Saxena, 2010). This metric can be expressed as a percentage and so has a range of 0 to 100. In this network system, the most significant gamma index is 0.42 of the Dhamsona union. The network is 42 percent connected in terms of maximum connectivity, indicating that the road network is moderately connected, with nearly 50 percent of the system connected. The Gama index is less than the Dhamsona union of the study area in this case. This number denotes a lack of connectivity in this route network. α, β, γ index of Savar Upazila chronologically 0.026, 0.94, 31٪ which indicates the road network system is inferior and not well connected.

Table-2: Union-wise connectivity indices of the study area.

Union	α	β	γ
Amin Bazar	0.034	0.88	0.333
Ashulia	0.041	1.06	0.365
Banagram	0.09	0.80	0.282
Bhakurta	0.188	0.62	0.219
Biralia	0.113	0.76	0.264
Dhamsona	0.119	1.19	0.421
Kaundia	0.14	0.66	0.333
Pathalia	0	0.97	0.341
Savar	0.085	0.80	0.291
Savar Paurashava	0.014	1.00	0.352
Shimulia	0.115	1.18	0.419
Tatuljhora	0.037	0.90	0.316
Yearpur	0.602	1.09	0.380

5.3 Accessibility: According to Robinson and Bamford (1978), Accessibility is one of the most significant characteristics of a transport network, and the geographer is particularly concerned with accessibility as a locational trait. A geographer is interested in node connectivity associations in terms of accessibility when looking at a transport network. The structure of a network changes when new linkages are added, or current linkages are improved. Developments in nodal accessibility reflect these changes. The graph theory is used to calculate nodal accessibility. Any network can be described as a matrix, with rows corresponding to origins and columns corresponding to destinations. The number of rows and columns corresponds to the number of network nodes. According to the convention, the horizontal rows of a matrix are defined as origin nodes, and the vertical columns are defined as destination nodes. The research area's 13 unions have been assigned a level of nodal accessibility. Topologically, Accessibility can be evaluated in three ways, such as;

- **By shortest path matrix:** the number of arcs utilized in the shortest path between all feasible pairs is determined by the shortest path matrix.
- **By the associated number:** the number of arcs required to connect a node to the farthest away node and
- **By the Shimbel index:** obtained from the shortest path matrix, which shows how many arcs are required to connect any node to all other nodes in the network using the shortest path.

5.3.1 Road Accessibility in Study area

The current research is focused on nodal accessibility. To determine the nodal accessibility, the unions and Paurashava are used as the main nodal sites (Figure-4). The relative location of a vertex in the transport network determines the degree of accessibility to that vertex. When compared to vertices on the periphery, centrally situated vertices are frequently more accessible. The Shimbel Index was used to identify such differences in the degree of accessibility across the Study area.

5.3.2 The Network as a Matrix

Any network can be described as a matrix, with the sources and destinations represented by the rows and columns, respectively. The number of rows and columns corresponds to the number of network nodes. According to the convention, the horizontal rows of a matrix are defined as origin nodes, and the vertical columns are defined as destination nodes. Each cell entry in the matrix can be used to record information about a pair of nodes' relationships. Any node in a network that is well connected to other nodes is said to be accessible. The topological graph in Figure-4 shows that the shortest path matrix has been prepared in the appropriate squares and the number of arcs in taking the shortest path between all the paired nodes (Figure-5). The top row of figures in the matrix gives the number of arcs in the shortest path from Amin Bazar to all the other nodal centers.

5.3.3 Topological Graph

The study of transport networks has become a crucial component of geographical research. Transport networks are extremely complicated spatial systems, and graph theory is used to analyze them. A regional transport system consists of a series of point-

to-point movements connecting origins and destinations. “When different points, whether in one, two, or three-dimensional space, are linked together into a structure, they are said to form a network. Such networks by carrying flows of goods, people, information or anything else that is moved from place to place, give rise to regional transport system” (Robinson and Bamford, 1978).

A topological map or graph simplifies a transport network, making it easier to comprehend its characteristics. The topological properties of line patterns or networks are described in such a map based on contiguity, relative locations, and systematization of lines and junctions rather than distances and directions.

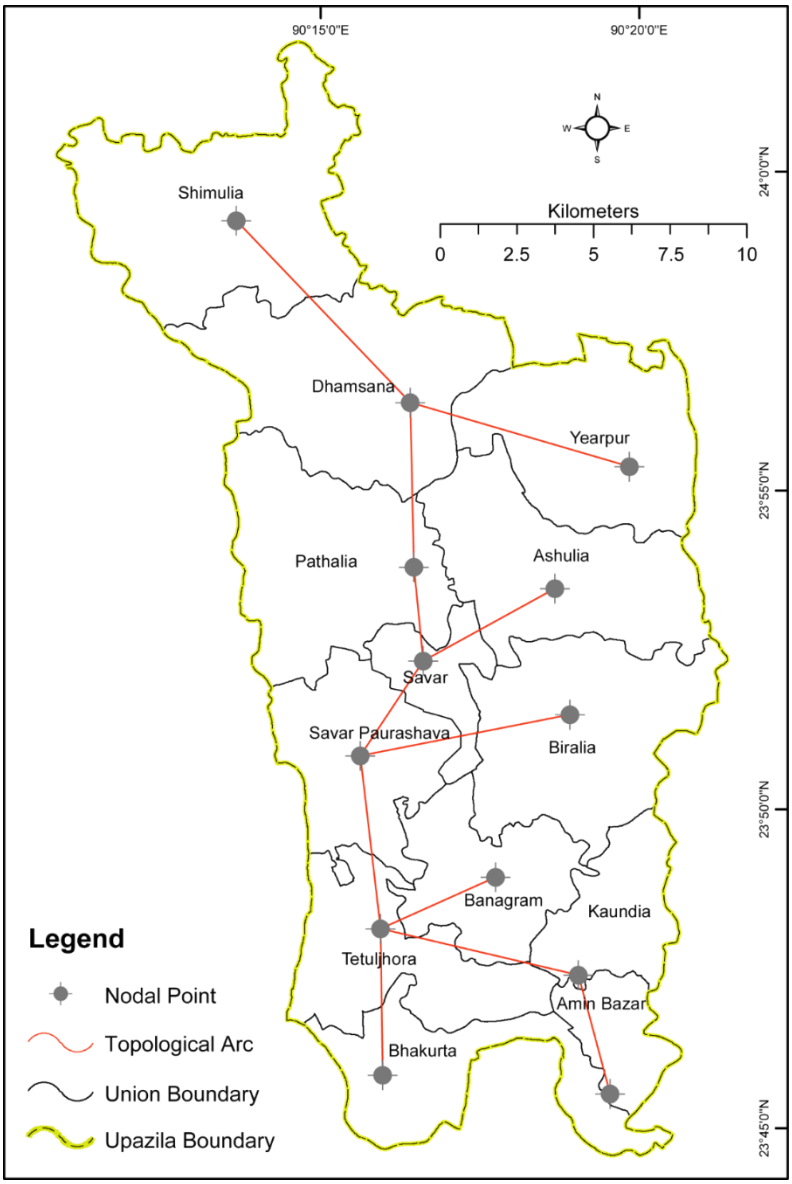


Figure-4: Topological map of the study area.

5.3.4 Shortest Path Matrix: Any node in a network that is well connected to other nodes is said to be accessible. Figure-5 depicts 13 nodes connected by a series of arcs, with the most accessible node, Savar Paurasava, readily apparent. As shown in Figure-5, accessibility can be determined by creating a matrix known as the shortest path matrix. Each row's totals can be summed up, and the node with the lowest total is the most accessible. Savar Paurasava has the lowest total (27), making it the most accessible, while Shimulia has the most incredible total (51), making it the least accessible.

5.3.5 Associated number: The number of arcs required to connect a node to the farthest node is the related number, the associated number is the highest number in each row, e.g., in row Amin Bazar, Yearpur, Shimulia7 and in row Savar Paurasava, Savar with an associated number 4 (low) is the most accessible of all nodes. Smallest associated number is the most accessible node which this study got the most accessible node is Savar Paurasava, Savar.

5.3.6 Shimbel Index: The Shimbel index, on the other hand, is generated from the shortest path matrix, which represents the number of arcs required to connect every node in the network to all other nodes through the shortest path. The Shimbel Index is calculated by adding the sum of each row. This is accomplished using the shortest path matrix (Figure-5), which shows the number of arcs required to connect every node to all other nodes in the network using the shortest path. The shortest path matrix between 13 nodal points in Savar Upazila is shown in Figure 2, illustrating their accessibility. The node with the lowest Shimbel index is the most accessible, while the node with the highest Shimbel index is the least accessible. Table-6 reveals that the 27 Shimbel value of Savar Paurasava has the greatest accessibility from all other nodal points. Because Yearpur, Shimulia, and Amin Bazar are located in the Study area's foremost union, the shortest path analysis shows that they are less accessible. Lower numbers suggest greater connectedness and accessibility, according to the Shimbel index analysis.

Nodal Point	Amin Bazar	Kaundia	Banagram	Bhakurta	Tetuljhora	Savar P.	Biralia	Savar	Ashulia	Pathalia	Dhamsona	Yearpur	Shimulia
Amin Bazar	0	1	3	3	2	3	4	4	5	5	6	7	7
Kaundia	1	0	2	2	1	2	3	3	4	4	5	6	6
Banagram	3	2	0	2	1	2	3	3	4	4	5	6	6
Bhakurta	3	2	2	0	1	2	3	3	4	4	5	6	6
Tetuljhora	2	1	1	1	0	1	2	2	3	3	4	5	5
Savar P.	3	2	2	2	1	0	1	1	2	2	3	4	4
Biralia	4	3	3	3	2	1	0	2	3	3	4	5	5
Savar	4	3	3	3	2	1	2	0	1	1	2	3	3
Ashulia	5	4	3	4	3	2	3	1	0	2	3	4	4
Pathalia	5	4	4	4	3	2	3	1	2	0	1	2	2
Dhamsona	6	5	5	5	4	3	4	2	3	1	0	1	1
Yearpur	7	6	5	6	5	4	5	3	4	2	1	0	2
Shimulia	7	6	6	6	5	4	5	3	4	2	1	2	0

Figure-5: Shortest Path Matrix for road accessibility

Table-3: Accessibility Index of Study Area

Name	Associated Number	Shimbel Index
Amin Bazar	7	50
Kaundia	6	39
Banagram	6	41
Bhakurta	6	41
Tetuljhora	5	30
Savar P.	4	27
Biralia	5	38
Savar	4	28
Ashulia	5	38
Pathalia	5	31
Dhamsona	6	40
Yearpur	7	50
Shimulia	7	51

Three accessibility measurement of the study area shows the most accessible zone is Savar Paurasava which is connected with the Dhaka-Aricha national highway and situated in the middle of the study area. Based on Shimbel Index, all the 13 nodal centers have been divided into five categories shown in Figure-6.

- **Very high Accessible Centers (Below 28):** One nodal center, namely Savar Paurasava, is included in this category which connected with other nodes
- **High Accessible Centers (28-33):** Three nodal centers, namely Savar (28), Tetuljhora (30), and Pathalia (31), lie in this category. All these centers are connected with the national highway.
- **Moderate Accessible Centers (34-39):** Three nodal centers, namely Ashulia (38), Biralia (38), and Kaundia (39), lie in this moderate category.
- **Less Accessible Centers (40-46):** Only Dhamsona lies in this category connected with Shimulia and Yearpur. This center is located near the periphery of the Upazila, and that's why it gets the high value of the Shimbel Index and is less accessible from other centers.
- **Very Less Accessible Centers (Above 46):** Three nodal centers, namely Amin Bazar (50), Yearpur (50), and Shimulia (51), are enlisted in this last category. Due to their farthest location, these centers are very less accessible. Shimulia is situated on the northern side of this study area, a very less accessible nodal center.

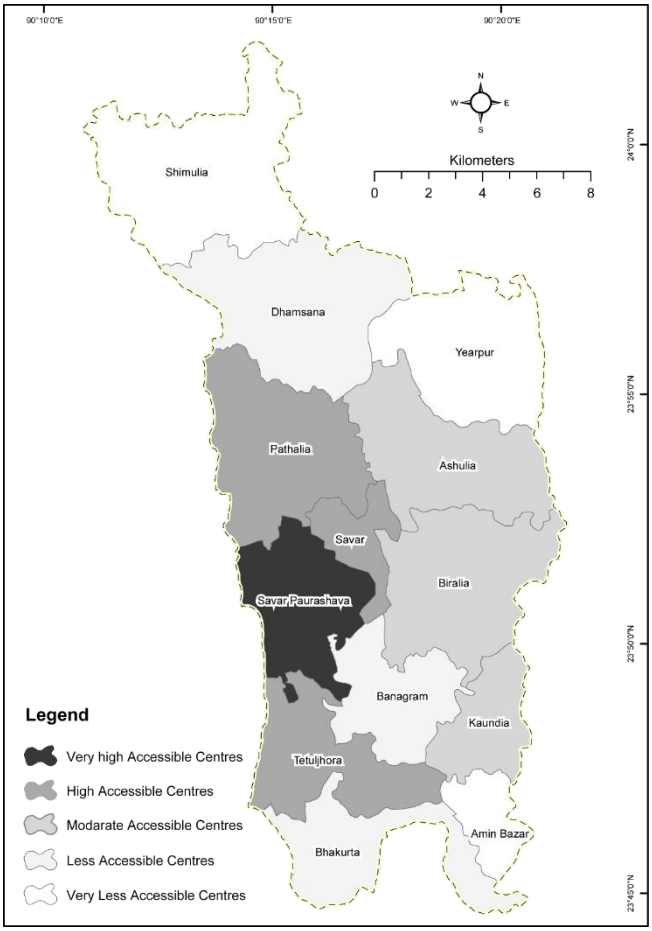


Figure-6: Accessibility map of Savar Upazila.

6. Conclusion

The transport network has played a crucial role in spatial interaction in the study area. The purpose of the study is to the structural analysis of the transport network of Savar Upazila, which this study illustrated union-wise. One of the most significant parts of network analysis is accessibility and connection. The topological and geometric components of the road network's spatial organization are examined (graph-theoretic measures). The research area comprises 12 unions and 1 Paurashava, with 473 arcs and 500 nodes. The graph theory is used to calculate nodal accessibility. The analysis of each point's connectedness and accessibility is neither practicable nor viable. Out of these nodal sites, the places that have been the most interactive for various functional and service objectives have been chosen to research connectivity and accessibility indices. The alpha, beta, and gamma indices were used for connectivity analysis, while for accessibility analysis, the *shortest path matrix*, *associated number*, and *Shimbel index* were used. These three accessibility analysis methodologies identify Savar's extremely high accessible zone, which is located in the research area's center and connects all nodal points. Areas with excellent accessibility attract more people and goods, resulting in the

formation of towns and cities. So, the Savar zone is most prominent from all other nodal centers. The study area connectivity and accessibility indices union-wise have not varied mostly, indicating physiographic conditions of this area are almost the same and poor road connectivity. Changes in nodal accessibility reflect the structure of a network and changes in reaction to the addition of new linkages or the enhancement of existing linkages.

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Modeling Approaches in Social Sciences: Critical Reviewing on Selected Models and Their Application in Bangladesh Context

Md. Nazrul Islam*

Abstract: It is currently being hardly used modeling applications as a tool for social sciences research methods in worldwide. Although theory has been used in social science research in a long time. But the application and practices of modeling approaches in social science research is much less than that. In our country Bangladesh, although the theory is applied in different branches of social science research on a small scale but still applying modeling tools for developing original research design is so less. Several secondary data sources have been used for collecting data and information for this compressive review of this paper. This paper examinations the Scopus Google engines bibliographic search, possibly the biggest database of peer-reviewed research literature on theories, models and modelling approaches of social sciences domain. Especially, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology flow diagram showing screening of the 370 articles primarily, then 260 articles were evaluated and finally it has been selected 140 articles those were analyses the modeling approaches. Also, PRISMA flow diagram is designed for gathering literature review process for screening application and importance importance of modeling methods in social sciences research. The paper has successfully identified the most important modeling approaches i.e. 25 for geography and environment, 20 for urban and regional planning, 20 for economics, 20 for government and politics, 20 for anthropology, 20 for public administration, 20 for sociology and social welfare research respectively. The findings also recommend if the research are designed by those modeling ideas at the socio-environmental and political aspects of Bangladesh, then the field of research in social science would be valued more wide and unique. Through this research, it would be possible to develop several models by applying these identified theories and modeling approaches that can play a vital role for improving the social sciences research portfolio in Bangladesh as well as the other nations.

Keywords: Modeling; Social Phenomena; Innovation; Validation, Social Science

Introduction

The focus of fundamental and applied research is to analyze the interaction of human and the social environmental aspects around them and to plan for the future generation accordingly (Semtner, 1995; Rummukainen, 2010; Ganju, 2016; Parna et al., 2018; Pasquale et al., 2021). All the elements of the human environment are hidden in the various basic disciplines of the social sciences (Mershon and Shvetsova, 2019). And to know about these, of course, the need for fruitful research in various subjects of social sciences is immense. Social science research provides trustworthy information to the people that are systematically recognized so that end users can rely upon it (Nisio and Battista 2010; Hafsa, 2019; Babalola and Nwanzu, 2021). It is well-know that the social science research helps to explain the nature and behaviors of the society and the attitudes of people, how society works, discovering all from generates of economic growth and causes of redundancy to what makes people happy in their respective society (Mahmud, 2008; Rahman et al. 2015). The important information of social sciences are vital and can

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be used for developing many conceptual and theoretical models. Among other properties, it helps to shape managment strategies and government policies to ensure the future policy frameworks also (Weber, 2011; Albert and Neil 2010; Oliverio, 2020). Social science research supports the community or society in finding the solutions to different social problems and issues (Lave and March, 1975; Box, 1999; Bilaniuk, 2008).

Since 1960, many common but scientific research methods have been applied for social science as examples case studies, historical research, interviewing techniques, stakeholder participation, field observation, social network analysis, questionnaire survey research and statistical analysis etc. (Haq 2020; Babalola and Nwanzu, 2021). Through these traditional reseach methods, it would be possible to develope more sceintific reserach standardized set of techniques for building scientific knowledge or models (Cheng, 2001; Westland, 2010; McKie and Ryan, 2012). Other selective components in social science research are generally used in to achieve the research objectives, analysis and confirmation of results of the particular research, error analysis, self-correction and quality controls etc. However, the innovation, development and application of modeling in the social sciences is extremely limited and it lags far behind the Western or developed world. (Smith and Davis, 2016; Babalola and Nwanzu, 2021). But in the current scientific evidences show that many the researchers are highly encouraged to use models when they can assist in identifying significant variables in such a way that tests of hypotheses can be defined more sharply in their innovative social sciences research (Argyriades, 2006). In generally, the model is considered theoretical aspects of social and learning philosophies inform the social infrastructure and socio-environmental development. Figure-1 indicates that Input-Output System of modeling parameters for social science research, how to model building for predicting the social problems and issues.

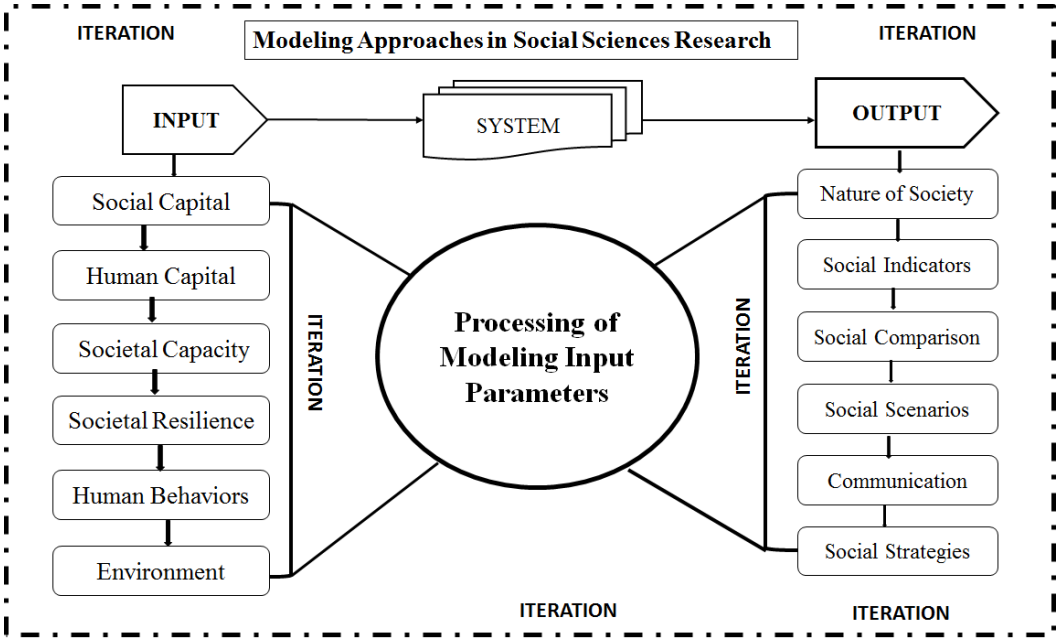


Figure 1: Input-Output System of modeling parameters for social science research, how to model building for predicting the social problems and issues.

Due to the skilled manpower and technological improvement in western world especially Europe, America and Asia pacific countries researchers developed many conceptual, theoretical and predictive models on social sciences research (Amy et al., 2003; Cumber and Githens, 2014; Xue et al., 2020; Allen, 2021). Problems were that all the social theories and models were developed in the above mentioned countries or regions especially on the basis of data collection from those areas (Lave and March, 1975; Box, 1999; Bilaniuk, 2008). But there is no doubt that models developed in social science research in Europe and America can be applied in practice and have the status of universal models. But the problem is that these models are modeled on the developed world, which is a real danger when applied in poor developing or underdeveloped countries (Mahmud, 2008; Rahman et al. 2015; Hafiz et al., 2020). Because in reality, these are not the models for the universal social system in the world. Therefore, understanding the structure, function, application and limitation of all these models, for a diverse society like Bangladesh, our sociologists or social sciences research should come forward for new model building and innovation (Hahl et al. 2016; Pasquale et al., 2021).

Significance of the Study

Now-a-days, many disciplines of the social sciences and its researchers are playing important role like the natural sciences, theoretical model building, hypothesis testing, and to make a comparative analysis (Amy et al., 2003; Hansen, 2003; Cumber and Githens, 2014; Xue et al., 2020; Allen, 2021). Apparently, the social scientists have acquired the inspiration for developing the modeling approaches in social sciences disciplines through the style of mathematical and econometrics modeling techniques used by the economists (Morton, 1999; Edling, 2002). In fact, in this age of information and technology, various aspects of the social sciences are in dire need of prediction, analysis, evolution and significant testing through modeling methods (Figure-2). The main goal of this study is to identify the source of the modeling method, to make a list of some models and to highlight the aspects of applying the models.

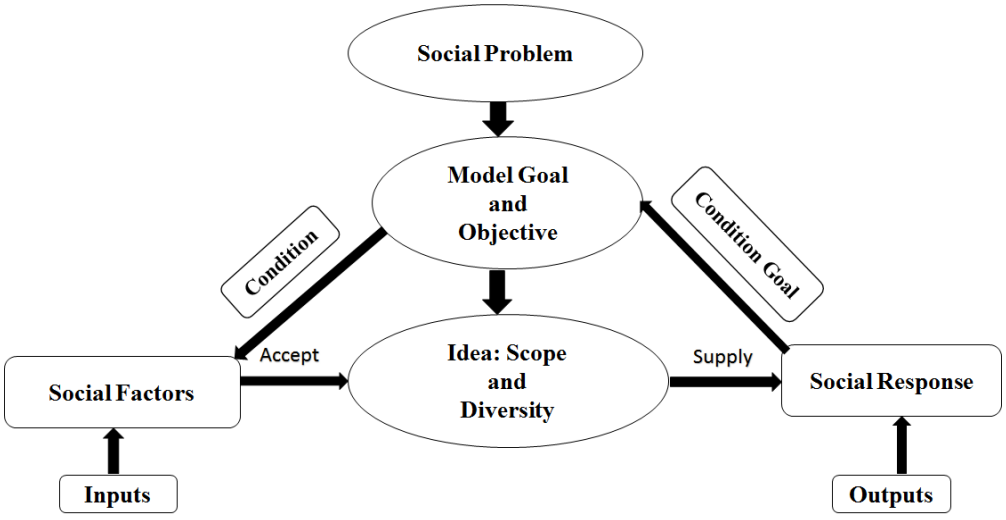


Figure 2: The rational-choice style of modeling in social problems from social factors to social response interacting the significance of model scope, goal and diversity.

In this review paper highlighted 145 social sciences related modeling approaches that could be the very helpful for doing social research and to prepare some models. Also, important research models have been presented in this paper so that the researchers in the social sciences can use their intelligence to create new research models with the help of numerical techniques, econometrics and machine-learning methods to develop social behavioral predictive models. (Edling, 2002; Kolkman et al., 2016; Haq 2020; Babalola and Nwanzu, 2021). If researchers can be able to do their fundamental and applied by applying modeling methods combining different types of theories in the social sciences, the stakeholders of the societal issues and problems will be to understand different elements of society, people and environment. Thus, modeling approaches in social science are very important because it provides an evidence-based foundation on which to build a more effective direction and consensus. Because these models help to understand the society structure and functions, and to know the societal behaviors. (Kolkman et al., 2016; Allen 2021).

Materials and Methods

In this study, a comprehensive review identify the Scopus Google engine's bibliographic search, possibly the major record of modeling related research literature on modeling approaches for social sciences research (Meraj et al., 2021). Systematically it has been searched for undertaking to appraisal all the works using a bibliographic Google/Google scholar search. The main criteria for selection has been included only modelling oriented paper published between 1960-2021 with the subsequent terms in the title, keywords, or abstract ("models" or "model application" or "social science" (Meraj et al., 2021). In this study, at first 370 papers have been selected that contained modelling approaches but carefully evaluation it has been selected for 2nd screen became more than 260 papers. Figure-3 mentioned that the indication of the literature review and study methods, design, information collection by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology flow diagram showing screening of the 370 articles, 260 were evaluated and finally selected of 145 modeling approaches for future incorporating of social sciences research. The PRISMA is a screening oriented components or items for recording in methodical reviews and systems analysis (Moher et al. 2015; Shamseer et al. 2015). The PRISMA mainly attentions on the reportage of appraisals for assessing the effects of involvements, but can also be used as a basis for reporting the comprehensive reviews (Moher et al. 2015; Shamseer et al. 2015).

Research Context

In this study, a qualitative research design has been applied for collecting the data and other information. From the point of social science view, qualitative and quantitative research help to collect many evidences in the respective social attitudes, behaviours, and knowledge and human perceptions etc. Several content analysis and insensitive literature review follows the Scopus Google engine's bibliographic search has been applied for collecting, analysis and visualize data for this study. Also for collecting the baseline information like social capacity, social resilience, socio-economic, human attitudes and environmental status, it has also been studied books, many journals articles, periodic, blog and others secondary sources also.

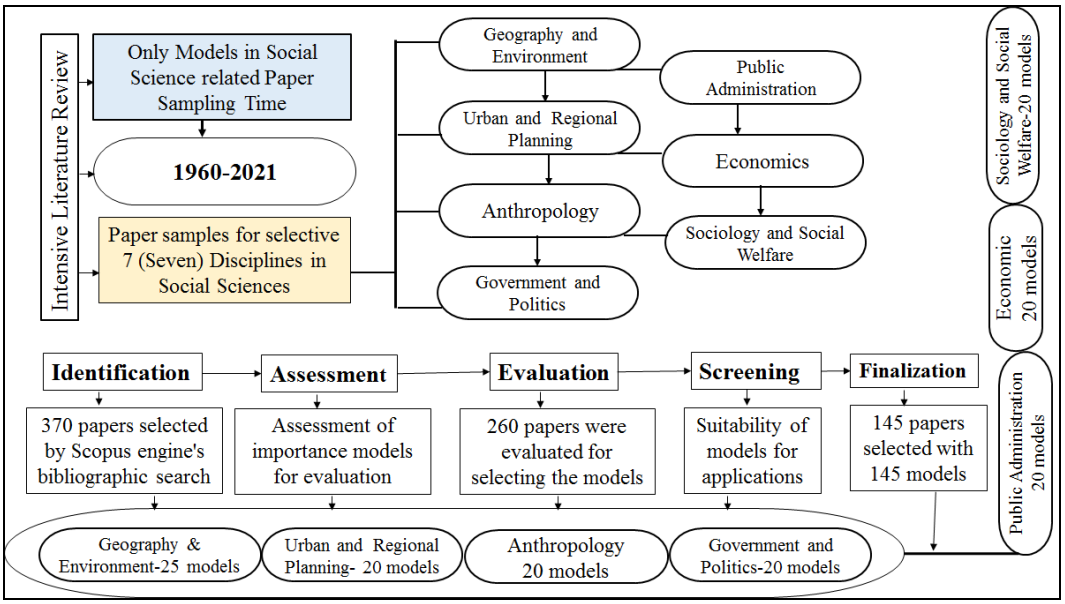


Figure 3: Indication of the literature review and study methods, design, information collection by PRISMA methodology flow chart showing screening of the 370 articles, 260 were evaluated and selected for 145 modeling approaches for future incorporating of social sciences research.

Aims and Objective of the Study

Various scientific research methods or techniques have been used for research in different branches of social sciences. But even if some theory or mathematical formulas are used in short range, but the application of modeling is very limited in social science research. Modeling is being used in basic research in various branches of science but the innovation, development and application of modeling in social sciences is very limited and it is far behind of the western or developed world. But in fact, the structure of the underdeveloped and developing countries social system, social environment, socioeconomic characteristics, human behavior and their customs, are very diverse. So if the researchers can combine the different theories and models of social science considering modern thinking and context, then it will be much easier to deal with human environment interactions in their respective society and other social problems and issues.

Models in any discipline enable the researcher to utilize a framework for understanding and solving a given problem in some contexts. In the case of social sciences in particular, there is a need to apply and develop modeling in research to create some scenarios of how difficult socioeconomic conditions change between people and the environment, and how complex social systems change over time, space and situation. There are some good quality research papers have been published in different branches of social sciences at the higher education level in Bangladesh. But most of the research works which have been performed using standard qualitative research methods and techniques. However, in some branches of social sciences, the researchers have successfully applied social theory and modeling approaches in the basic and applied research papers. The fact of the matter,

however, is that most of the research results demonstration that there is very little development or innovation of models in social science issues. And considering all these aspects, the aim and purpose of the present comprehensive review research paper has been fixed and summarized. Considering the above mentioned aims the specific objectives of the study are:

1) To identify the suitable models for selective disciplines in social science research,
2) To evaluate the implication of modeling approaches in the social science research;
3) To explain the challenges of model building constraints in the social science research.

Results and Discussion

Application of Modeling Approaches in Geography and Environment Research

Geography and environment is a dynamic subject of social sciences phenomena change in space and time. In many countries, including Bangladesh, Geography and Environment are taught in the Faculty of Social Sciences, Biological Sciences, Physical and Environmental Sciences. In some countries, Human Geography is also taught in the Faculty of Arts and Humanities. Therefore, in order to apply modeling to the subject of Geography and Environment, the researcher has to be proficient in Science, Biology and Social Sciences or Multidisciplinary approaches (Figure 4).

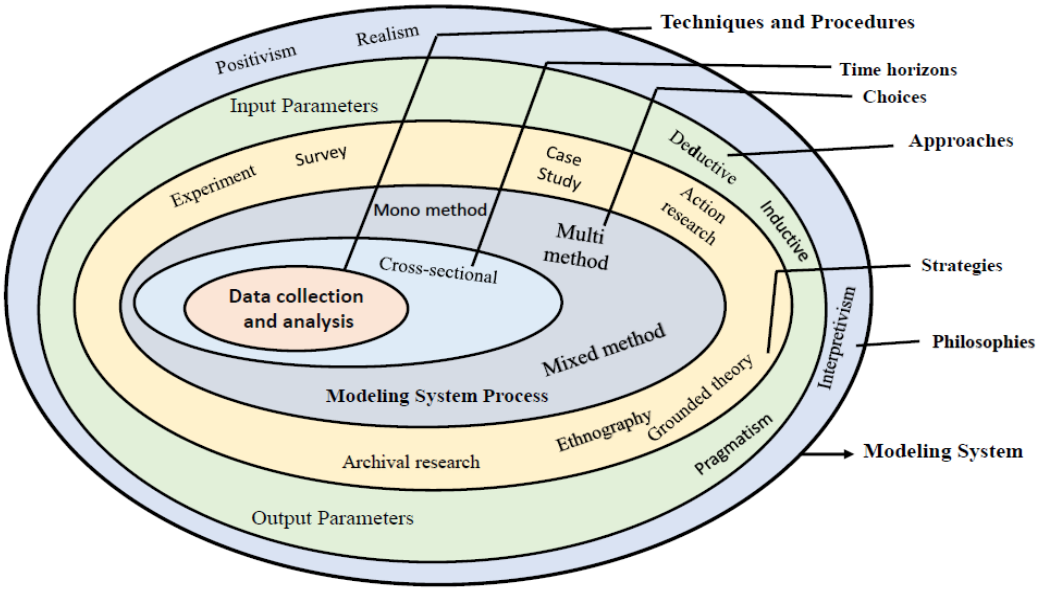


Figure 4: Implementation and interactions among the multidisciplinary social sciences research themes, philosophies, methodologies and evidence based modeling approaches Venn diagram (Fig. 4 credit goes to Saunders et al., 2007; after adopted, modified and adding modeling approaches).

But to overcome this complexity, the researcher has to decide on the application of modeling in the study by combining it with his or her dilemma. Modeling can be used

extensively at the research in geography and environment. The models identified and selected in our paper can be used for higher research, especially in the fields of physical geography, environmental geography and human geography (Table-1). The identified models can help the academicians and researchers to visualize, or picture in their mind, something that is difficult to see or understand. Environment related models help to inform both decisions and policies. Models improve the understanding of natural systems and how they react to changing conditions, such as exposure to hazardous substances and the temporal and dose effects from the exposure.

Table 1: List of selective modeling approaches in geography and environment research

S.L	Name Model	Suitability of Application	Sources/References
1	Physical System Model	Relevant properties of real world	Chorley and Haggett (1967)
2	Spatial modeling	Identify spatial features by GIS	Kirkby (1987)
3	Stochastic Models	Behavior of situation or process	Kirkby (1987)
4	Deterministic model	Assume that known average rates	Hahl and Kremling (2016)
5	3-D River Model	Labelled features of River basin	Parna et al. (2018)
6	Ocean Circulation Model	Predictability of ocean environment	Semtner (1995)
7	Hydrodynamic Coupled Model	Processes and interactions	Ganju (2016)
8	Regional Climate Models	Predict to regional climate	Rummukainen (2010)
9	Soil erosion model	Occurrence of soil erosion	Pasquale et al (2021)
10	Statistical Model	Prediction of statistical features	Saltelli (2019)
11	Mathematical Model	Prediction mathematical features	Saltelli (2019)
12	Cultural Diffusion model	Drivers of cultural transmission	Joaquim (2015)
13	Demographic Transition Model	Population dynamics & transition	Kirkby (1987)
14	Epidemiologic Transition Model	Risk factors for death or injury	Omran (2005)
15	Christaller and Losch Model	Hexagon of higher order centers	Britannica (2019)
16	Concentric Zone Model	Spatial urban arrangement	Kirkby (1987)
17	Rostowa´s Growth Model	Marginal utility of income	Rostow 1959; Minca 2009

S.L	Name Model	Suitability of Application	Sources/References
18	Von Thunen Theory/Model	Agriculture location and land use	Britannica (2014)
19	SWAT Model	Soil and Water Assessment Tool	Gassman (2007)
20	SWOT Model	Identifying their perceptions	Islam et al. (2015)
21	IMPACT Model	Mitigation Strategies of toxic algae	Islam et al. (2013)
22	Environmental-Societal Model	Dynamics of societal environment	Kirkby (1987)
23	DPSIR Model	Indicators structural organization	Tscherning et al. (2012)
24	The Butler Model	Tourism carrying capacity	Britannica (2019)
25	Spatial Exploration Model	Growth of the urban hierarchy	Sun et al. (2019)

Application of Modeling Approaches in Urban and Regional Planning Research

The use of models are very important for research in urban and regional panning. Through this study, 20 very important models have been provided in Table-02. If the researchers appreciate the content of these models and apply these models to the urban and regional planning research in Bangladesh, it will be easier to predict urban and regional problems and issues. Because these models help to understand us the wider purposes of urban citizens and their motive (Sharma et al., 2011; Mohsin and Anwar, 2015; Taubenböck et al., 2019).

As the concept of urbanization is gaining momentum in today's world, the importance and subject visions of the urban and regional planning has increased and its scope has multiplied day by day. In particular, scientific models of the planning process and of the urban system have been developed in depth, and many of these ideas have found their way into practice through the preparation of Structure Plans. But now there is need for a period of reflection and criticism so that these developments can be consolidated and interpreted in a broader perspective (Batty, 1976; Liu et al., 2018; Tusting et al., 2019).

In this study, 20 important models have been identified for applying urban and regional planning research in Bangladesh. Though many models are used in by the urban and regional planners but it is important to use the computer programing based simulations models for testing theories about spatial location and urban activities in Bangladesh (Herbert and Stevens, 1960; Zogas et al. 2005; Romain, 2008). The models obtained from this study can be used to make detailed scenarios and predictions about urban planning, urban growth, urban land use, urban environment, urbanization trends, urban culture and urban fringe etc.

Table 2: List of selective modeling approaches in urban and regional planning research

S.L	Name Model	Suitability of Application	Sources/References
1	Concentric Zone Model	Assumption on CBD center of city	Sharma et al. (2011)
2	Sector Model	Wedge-shaped patterns	Romain (2008)
3	Linear Urban Model	Belt or a buffer zone	Romain (2008)
4	Urban Ecological Model	Explain the spatial pattern	Schwirian (1983)
5	The CATS Model	Land use accounting purpose	Humburg and Sharkey (1961)
6	The UNC Model	Land use growth and succession	Chapin et al. (1964)
7	The EMPIRIC Model	Locational pattern analysis	Hill (1965)
8	The POLIMETRIC Model	Metropolitan development	Bolan. et al. (1963)
9	The Pittsburgh Model	Urban activity distribution	Lowry (1964)
10	The Penn Jersey Model	Market demand of urban land	Herbert and Stevens (1960)
11	The San Francisco Model	Community renewal market supply	Little (1966)
12	Eastern European Model	Cities with residential centers	Taubenböck et al. (2019)
13	Gravity Model	Interaction urban centers & distance	Almog et al. (2019)
14	Multiple Nuclei Model	Creation of different nuclei	Mohsin and Anwar (2015)
15	Western European Model	Cities with industrial centers	Taubenböck et al. (2019)
16	Galactic City Model	Mini edge cities by highways.	Liu et al. (2018)
17	Islamic City Model	Development of a city by mosque	Falahat (2014)
18	Sub-Saharan Africa Model	Natural resources and diversity	Tusting et al. (2019)
19	Southeast Asia Model	Squatter settlements and industry	McGee (2002)
20	Hoyt Model	Rents within a city	Zogas et al. 2005

Application of Modeling Approaches in Economics Research

Selection of economic models are not easy for developing nations for considering the socioeconomic aspects. In a sense, an economic model help to us regarding the reality of a simplified version of the abstract of real world features that allows us to perceive, recognize, and make predictions about economic activities, behavior and aspects (Yock et

al., 1986; Nakata, 2004; Donghan et al., 2014; León, 2019). In this study, it has been identified 20 important economic models that could be suitable for doing further research in Bangladesh. These selective models can be used as a fundamentals tools for descriptive the economic issues and problems in Bangladesh. Some economic models are introduced in the Table-3 which would be the suitable for developing the conceptual models or mathematical model (Nisio and Battista, 2010). Especially, macro-economic model, econometric model and binary response model offer a way to grow a comprehensive view or image of an economic condition and realize how economic aspects appropriate together (Nakata, 2004; Hansen, 2005; Donghan et al., 2014).

Table 3: List of selective modeling approaches in economics research

S.L	Name Model	Suitability of Application	Sources/References
1	General Equilibrium Model	Suppression as economic activities	Grossman (1991)
2	Econometric Model	Prediction of economic time series	Hansen (2005)
3	Benefit Financing Model	Consequences of unemployment	Wayne Vroman (2005)
4	Macro-economic model	Macro-economic systems analysis	Yock et al. (1986)
5	Cobb-Douglas Model	Deterministic profit maximization	Zellner et al. (1966)
6	Solow-Swan Model	Exogenous impact of population	Donghan et al. (2014)
7	Lucas Islands Model	Politics of monetary policy	Lohmann (1999)
8	Heckscher-Ohlin Model	Analysis of international trade	Khan (1980)
9	Black-Scholes Model	Option of economic price	Sovan (2012)
10	AD-AS Model	Aggregate demand and supply.	Pierre-Richard (2004)
11	DAD-SAS Model	Identification of susceptibility	Martinez et al. (2003)
12	Shock Therapy Model	Dramatic changes of economy	León (2019)
13	Russia's Economic Model	Command economy.	León (2019)
14	Binary Response Model	Estimation of loss and profit	Horowitz and Savin (2001)
15	Manpower forecasting Model	Human resource forecasting	Zhao et al. (2021)
16	Energy-economic model	Understand the energy systems	Nakata (2004)
17	Hedonic Pricing Model	Rent or house value	Malpezzi (2003)
18	Bio-economic Farm Model	Formulations describing farmers'	Janssen and Van (2007)
19	Monetary-Policy Model	Dynamics in the data to price	Fuhrer (2000)
20	Structural Equation Model	Assessing consumer satisfaction	Nisio and Battista (2010)

Application of Modeling Approaches in Government and Politics Research

In recent times, worldwide social government and politics relevant researchers have used some models but no realistic model of political science and policy formulation has been developed in Bangladesh (Carver, 2000; Kolkman et al., 2016; Xue et al., 2020). Integrating governance and policies are very significant issues because it is quite supporting the citizens to understand the functions and working strategies of political frameworks around the world (Schmitter, 2009; Cumber and Githens, 2014). In this aspects, it is found that there are many types of government and political schemes and framework worldwide according to the reliable, societal, cultural, ethnic, and social antiquity (Carver, 2000; Clarke et al., 2007). That's why it is quite difficult to build a model with comparative constructions of political association that has the bent to change preliminary with one nations then onto the next nations. Table-04 shows the list of selective modeling approaches in government and politics research.

Applying modeling approaches in government and politics research on examining empirical relationships, traditional corporate governance, and multi-theoretical perspective with developing casual thinking models are the demand of the time (Clarke et al., 2007; Uzonwanne, 2016). This is because modeling approaches can show of harmonizing the political aspects of a developing country with the principles of the components of governance considering the global situation. For developing any policy models, the researchers should be aware that the policies are a instrument for regulatory the performance of an society by leading the behavior of the inhabitants of the society (Clarke et al., 2007; Mullineux, 2010). In most cases the basic idea of the existing policies and the input parameters of the social model in the given situation are confirmed. But developing a governance a policy model selecting the input parameters or characteristics are very risky to balance the model validation.

Table 4: List of selective modeling approaches in government and politics research

S.L	Name Model	Suitability of Application	Sources/References
1	Delegate Model	Convey the views of others	Clarke et al. (2007)
2	Model of policymaking	Develop to describe policy	Kolkman et al. (2016)
3	Causal thinking Model	Examining empirical relationships	Clarke et al. (2007)
4	Pluralism of Model	Description and modeling task	Beck (2000)
5	REMM Model	Resourceful, Evaluating, Maximizing	Allen (2021)
6	Advisory Model	Multi-theoretical perspective	Cumber and Githens (2014)
7	Cooperative Model	Social program is the business	Xue et al. (2020)
8	Policy Board Model	Organizational effectiveness	Carver (2000)
9	The Anglo-US model	Corporate governance and capitalism	Mullineux (2010)
10	The German model	Traditional corporate governance	Mullineux (2010)
11	The Japanese model	Japan Revitalization Strategy	Passador (2016)

S.L	Name Model	Suitability of Application	Sources/References
12	Carver Board Model	Good personnel policies	Carver (2000)
13	Cortex Board Model	Operating a business/organization	Kolkman et al. (2016)
14	Consensus Board Model	Unambiguous leadership	Carver (2000)
15	Competency Board Model	Improve overall performance	Carver (2000)
16	Rational Policy Model	Model of decision making	Uzonwanne (2016)
17	The Traditional Model	Team members has leadership role	Amy et al. (2003)
18	The Team Spirit Model	Sharing of authority responsibility	Clarke et al. (2007)
19	The Cutting Edge Model	Group who manage themselves	Amy et al. (2003)
20	The Task Force Model	Group for specific time	Kolkman et al. (2016)

Application of Modeling Approaches in Anthropology Research

Anthropological models aim to solve the same fundamental problem about the relationships existing between reality, representation and imaginary (Whyte, 2002; Mahmud, 2008; Diah et al., 2014). So the anthropologist can also construct a sensory model of a society on the basis of the cultural body, as the senses are present in whatever aspect of knowledge (Table-5). The models that guide us through our everyday concerns may be termed folk models (Lave and March, 1975; Gatewood, 2012).

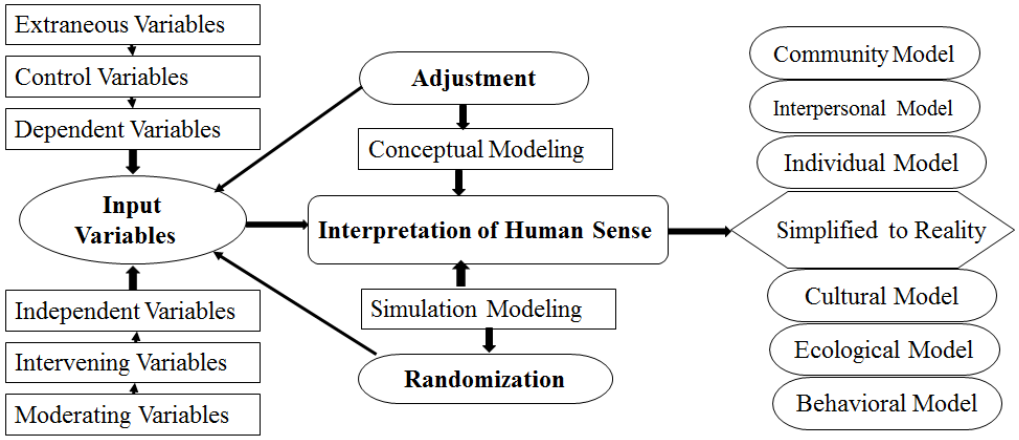


Figure 4: Schematic diagram of the major input variables, interpretation of human sense processing with adjustment and randomization condition for conceptual and simulation model for anthropological research.

In this study, 20 models have been selected from in different disciplines of anthropology which are related to human-environmental interaction. Although these models are not made in the context of Bangladesh, but anthropologists in Bangladesh will be able to create new models by following these models (Table -5).

Table 5: List of selective modeling approaches in anthropology research

S.L	Name Model	Themes and Concepts	Sources/References
1	Agent-based Model	Behavioral dynamics	Bonabeau (2002)
2	Cultural Model	Concerning the of psychology	Gatewood (2012)
3	Collaborative Model	Community collaboration	Lobban (2008)
4	Moral Model	Allocate reward and punishment	Andrade (1995)
5	Explanatory Model	Cross-cultural comparisons	Bollig and Finke (2014)
6	Charles Darwin Model	Process of gradual development	Freeman et al. (1974)
7	Anti-positivist Model	Individuality and diversity	Mahmud (2008)
8	Sapir-Whorf Model	Common frame of reference	Bilaniuk (2008)
9	Sociolinguistics Model	Language within cultural context	Miller (2011)
10	PCMH Model	Emphasize patient-centered	Diah et al. (2014)
11	Optimal Foraging Model	Predictor of foraging patterns	Hill et al. (1987)
12	Information Flow Model	Traditional anthropological problem	Zachary (1977)
13	EMIC Model	Clarifies the experience of illness	Weiss (1997)
14	Cybernetic Model	Interaction of human-environment	Viličić et al. (2007)
15	E-R Case Studies Model	The mapping constraints	Weiss (1997)
16	Mutual Exploitation Model	Behavior of the study informants	Zachary (1977)
17	Chinese Kinship Model	Aware of historical issues	Watson (1982)
18	Evaluative Model	Boundaries are quite arbitrary	Lobban (2008)
19	Knowledge-based Model	Understanding the world	Whyte (2002)
20	Dance Therapy Model	Aspect of human experience	Panagiotopoulou (2011)

Application of Modeling Approaches in Public Administration Research

This study examine that the several branches of public administration research are quite suitable for building a conceptual or mathematical model. The traditional theories of public administration like classical theory, management theory and postmodern theory are the strong scope for developing and applying the modeling approaches (Fox and Miller, 1995; Brian, 2003; Anyebe, 2017; Lampropoulou et al., 2018). Though some complexities could be raised to build a model using these three different perspectives of public administration theories. Developing a model for public administration research, it is important to learn about the below input parameters, its characteristics and their interrelationships (Stephen (2007; Tkach et al., 2019) (Table-6). Such as:

- Strengthening the functions of the government
- Authority fixation and ensuring flexibility
- Confirming performance, regulator and accountability
- Improvement the management of human resources
- Improving competition and optimal variables
- Enlightening the value of regulations
- Ensuring responsive services

Table 6: List of selective modeling approaches in public administration research

S.L	Name Model	Suitability of Application	Sources/References
1	Theoretical Model	Constructs and presents a framework	Lampropoulou et al. (2018)
2	Comparison Model	Common practice to estimate	Milne (1962)
3	Closed and Open Model	Study complex organizations	Brian (2003)
4	Institutional Model	Economic paradigm development	Tkach et al. (2019)
5	Elite-Mass Model	Policy output analysis,	Anyebe (2017)
6	Group Model	Group system dynamics.	Bérard (2010)
7	Systems Model	Introduce to the real systems	Hick et al. (2019)
8	Classical Theory-Model	Classical analysis of a concept	Woodrow Wilson (1887)
9	Public Management Model	To improve the efficiency	Stephen (2007)
10	Postmodern Theory-Model	The role of ideology of an issue	Fox and Miller (1995)
11	Entrepreneurial Model	Creation of a new business	Tkach et al. (2019)
12	Public Governance Model	Replace bureaucratic mechanisms	Anyebe (2017)
13	Structural Equation Model	Quality of policy formulation	Rathachatranon (2018)
14	East Asian Model	The separation of administration	Nakamura (2021)
15	Spatial Econometric Model	Spatial econometric methods	Hansen (2005)
16	Organic Model	Varieties of the mechanistic	Milne (1962)
17	Consensus-Building Model	Policy and Administrative Discretion	Hick et al. (2019)
18	Bureaucracy-Driven Model	Higher levels of cooperation	Vigoda-Gadot (2004)
19	Citizen-Driven Model	Citizen levels cooperation	Vigoda-Gadot (2004)
20	Political Accountability Model	The nature of government	Simms (1999)

Application of Modeling Approaches in Sociology and Social Welfare Research

The scientific evidences have shown that the most of sociologists are interested to study on social procedures, communications, shapes and forms etc. The sociology related academician and researchers have always tried to analyses societal problems, their sources and underlying causes. During this study it is observed that the most of the sociological theories pursue to elucidate social problems and their traditional solutions methods (Allan, 2006; Col, 2017). Of course these theories could be the main sources to build social models for predicting the future scenarios of sociology and social welfare (Allan, 2006).

Table 7: List of selective modeling approaches in sociology and social welfare research

S.L	Name Model	Suitability of Application	Sources/References
1	European Social Model	Promoting social protection	Albert & Neil (2010)
2	Cognitive Behavioral Model	Behavioral factors	Davis (2001)
3	Anglo-Saxon Model	Free-market economy	Boeri (2002)
4	Mediterranean Model	Distinct approaches to capitalism	Albert & Neil (2010)
5	Continental Model	Small financial markets	Christian et al., (2009)
6	Nordic Model	Combines features of capitalism	Albert and Neil (2010)
7	Problem-Solving Model	Generate possible solutions	Firend (2014)
8	Crisis Intervention Model	Emphasizing rapid assessment	Roberts & Ottens (2005)
9	Solution-Focused Therapy Model	Goal-oriented therapy	Ivesonn (2002)
10	Rational Choice Model	Optimization-based approach	Levin & Milgrom (2004)
11	Social Learning Model	Learning social media	Lowry et al. (2016)
12	Social Systems Model	traditional social structures	Brown & Stillman (2017)
13	Psychosocial Development Model	Cultural implication of development	Abbass et al. (2013)
14	Psychodynamic Model	Dynamics of behavior of a person	Abbass et al. (2013)
15	Social Exchange Model	Involves social exchanges	Cook et al. (2013)
16	Panel Model	Estimating causal parameters	Halaby (2004)
17	Black-Box Model	Network parameters affect	Davidson (2019)
18	Age-Period-Cohort Model	Measurements dependent quantity	Fienberg & Mason (1979)
19	Revolt Model	Sociological Systems Analysis	Chikafu (1993)
20	Nonrecursive Model	Simultaneous equation mode	Waite & Stolzenberg (1976)

Ivesonn, 2002 revealed in his study, in sociology, *"a few theories provide broad perspectives that help explain many different aspects of social life, and these are called model and paradigms".* Brown and Stillman, 2017 also stated that *"these model and paradigms are philosophical and theoretical frameworks used within the discipline to formulate theories, generalizations, and the experiments performed in support of them".* Table-07 shows the list of selective modeling approaches in sociology and social welfare research. Developing a sociology and social welfare related model it is important to learn the following phenomenon (Zongozzi et al, 2016). Such as:

- Select the suitable purpose and goals
- Identify and screening the concepts
- Regulate the social characteristics
- Finalize the model case and boundary condition
- Classify conflicting, designed, and prohibited cases
- Visualize the experiences and significances
- Communicate with realistic reference

Challenges of Model Building Constraints in the Social Science Research

The application of modeling techniques in the field of social sciences research greatly enhances the quality of research, no doubt (Waite & Stolzenberg, 1976; Fienberg and Mason, 1979). But the different disciplines of social sciences have some different thoughts, philosophy, wisdom and phenomena are arranged in different ways that's why so many challenges have to be faced while creating models in social science research. The main difficulties to develop a model for social science research no systematic theoretical approaches were not well defined (Waite and Stolzenberg, 1976; Fienberg & Mason, 1979; Halaby, 2004; Abbass et al. 2013; Retter, 2020).

To build a model, the main challenges of social sciences research are the various social systems components, different opinions and variations of behavioral approaches (Alsadey et al., 2021). As examples, i) challenges sampling from large samples, ii) lack of education and knowledge in the subject matters; iii) lacking of suitable theoretical frameworks, iv) lack of skilled manpower for preparing conceptual framework, v) Lack of statistical, mathematical and computer based programing skills (Omran, A, 2021; Alsadey et al., 2021). Executing a model applying in socials science is always complex job, experiencing thorough scheme and provisions, continuous responsibility, and robust governances are the key factors (Balanchine, 2018).

Challenges of parameters selection for model building

Any kind of modeling the most difficult steps of selecting the input parameters. It is important to understand that the input parameters dictate the models all the time. If the model input parameters are well-organized model could be the well-defined and more efficient and valid. But choosing the model input parameters are quite complex especially social sciences oriented research. The several challenges of parameters selection for model building in social sciences research are as below:

i) Complex human behavior and attitudes

ii) Multivariate culture, philosophy and wisdom

iii) Difficult to understand the interaction of societal impact the selected variables

iv) It is very difficult to separate the impact of hydrology, ecology, morphology, sociology, and anthropogenic impacts

v) Especially, selection of model parameters building a mathematical is more complex than the developing a conceptual or theoretical model

Challenges of systems domain to model process boundary

The system boundary is a conceptual line or domain. It divides the system many forms as example square, rectangle, leaner, non-leaner and smooth etc. The boundary conditions are the system's environment as being made up of those things that are not part of the model system, but can either affect the modeling process system or be affected the model parameters and output by it. Though a boundary condition is a discretionary graphic relief in the diagram; it does not add semantic value to the model theoretical or conceptual model. But it is mandatory to prepare boundary condition for mathematical or regional climate models ((Semtner, 1995; Rummukainen, 2010; Ganju, 2016; Parna et al., 2018; Pasquale et al., 2021). For example, if a researcher wants to make a numerical simulation model or computer based program model with a lake, river, estuaries, coast, sea or ocean pollution, he has to must give a boundary condition or system boundary. But building this boundary condition or systems boundary has become very challenging for researchers in many departments of social sciences.

Challenges of calibration and validation of the model

Model calibration is the procedure of modification of the model parameters by tuning or iteration and imposing within the boundary condition in the particular models. Also, resolving the errors and the uncertainties in model parameters it is necessary to calibrate model repeatedly (Semtner, 1995; Rummukainen, 2010; Ganju, 2016; Parna et al., 2018; Pasquale et al., 2021). Measurement uncertainty is reduced by ensuring accuracy in the model through calibration. Model calibration is performed until the measurement process is controlled by eliminating errors or measuring uncertainties at an acceptable level.

Validation is the process of verifying the accuracy of a model. The scenarios, results or cases obtained by the model are solved by comparing them with the actual system and its behaviors (Parna et al., 2018; Pasquale et al., 2021). It is very difficult to do model calibration and validation by proving statistically significant with qualitative data without creating mathematical model or computer programming based modeling in different branches of social science.

Conclusion

In developing countries including Bangladesh, it is very important to carry out fundamental and applied research in different departments of social sciences. Because social science research provides trustworthy evidence to the publics that are systematically recognized so that end users can rely upon it. But in the current scientific evidences show that many the researchers are highly encouraged to use models when they can assist in identifying significant variables in such a way that tests of hypotheses can be defined more sharply in their innovative social sciences research. However, in Bangladesh, various higher education institutions, public and private research

organizations use conventional qualitative and quantitative methods in social science research, but the number of researches using modeling techniques is insufficient.

And with this in mind, the current comprehensive review paper includes an introduction to 145 models published in various social science disciplines from 1960-2021. Researchers from different disciplines of social sciences in other countries of the world including Bangladesh will be able to get acquainted with 145 models through this article. They will also be able to learn more about the use and application of models using the Google search engine. In this way, researchers of different disciplines of social sciences may be interested in applying their research models and creating new models.

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Socio-economic and Political Status of Rural Leaders: Case Study of Sanora Union in Bangladesh

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Abstract: Understanding the socio-economic and political status of the formal and informal leaders of the Union makes it easier to understand their role in the activities of the Union. The socio-economic and political status of the formal and informal leaders of the Union is discussed in this study. As Bangladesh is a major agricultural country in the thirld world, it has had an impact on the socio-economic and political status of rural leaders. In this study, data has been collected by asking the question directly from the selected leaders for the research. In addition to asking a direct question, the observation method has been used in the study. Ownership of agricultural land decreased among the leaders of Sanora Union in 2017 as compared to 1990. Business has increased among rural leaders. In 1990, 26% of rural leaders were involved in business. But in 2017, 32% of rural leaders were involved in business. In 1990, 60% of rural leaders were involved in agriculture. But in 2017, 36% of rural leaders were involved in agricultural sector. In 1990, the annual income of 38% of the leaders was 0-60,000 taka(BDT). But in 2017, the annual income of 50% of the leaders ranged from1,20,001-2,40,000 taka(BDT). In 2017, the presence of more young leaders was noticed in Sanora Union. In 1990, 34% of leaders were between the ages of 41 and 50. But in 2017, 42% of leaders were between the ages of 31 and 40. In 1990, 52% of the leaders were educated from class five to class ten. But in 2017, 54% of leaders were educated from S.S.C.(Secondary school certificate) to H.S.C.(Higher secondary certificate). In 2017, 58% of Sanora Union leaders were involved in the politics of Bangladesh awami league. But 40% of Sanora Union leaders were involved in the politics of Bangladesh Nationalist Party(B.N.P.). In 1990, there were more leaders of high lineage but in 2017, there were more leaders of the middle lineage.

Keywords: Rural Leader, Socio-economic and Political Status, Union, Agricultural Land, Lineage, Sharecropping, Mortgage, Kinship,

Introduction

Nowadays, it has become an important issue to discuss the socio-economic and political status of rural leaders for us. At present, modern leadership has emerged in the rural society instead of the traditional leadership. Rural leaders' gender, age, education, profession, ownership of the land, income, culture, political party affiliation etc. will be included in this study of socio-economic and political status.The present study deals with socio-economic and political status of rural leaders. Because, it has an impact on their functions as a whole. Moreover, in order to know what kind of people are dominating in rural politics and representing the people in the Union Parishad, what attitude they have, how they are distinguised from the rest of the society,we need to know their social background. It is also known what kind of relationship they have with the rural people.

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In fact, the leadership of these Union Parishads is expected to play a vital role in the successful implementation of the development programmes aimed at ensuring "equity" and "social justice" (Statistical year book of Bangladesh,1981). It is essential to have a well-thought-out view of their emergence and influence in rural politics, as well as to find out the reasons for their role and what is at the root of the small community's influence over the larger population. We must see whether the people in the society are loyal to them or the people are compelled to obey them, how they look at the people, whether they are working for the welfare of the people or using the people for their own welfare.Their socio-economic status may have some relations with their performance in the rural local councils(Dube,1965,Pp.23-35). The leading community members the elites – have combined in themselves some notable attributes : numerical dominance, economic solvency, dominant political position, high influence and high level of participation in the decision making process. These issues have been given priority in this discussion.

Theoretical Framework

In South Asian Studies, we look at the type of analytical bifurcation of several traditional and customaryleadership. Alan Beals saw two types of leadership in (India) Namhali village by survey of Mahishur.[1]One of his creations originated from the government system and the other originated from the rural tradition-based social organization.On the other hand, Epstein noticed that there is a traditional type of leadership in the village where economic development has decreased and in the village where irrigation system has helped in significant economic development,there are signs of fundamental political change. According to him, the panchayat members no longer need to become an elderly person of the group-rather the acquired leadership has occupied the place. On the contrary, there was no change in traditional politics of traditionally dependent villages. There the village panchayet is still formed with the elders of the clan and now Panchayet[2] resolves the problems of villagers. Epstein analyzes the study, how old and new values are in the process of social change. It also explains what has happened in the political and ritual ceremonial roles and what has changed in the principles of social organization. Thus, with a political and organizational change, Epstein established a positive correlation of economic change. He saw the economy as a determining driver in that case.

Lewis mentioned that-

.....in the traditional pattern of leadership, the older men were both ceremonial and panchayat leaders. With the coming of education and outside employment however, middle aged educated people are being given opportunities by the older people to represent them official panchayats, school committees and deputations outside the village (Lewis, 1958: P. 130).

R. M. Stogdill thinks about leadership, Leadership may be considered as the process (act) of influencing the activities of an organized group in its efforts toward goal setting and goal achievement (Stogdill, 1974: P.144).

[1]Namhali, Mahishur (area of India)

[2]panchayet (Indian local government system)

Many theorists and researchers expressed their views as a strong and strong relationship between leaders and followers.In this case,James M. Kouzesand Barry Z. Posner expressed strong opinion.They said- "Leadership is a relationship between leader and followers. A Complete picture of leadership can be developed only if we ask followers what they look for or admire in a leader (Kouzes and Posner, 1990: P. 25).

In the book of Public leadership (Bell, Hill and Wright, 1960: Pp. 1-27),the concept that has been found in the leadership class category is-

1. Positional or formal Leadership
2. Reputational or Nominal Leadership
3. Social Participation
4. Personal Influence or Opinion Leadership
5. Event Analysis or Decision making

Ahmed attempted to study the power structure in contemporary rural Bangladesh and thus he conducted a field work in a village named Bizna (pseudonym) of Comilla district in eastern Bangladesh. His study was devoted to provide some understanding of the changing pattern of power hierarchy in the context of social change in Bangladesh. He indicated a change in the power structure of the village which is that outcome of modern education by the villagers. Education began to be more powerful than the land-based power hierarchy in the village.Moreover, a good number of the educated young men went out to various places and, on their return they developed a spirit of defiance to the village elders. In this way the change in the power structure began to take shape (Ahmed, 1983). In the light of this study, modern and educated leadership can be explained.

Karim made a study on the leadership pattern in two Bangladeshi villages named Dhononjoyapara and Gopalhati located in the northern part of the country (Rajshahi District). His study directed a change in the institutions through which leaders can exert power due to government funded programs and projects run by the Union Parishad, gram sarkar, farmer's cooperatives and Rural social Service (RSS). He observed that although there appeared a change in the leadership pattern, the basic structure of leadership remains unchanged. His study revealed that two or more gosthis(lineages) in a neighborhood formed a samaj(an informal village social organization and a traditional power domain). The leadership in the samaj was held by the persons who came from demographically stronger gosthi and the persons who represented strong landowning gosthis. The real political power of the pardhan(chief samaj leader) and paramanik (one of the samaj leaders) was exercised in setting disputes between members of the samaj through traditional and informal village courts bicher and salish(Karim, 1987). In the light of this study, young and educated leadership can be explained.

Rahman studied 60 unions of several districts in Bangladesh to identify the class character and to stress the bachground of Union Parishad (UP) leaders. He interviewed about 132 UP leaders during the early part of 1978 to show clearly the linkages that existed between the local level leaders and the central leaders who were in control of the state machinery. He considered the UP leaders as 'the landing ground "or national leadership via the bureaucrats'. In stressing the characteristics of the UP leaders, Rahman claimed that they were more close to the characteristics of so-called 'feudal leaders'. He

showed that "the class that drives all its power from land-ownership and concomitantly grabs other surplus siphoned off unproductive activities"(Rahman, 1981). In the light of this study, dominant political position of rural leaders (Inclusion in the political party) can be explained.

Jahangir identified a "process of class differentiation, stimulated by new opportunities for the accumulation of capital, results in a process of polarization" (Jahangir,1979). In the light of this study, the practice of share cropping and mortgage can be explained.

Geoffry Wood studied the political process and rural power structure in comilla village. It showed that "the description of class formation and the emergence of dominant power groups correlated these processes with the indebtedness which abounded as the small peasant's land was gradually expropriated and so he was transformed into a sharecropper or a dependent laborer"(Wood, 1976)). In the light of this study, mortgage practices can be explained.

The centralization of power in the leadership structure is evident. People having no leadership wield little or no power. So there is a correlation between leadership and power. As a matter of fact the elite and the ordinary masses are not homogenous in most cases in regard to socio-economic attributes. The leaders are distinguishable from ordinary villagers by numerical dominance, economic solvency, dominant political position, high influence and high level of participation in the decision making process.

Definition of the Main Concept

Socioeconomic status is an economic and sociological combined total measure of a person's work experience and of an individual's or family's economic and social position in relation to others.

Political status is the level of political value a person is considered to hold.

Variability

The transition from existing condition to other condition is called variability.

Rural Leadership

Rural Leadership means to influence and encourage rural people to work together in a common action effort to achieve any objective.

According to Ordway Tead,"Leadership is the activity of influencing people to co-operate towards some common goal which they come to find desirable" (Tead, 1935: P. 20).

According to Pigors,"Leadersip is a process of mutual stimulation which by the successful interplay of relevant individual differences, controls human energy in the pursuit of a common cause" (Sing, 1968: P. 12).

Leadership of the aforementioned leadership definition is meant only to those rural leaders who can lead the rural people to a universal purpose and can influence the rural people for determining the destination and conducting activities like reaching the destination.

Sampling

In this study, simple random sampling method (random number table) has been used to determine the sample. Data has been collected from 100 leaders out of 300 leaders of Union randomly. This can be considered as the shape of the sample.As a research area, the Sanora union of Dhamrai upazila in Dhaka district has been selected.[3]

Data Collection Method

In this study, the question paper system was originally used. Data has been collected by asking the question directly from the selected leaders for the research. From the structural point of view, these question papers are open-ended. The questionnaire has been verified before making the final questionnaire. In addition to asking a direct question, the observation method has been used in the study.

Socio-economic and Political Status of Rural Leaders

Types of Ownership of Agricultural Land of Sanora Union leaders

The main occupation of the leaders of Sanora Union is agriculture and business and the main element of agriculture island.Therefore, determining the amount of the land of the elites is an important issue.It is commonly seen in rural areas that most of the property is owned by a few individuals and most people have very little property. Therefore, by questioning them about this, based on the results obtained from the field level, the ownership of agricultural land of rural elites has been analyzed through table. Here is a comparative studyof50elitesin 1990 and 50 elites in 2017.

Table 1: A Comparative Figure of the Type of Agricultural Land Ownership of the Sanora Union Leaders (2017 and 1990).

Agricaltural Land (acre)	Year 2017		Year 1990	
	Number	Percentage	Number	Percentage
0-1acre	5	10%	3	6%
1-2acres	6	12%	5	10%
2-3 acres	19	38%	5	10%
3-4 acres	16	32%	11	22%
4-5 acres	2	4%	12	24%
5-6acres	1	2%	10	20%
6 acres and above	1	2%	4	8%
Total	50	100%	50	100%

Source: Obtained from Field Level Data.

[3] Sanora union of Dhamraiupazila in Dhaka district (Union, Upazila- local government system of Bangladesh.)

Table-1 shows that in 2017, 10%, 12%, 38% and 32% of the leaders in Sanora Union had agricultural land from 0-1 acre, 1-2 acres, 2-3 acres and 3-4 acres respectively, but in 1990, 22%, 24% and 20% of the leaders in the Sonora union had agricultural land from 3-4 acres, 4-5 acres and 5-6 acres respectively.The table above indicates that the land of the Sonora Union leaders in 1990 was more than in 2017. So, agricultural land has been divided. In 1990, 3-6 acres and more of the Agricultural land were noticed among a large numbers of leaders.But in 2017, a greater number of leaders had agricultural land ranging from 0-4 acres. Although the dominance of landlords was observed among the leaders of Sanora Union in1990, the dominance of landlords in rural politics was rarely noticed in 2017. Ownership of above four acres of land is a determining factor in holding chairmanships in the Union Parishads (Hitchcock,1959:Pp.395-414). The results of the field level study show that the status of the leaders in the union is high- middle class and middle class because some people have more agricultural land than the leaders and most people have less agricultural land. Some people do not aspire to be leaders despite having the most agricultural land in the union or cannot take the lead due to lack of popularity. As an indicator of socio-economic status, agricultural land plays a role in influencing the leaders of rural Bangladesh. Therefore, in order to analyze the leadership trend, it is necessary to know the socio-economic status of the leaders. There is a difference between the socio-economic status of 1990 and 2017. Because, rural leaders more or less secure their position on agricultural land. This implies that agricultural land is gradually declining per household among the leaders. Ownership of agricultural land among leaders is declining due to expansion of non-agricultural economy and migration to cities. In Bangladesh Situation ‘resources are absorbed and distributed by the same set of institutional forces that control land’(Stepanek,1979: p.100).

Types of the Main Occupations of the Leaders(Formal and Informal) of Sanora Union

There is considerable importance in analyzing the professions of leaders in elite research. For example, profession is a criterion in determining social status. So, the professionalism of the elites needs to be judged. Secondly, it is easy to know a person's character through profession. For example, teachers farmers, doctors and businessmen have different roles due to different professions. So, on the basis of the results obtained from the field leve by asking them about this, the professions of the elites of Sonora Union has been analyzed through the following table . Here is a comparative study of 50 elites in 1990 and 50 elites in 2017.

Table 2: A Comparative Figure of Types of Main Occupations of Sonora Union Leaders (2017 and 1990).

Profession	Year 2017		Year 1990	
	Number	Percentage	Number	Percentage
Agriculture	18	36%	30	60%
Business	16	32%	13	26%
Part time job	10	20%	5	10%
Contracting	2	4%	0	0%

Housewife	4	8%	2	4%
Others	0	0%	0	0%
Total	50	100%	50	100%

Source: Obtained from Field Level Data.

Table-2 shows that, In 1990, 60%, 26% and 10% of the leaders were involved in agriculture, business and part time job, respectively. But in 2017, 36%, 32%, and 20% of the leaders were in agriculture, business and part time job respectively. The presence of Sonora union leaders in business and part time jobs in 20107 was higher than in 1990. That clearly indicates the expansion of the non-agricultural economy. At the same time, the change of profession indicates the change of nature of the rural leaders. Meanwhile, due to the impact of globalization on rural political and economic environment and the fragmentation of land due to population growth, agricultural land is no longer able to meet the needs of the leaders in Sonora union, So, the leaders have been seen leaning towards this modern profession and the income in this modern profession is much higher. The non-agricultural economy is expanding in 2017 compared to 1990. In 1990, 60 percent of the leaders were in agriculture but in 2017,36 percent of the leaders are in agriculture. 32 percent and 26 percent of the leaders were associated with the business in 2017 and 1990 respectively. In 2017, part- time jobs increased by more than 10 percent. Thus the poor villagers are bound by a sense of gratitude to vote in favour of their patrons, no matter what personal complaints they might have against them(Gerth and Mills,1970,p.180).Those whohave controlover resources in rural areas have an impact on other people. This influence is the key to controlling political power. There are two features of social inequality: distributive and relational (Beteille,1972).

Annual Income of the Leaders of Sanora Union

Discussions on the occupations of the elites of Sonora Union have shown that the main occupations of the elites are agriculture, 'agricultural and business', part-time jobs and other. And the characteristic of rural elites is that they are people with higher income than the general population. Therefore, it is necessary to discuss the type of annual income of elites. The income of the people of the Union is not very satisfactory. And the elites are different from this situaion. So, based on the results obtained from the field level by questioning them, the annual income ofthe elites ofSanora union has been analyzed through the table below. Here is a comparative studiy of 50 elites in 1990 and 50 elite in 2017.

Table-3: A Comparative Figureof the Annual Income (2017 and 1990) of the Leaders of Sanora Union.

Annual Income (Taka -BDT)	Year 2017		Year 1990	
	Number	Percentage	Number	Percentage
0 - 60,000	3	6%	19	38%
60,001 - 1,20,000	12	24%	18	36%
1,20,001 - 2,40,000	25	50%	11	22%
2,40,001 - 4,80,000	10	20%	2	4%
4,80,000 Taka and Above	0	0%	0	0%
Total	50	100%	50	100%

Source: Obtained from Field Level Data.

Table-3 shows that in 2017, 24%, 50% and 20% of the leaders earned an annual income of BDT[4] 60001-120000, 120001-240000 and 240001-480000 respectively. In 2017, half of the leaders earned an annual income of BDT 1,20,001-2,40,000. But in 1990, 74 percent of the leaders earned an annual income of BDT 0-120,000. In 2017, the income of the leaders has increased almost several times as compared to 1990.In terms of income, the leaders of the union are upper class and middle class. Landholders and large farmers control the rural economy through their surplus land and supply of credits(Sobhan,1968:Pp.83-86).

Age of the Leaders of the Sanora Union

Discussion of age is particularly necessary for elite study. Because if an organization is run by an older person, that organization is not able to meet the expectations of the younger generation. And if the leadership of an organization comes from the youth, then that leadership is revolutionary and risky. That is why, it is difficult for them to gain the trust of the vast population. That is why, middle-aged people are more influential in developing countries. But in a transformative and developing society like Bangladesh, especially in Sanora union, my research area, most of the rural elites are young. Therefore, the age of the elites of Sonora union has been analyzed through the following table based on the results obtained from the field level by asking them about this. Here is a comparative study between 50 elites in 1990 and 50 elites in 2017.

[4] BDT- Taka(Bangladesh)

Table-4:A Comparative Figure oftheAge of the Leaders of the Sanora Union (2017 and 1990)

Age(Year)	Year 2017		Year 1990	
	Number	Percentage	Number	Percentage
0-30	1	2%	0	0%
31-40	21	42%	12	24%
41-50	18	36%	17	34%
51-60	7	14%	13	26%
61 years and above	3	6%	8	16%
Total	50	100%	50	100%

Source: Obtained from Field Level Data.

Table-4 shows that in 1990,24%, 34% and26% of leaders ranged in age from 31 to 40,41 to 50 and 51 to 60 years respectively. But in 2017, 42%, 36%, and 14% of the leaders ranged in age fron 31 to 40, 41 to 50 and 51 to 60 years respectively. In 2017, I saw a greater presence of leaders aged 31 to 40 years. But in 1990, there were more leaders over the age of forty. The number of relatively young leaders in Sonora union in 2017 is higher than in 1990. Modern, agile and young leaders have emerged in place of the conservative experience. It is consistent with the real situation.Because if an organization is run by older people, that organization is not able to meet the expectations of young people.

Education of the Leaders of Sanora Union

Education plays an important role in advancing to the elite level. Therefore, in order to do research on rural elites, it is first necessary to know the education status of the elites. Therefore, the analysis of the leadership style of the Sonora Union was started in the context of education. Therefore, by asking them about this, based on the results obtained from the field level, the education of the leaders of Sanora Union has been analyzed through the following table. Here is a comparative study between 50 leaders in 1990 and 50 leaders in 2017.

Table 5: A Comparative Figure of the Education of the Leaders of Sanora Union (2017 and 1990)

Level of Education	Year 2010		Year 1990	
	Number	Percentage	Number	Percentage
Illiterate	0	0%	2	4%
From being able to sign to class four	3	6%	12	24%
Class five to ten	14	28%	26	52%
SSC and HSC(passed)	27	54%	10	20%
Graduate and above	6	12%	0	0%
Total	50	100%	50	100%

Source: Obtained from Field Level Data.

Table-5 shows that in 1990, 4%, 24% and 52% leaders were illiterate, from being able to sign to class four and from class five to class ten respectively, but in 2017, 6%, 28% and 54% of the leaders were from being able to sign to class four, from class five to class ten and from SSC to HSC respectively.[5]Compared to 1990, formal education has increased among the leaders of Sanora union in 2017. In 1990, more than half of the leaders were from class five to ten. But in2017, 54% and 12% of the leaders passed 'S.S.C. and H.S.C.' and degree respectively. It is currently in line with the education of people of Sonora Union. Rural people are gradually being educated in formal education.They do not want to accept the old leadership, especially young people. Although a large section of the traditional leaders of the village think that this situation is causing the decline of the village. The leadership in the rural local councils seems to be by and large better educated in comparison to the national average figure of literacy which is about 26 percent(World Bank,1983:Pp.148-49).

The Shape of the Family

The shape of the family plays an influential role in becoming a rural leader. It used to be much more influential but now it is less important. Now the family of rural leaders is not as big as before. Now, the main topic of discussion is the relationship of the family shape with the rural leadership. Therefore, based on the results obtained from the field level by asking them about this, the family shape of the leaders of sanora union has been analyzed through the following table . Here is a comparative study between 50 leaders in 1990 and 50 leaders in 2017**.**

Table-6: A Comparative Figure of the Families of the Leaders of Sanora Union (2017 and 1990)

Number of Members	Year 2017		Year 1990	
	Number	Percentage	Number	Percentage
0 -5	21	42%	1	2%
6 - 10	25	50%	21	42%
11- 15	3	6%	24	48%
16 - 20	1	2%	4	8%
Total	50	100%	50	100%

Source: Obtained from Field Level Data.

Table-6shows that the family size of rural leaders in 2017 is smaller than in 1990, that is, the number of members is less. In 1990, 42% and 48% of the leaders had families of 6 to 10 and 11 to 15 members, respectively. But in 2017, the families of 42 percent and 50 percent of the leaders were0 to 5 and 6 to 10 members respectively. Large size families provide opportunities to develop leadership qualities and leisure time to their members to devote themselves in political activities(Rahman,1979:Pp87-116).

[5] The formal education system of Bangladesh(level of education)

Gender- based Position of Sanora Union Leaders

As the democratic environment does not yet exist in the village, the influence of male-dominated leadership can be seen. Women leaders still have to fight for their rights. Women leaders in rural areas have not yet realized their rights. So the women leadership in the union parishad is not seen to be able to work from their position. This study compares gender-based leadership. So, based on the results obtained from the field level by asking them about this, the gender-based position of the leaders of sanora union has been analyzed through the table below. Here is a comparative study between 50 leaders in 1990 and 50 leaders in 2017.

Table 7: Gender-based Comparative figure of Sanora Union Leaders (2017 and 1990)

Gender	Year 2017		Year 1990	
	Number	Percentage	Number	Percentage
Male	40	80%	48	96%
Female	10	20%	2	4%
Total	50	100%	50	100%

Source: Obtained from Field Level Data.

Table-7 shows that in 1990, 96 percent and 4 percent of the leaders were men and women respectively. But in 2017, 80 percent and 20 percent of the leaders were men and women, respectively. Rural leaders are predominantly patriarchal. In 2017, only a few women leaders are seen in the union, except for the reserved women seats in the Union Parishad. At present, only 20 percent of the the leaders are women,This is why, the role of judges in rural arbitration of women union leaders has not been seen in my research area. The same situation is seen in all the unions of Bangladesh. The leadership in our village is practically male-dominated. Though the females play the role of a leader at the household level(Barman,1988: p.139).

The Status of Leaders on the Basis of Heredity and Kinship

Although hereditary leadership was predominant in the 1990s, it is important to analyze how much it has declined in 2017.The role of hereditary heritage in rural society is now a matter of research in order to become a rural leader. Therefore, based of the results obtained from the field level by questioning the extent to which hereditary influence currently exists in the rural leadership has been studied through table. Here is a Comparative study between 50 leaders in 1990 and 50 leaders in 2017.

Table 8: Comparative Figure of Sanora Union Formal and Informal Leaders Based on Heredity and Kinship (2017 and 1990)

Inclusion	Year 2017		Year 1990	
	Number	Percentage	Number	Percentage
Included	26	52%	38	76%
Not included	24	48%	12	24%
Total	50	100%	50	100%

Source: Obtained from Field Level Data.

Table- 8 shows that in 1990, 76% leaders were based on kinship and clan.But in 2017,52%. leaders were based on kinship and clan. There are more leadership qualities acquired among leaders in 2017 than in 1990. The way in which the state is bound up with the relations of production constitutes its primary relation with social classes and the class struggle (Poulantzas, 1978:P.25).

Share cropping, Mortgage and Fixed Rent Related Rural Leaders' Agricultural Land

Agricultural land plays an important role in becoming a rural leader. Although the importance of land has diminished since the 1990s, it deserves an analysis of how closely it relates to leadership today. So, land is one of the top priorities in analyzing the socio-economic status of rural leadership. It is also a study of how much the leaders use the rural people for their own benefit through all these activities. For example, share cropping system, mortgage system and fixed rent. Therefore, based on the results obtained from the field level by questioning them, these activities of the leaders of Sanora union have been analyzed through the table below. Here is a comparative study between 50 leaders in 1990 and 50 leaders in 2017.

Table 9: Comparative Figure of Sharecropping System, Mortgage System and Fixed Rent of Agricultural Land of Sanora Union leaders(2017 and 1990).

Year	Mortgage System	Percentage	Sharecropping System	Percentage	Fixed- rent	Percentage
2017	9	18%	21	42%	20	40%
1990	14	28%	25	50%	11	22%

Source: Obtained from Field Level Data.

Table-9 shows that in 1990, the mortgage system, sharecropping system and fixed rent on agricultural land were 28%, 50% and 22% respectively. But in 2017, the mortgage system, sharecropping system and fixed rent on agricultural land were 18%, 42% and 40% respectively. The current fixed rent in agricultural land is 40%. This indicates a gradual increase in the fixed rent system in agricultural land. Fixed rent system has increased on agricultural land in 2017 compared to 1990. The sharecropping system is the same as before. Even though the sharecropping system is similar, now the rural leaders can have less impact on the poor farmers through the sharecropping system. In

opposition to the paternalistic value judgement, a different value judgement considers it a system based on exploitation of the cultivator, the sharecropper and labourer; a system of economic dependence and political domination(Alavi,1973: Pp.23-62).

Inclusion of Sanora Union Leaders in the Political Party

At present, inclusion in the national political party is one of the most important issues to become a rural leader. Therefore, if we want to know the political status of rural leaders, we must first know what kind of relationship they have with the national political party. Due to population growth, globalization, fragmentation of land, concentration of leaders in modern occupations and expansion of non-agricultural economy,a class of young, agile, educated and progressive leaders has emerged in 2017 compared to 1990.These are the people who are influencing rural politics by keeping in touch with national politics. So, based on the results obtained from the field level by asking them about this, the political status of the rural leaders has been analyzed through the following table. Here is a study of their political status by comparing 50leaders in 1990 and 50 leaders in 2017.

Table 10: A Comparative Figure of the Inclusion of Sanora Union Leaders in Political Party (2017 and 1990).

Year		Bangladesh Awami League	BNP(Bangladesh Nationalist Party)	Jatiya Party	Others	Total
2017	Number	29	20	1	0	50
	Percentage	58%	40%	2%	0%	100%
1990	Number	15	16	12	7	50
	Percentage	30%	32%	24%	14%	100%

Source: Obtained from Field Level Data.

Table-10 shows that in 1990, 30%, 32%, 24% and 14% of the leaders were involved in Bangladesh, Awami League, BNP(Bangladesh Nationalist Party), Jatiya Party and others respectively.[6] But in 2017, 58%, 40%, 2% and 0% of the leaders were involved in Bangladesh Awami League, BNP (Bangladesh Nationalist Party), Jatiya Party and others respectively.According to the political culture of Bangladesh, rural people and leaders want to be involved with the ruling party in hope of getting various opportunities. In 2017, 58% of the leaders were involved in Bangladesh Awami League.In 1990, 24% of the leaders were involved in the Jatiya Party. Due to the strong organizational structure of Bangladesh Awami League in the rural areas as an old party from the very beginning, a large section of the people have always been involved in the politics of Bangladesh Awami League. The key link in the system of patronage, through which the national institutions functioned (Block, 1969: P.169).

[6] Bangladesh Awami League, BNP, Jatiya Party, (Political Parties of Bangladesh, B.N.P.- Bangladesh Nationalist Party)

Experience of Sanora Union Leaders

Experience often plays an important role in becoming a leader. However, many modern, educated and young people are becoming leaders even though they are inexperienced, but they are being elevated to leadership level. If we want to do research on rural leadership, we need to discuss the experience of the leaders. So, the main discussion now is whether experience is needed to become a rural leader. Therefore, based on the results obtained from the field level by asking them about this, the experience of the leaders of Sanora Union has been analyzed through the table below. Here is a comparative study between 50 leaders in 1990 and 50 leaders in 2017.

Table 11: A Comparative Figure of the Experience of the Leaders of Sanora Union (2017and 1990).

Year		Experienced	Inexperienced	Total
2017	Number	20	30	50
	Percentage	40%	60%	100%
1990	Number	28	22	50
	Percentage	56%	44%	100%

Source: Obtained from Field Level Data.

Table-11 shows that in 1990, 56% and 44% of rural leaders were experienced and inexperienced, respectively. But in 2017, 40% and 60% of rural leaders were experienced and inexperienced, respectively. In 1990, a rural leader was elected more than once. But in 2017, a rural leader was rarely seen to be elected more than once. Informal leaders also led for a long time on the basis of their clan. That is, it would have happened in the case of informal leadership.

Social Status of the Leaders of Sanora Union

Social status is very important to be a rural leader. Its importance has decreased in 2017 compared to 1990, but its importance has not completely disappeared yet. We need to study the importance of social status to become a rural leader in 2017 . Therefore, the social status of the leaders of Sonora union has been analyzed through the following table based on the results obtained from the field level by asking them about it. Here, is a comparative study between 50 leaders in 1990 and 50 leaders in 2017.

Table -12: A Comparative Figure of the Social Status of the Leaders of Sanora Union (2017 and 1990). [On the Basis of Clan]

Social Status [Clan]	Year 2017		Year 1990	
	Number	Percentage	Number	Percentage
High	15	30%	27	54%
Middle	25	50%	15	30%
Low	10	20%	8	16%
Total	50	100%	50	100%

Source: Obtained from Field Level Data.

Table-12 shows that in 1990, 54%, 30%, and 16% of rural leaders were from the high, middle and low lineage respectively. But In 2017, 30%, 50% and 20% of rural leaders were from the high, middle and low lineage, respectively. At present, half of the leaders of Sanora Union belong to the middle lineage. At present, the importance of lineage has diminished. Now the quality acquired rather than pedigree plays a supporting role in achieving leadership.They clearly come from upper levels and the co-relation between wealth and leadership is highest as we move up the scale(Lewis,1958:p.16).

The data obtained show that the number of single families is increasing more than the number of joint familes among the rural leaders. Now to be a rural leader, family size and large clan are not very important. Weakening the people in irrational terms, courage, intelligence, strategy etc. are still a great help in achieving rural leadership.

Conclusion

Ownership of agricultural land decreased among the leaders of Sanora Union in 2017 as compared to 1990. Business has increased among rural leaders. In 1990, 26% of rural leaders were involved in business.But in 2017, 32% of rural leaders are involved in business. In 1990, 60% of rural leaders were involved in agriculture. But in 2017, 36% of rural leaders are involved in agricultural sector. In 1990, the annual income of 38% of the leaders was 0-60,000 taka(BDT).But in 2017, the annual income of 50% of the leaders ranged from1,20,001-2,40,000 taka(BDT). In 2017, the presence of more young leaders was noticed in Sanora Union . In 1990, 34% of leaders were between the ages of 41 and 50. But in 2017, 42% of leaders were between the ages of 31 and 40. In 1990, 52% of the leaders were educated from class-five to class-ten. But in 2017, 54% of leaders had education from SSC to HSC. In 1990, 48% of leaders had families of 11 to 15 members. But in 2017, 50% of the leaders had 6 to 10family members. In 1990, 96% of male leadership existed. But in 2017, I saw 80% male leadership. The status of male-dominated leadership in Sanora Union is still prevailing. In1990, 76% of leaders had hereditary status. But in 2017, only 52% of leaders' status was hereditary. But in 2017, I noticed that people are becoming leaders through acquired qualities rather than heredity. In 1990, sharecropping system was 50%.But in 2017, sharecropping system was 42%. In 2017, 58% of Sanora Union leaders were involved in the politics of Bangladesh awami league. But 40% of Sanora Union leaders were involved in the politics of Bangladesh Nationalist Party(B.N.P.). In 1990, 56% of Sanora Union's leaders were experienced. But in 2017, 40% of Sanora union's leaders were experienced. In 1990, there were more leaders of high lineage but in 2017, there were more leaders of the middle lineage. Moreover, the number of single families is higher among the rural leaders.

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Gender Inequality and Economic Growth: An Empirical Investigation in Bangladesh

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Abstract: Bangladesh is a highly populated South Asian country that has seen rapid economic expansion in recent years. It is equally vital to find both growth-promoting and growth-constricting elements in order to maintain this pace of growth. One of the most powerful issues that might hinder economic growth is gender inequality, which can limit growth by causing inefficient resource allocation and human capital accumulation. As a result, addressing gender inequality can help to boost current economic growth. In light of this, the current research investigates the dynamic relationship between gender inequality and economic growth. Gender inequality data was sourced from the United Nations Development Programs (UNDP), while data on real per capita GDP (which measures economic growth) was sourced from the World Development Indicators (WDI). The study also includes some pertinent control variables like labor, capital accumulation, electricity access, and trade openness, all of which are based on WDI data. The research uses quarterly data from 2005Q1 through 2019Q4 for all variables. The Phillips-Peron unit root test reveals that all variables have the same order of integration, and the Johansen cointegration test confirms that these variables are cointegrated. This study discovered that gender inequality has a large and negative impact on economic growth, which is in line with our assumptions. A 1% reduction in gender inequality leads to a 0.497 percent increase in economic growth, according to the findings, and vice versa. As a result, governments must develop an appropriate strategy to eliminate gender inequality in order to achieve the necessary economic growth.

Keywords: *Gender inequality, economic growth, cointegration, Bangladesh.*

1. Introduction

Many countries around the world are concerned about achieving their targeted economic growth. Economic growth raises the standard of living through an increase in a country's production of products and services in a given year. A higher per capita income allows people to get a better education, access to better healthcare, eat a wider variety of nutritious foods, and have enough energy and technology, among other things. Poverty and malnutrition are reduced as a result of economic progress. However, achieving the necessary level of economic growth is not straightforward. This necessitates better policies and governance. In order to design better policies, policymakers must first understand the variables that accelerate growth. Alfaro et al. (2004), Narayan et al. (2010), Ullah et al. (2013), Kumari (2014), Belloumi (2014), Ying et al. (2014), Karanfil & Li (2015), Connolly & Li (2016), Mireku et al. (2017), and Samu et al. (2017) are just a few examples of empirical studies that have investigated the determinants of economic

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growth and found evidence in favor of (2019). Again, some studies were unable to reach an agreement due to a lack of sufficient evidence. However, equal contributions from men and women are required to achieve the desired economic growth. Increased gender disparity can stifle growth, whereas decreasing gender inequality can help a country's economy grow.

Gender inequality is described as giving people different opportunities based entirely on gender concerns. Gender discrimination occurs when someone or a group is treated unfairly because of their gender. Gender inequality and discrimination are often associated with women, but anybody can be subjected to discrimination or inequality depending on their gender (Parziale, 2008). By impacting the fertility rate, child mortality rate, and children's health and education, gender disparity leads to inefficient resource allocation and human capital buildup. These factors can stymie a country's economic growth. In addition, gender inequality has certain long-term indirect economic repercussions. As a result, a slew of studies examining the influence of gender inequality on economic growth are necessary. In light of this, the current study aims to investigate the relationship between the two, and as such, Bangladesh has been chosen as the case study country.

Bangladesh is a highly populated South Asian country that has seen rapid economic growth during the previous decade. Bangladesh's per capita income has risen to $1287.82 in 2019, up from $359.46 in 1980 (in constant 2010 dollars). Gender disparity in Bangladesh has decreased to 0.537 from 0.708 in 1995, according to the UNDP (United Nations Development Program) Gender Inequality Index (UNDP, 2021). As a result, Bangladesh has made significant progress in decreasing gender disparity, and the economy is rising at a rapid pace as a result. This visual association paves the way for researchers in Bangladesh to investigate the dynamic causal relationship between gender disparity and economic growth. To avoid specification mistakes, the current study contains a number of relevant control variables.

The study's key contribution is that it examines the influence of gender inequality on Bangladesh's economic growth while controlling for a number of important variables. Section 1 of the research begins with an introduction. Following the introduction, in part 2, the relevant literature is addressed, in section 3, the specifics of techniques and materials are included, in section 4, the results are embellished with suitable discussion, and finally, in section 5, the study is concluded.

2. Literature Review

A variety of research has looked into the impact of gender inequality (GI) on economic growth (EG), with varying results. Some research has indicated a beneficial link between GI and EG, while others have discovered a negative link.

Gender inequality, according to Seguino (2000), is linked to economic growth in a beneficial way. He claimed that women's low wages in the industrial sector helped in the expansion of the manufacturing sector. Furthermore, a country's exports would benefit from women earning lower wages in the export-oriented sector. As a result, women's low wages can help to boost economic growth. Seguino (2000) discovered that GI was positively associated with economic growth in "semi-industrialized export-oriented

economies" between 1975 and 1995. Schober and Winter-Ebmer (2011), on the other hand, did not share Seguino's conclusion (2000). They contended that gender inequality, rather than promoting economic growth, stifles it in the long term. Schober and Winter-Ebmer (2011) looked at data from "a meta-study on gender wage discrimination" and found no evidence for a link between GI and EG. In contrast to Seguino (2000), Schober & Winter-Ebmer (2011) found that GI has a deleterious impact on EG.

Klasen and Lamanna (2009) used panel regression techniques to evaluate cross-country data from 1960 to 2000. According to the research, gender discrimination in education and the workplace, among other things, slowed economic growth. Furthermore, Cavalcanti & Tavares (2016) found that a 50% increase in the wage gap between men and women reduces long-term income per capita by 35%. Cuberes & Teignier (2016) concluded that long-term gender discrimination reduced output by 15.4% in OECD nations and 17.5 percent in developing countries after evaluating data from "33 OECD countries and 106 developing countries". Based on data from 37 European countries and the United States, Cuberes & Teignier (2016) found that gender discrimination reduced aggregate output by 13.2% in 37 European countries and the United States.

Kim et al. (2018) used the endogenous growth model to investigate how GI affects EG. According to the study, female labor force participation and the country's economic development would climb from 54.4 percent to 67.5 percent and 3.6 percent to 4.1 percent, respectively, in a gender-equality-free economy. Karoui & Feki (2018), for example, used the dynamic panel GMM estimate approach to assess data from 26 African nations between 1995 and 2012. The study's findings demonstrated that GI has a considerable unfavorable effect on EG. In a similar study, Lee (2020) looked at data from 66 nations and discovered that reducing gender inequality to the level of the United States would boost GDP per capita by 3% and agricultural labor productivity by 21%.

Furthermore, according to Bloom et al. (2015), the transition to sustainable economic growth may gain traction as women's health improves. Similarly, de la Croix and Vander Donckt (2010) discovered that nations with a high child mortality rate and low girl survival have a higher risk of falling into the low growth regime. Although some studies have looked into the dynamic interaction between GI and EG in different countries, there aren't enough studies available in Bangladesh to reach a conclusion. As a result, the current research aims to add to the existing literature by investigating the dynamic link between GE and EG in Bangladesh.

The study includes a total of four control variables, with labor and capital being included because they are the two most important factors for estimating long-run economic growth. In addition, depending on the literature, two additional essential variables are included. The study has added the electricity variable to the model by following the studies of Osman et al. (2016), Raza et al. (2016), Bah & Azam (2017), and M. M. Rahman (2020). There are four types of connections between electricity use and economic growth. The first is the growth hypothesis, which states that using electricity stimulates economic growth, and Raza et al. (2016) discovered that this theory is authentic for four South Asian countries. The second one is the conservation hypothesis, which predicts that economic growth will increase electricity consumption, and M. M. Rahman's study (2020) found the authenticity of this hypothesis.

The third strategy, known as the neutrality hypothesis, predicts that there is no relationship between these two, and Bah & Azam (2017) discovered that this hypothesis is valid for South Africa. Finally, the fourth approach predicts a feedback relationship between these two, known as the feedback hypothesis, which was validated in a study by Osman et al. (2016) for a panel of GCC countries. This research focuses on the growth hypothesis, which anticipates electricity as a growth contributor.

In addition, the study has added the trade openness variable in the model, following the work of Awokuse (2008), Brueckner & Lederman (2015), Hye & Lau (2015), Ulaşan (2015), and M. M. Rahman et al. (2019). Because no previous study has looked at the influence of gender disparity on economic growth in Bangladesh while controlling for the effects of labor, capital, energy consumption, and trade openness, the current study has attempted to add to the existing literature.

3. Methods and Materials

3.1 Gender Inequality Index

The UNDP has developed an index to measure the extent of gender inequality. Health, empowerment, and the labor market are the three dimensions of this indicator. By combining the three dimensions, a female and male gender index is initially calculated. The female reproductive health index is calculated using the "maternal mortality rate and adolescent birth rate"; the female empowerment index is calculated using the "female and male population with at least secondary education and the female and male shares of parliamentary seats"; and the female labor market index is calculated using the "female and male labor force participation rates" (UNDP, 2020). The female gender index is created by adding together the female reproductive index, female empowerment index, and female labor market index (UNDP, 2020). A male gender index is likewise computed in the same manner. The gender inequality index (GII) was created by combining the female gender index with the male gender index (UNDP, 2020). Figure 1 depicts the detailed chart flow of GII.

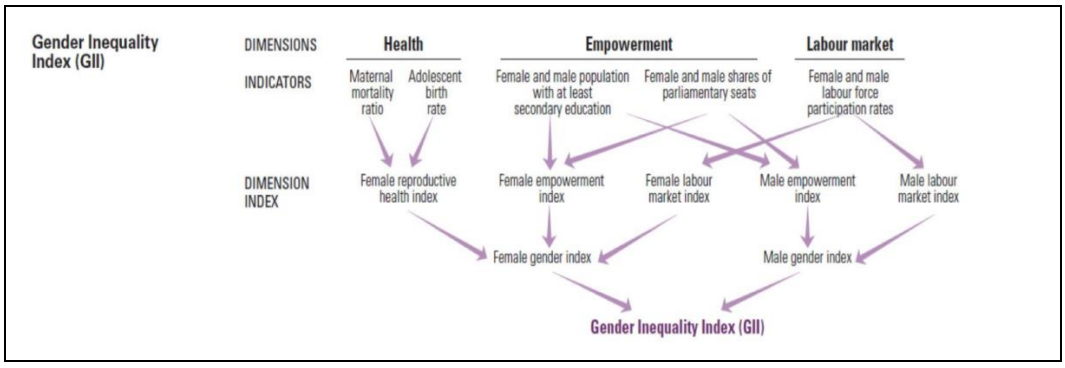


Figure 1. Chart flow of Gender Inequality Index

Source: UNDP, 2020

3.2 Model of the Study

The study has employed the following Cobb-Douglas production function:

$$Y = AL^{\alpha}K^{\beta}e^{it} \qquad (1)$$

"L" and "K" denote labor and capital, respectively; "α" and "β" represent labor and capital shares, respectively, and "A" is the symbol for technology in this case. Besides, 'e' represents the stochastic error term, 'i' is the cross-sectional unit, and 't' denotes time. This technological variable A is an endogenous variable that is influenced by a variety of other factors. We assume that access to electricity (the energy variable), the trade GDP ratio, and gender inequality are all factors that influence technology A.

Therefore, we can write

$$A = \mu(AE)^{\delta}(TO)^{\gamma}(GII)^{\sigma} \quad (2)$$

Where AE represents the access to electricity, TO represents the trade openness (which is trade percentage of GDP), and GII represents the gender inequality index. The notations δ, γ, and σ represent the share of AE, TO, and GII respectively. Now, substituting equation (2) into (1) we get:

$$Y = \mu(AE)^{\delta}(TO)^{\gamma}(GII)^{\sigma}L^{\alpha}K^{\beta}e^{t} \qquad (3)$$

Now, to normalize the equation (3), log transformation of the variables are used and we obtain the following equation:

$$Y = \pi + \beta_2 LnL + \beta_3 LnK + \beta_4 LnAE + \beta_5 LnTO + \beta_6 LnGII + \varepsilon_t \quad (4)$$

Where, π is the constant intercept term, and the parameter β_2, β_3, β_4, β_5, and β_6 represents the output elasticity of the labor, capital, access to electricity, trade openness, and gender inequality, respectively. Equation (4) is the required model for estimation in this study.

3.3 Econometric Methods

The study used data from WDI (WDI, 2021) for labor, capital, electricity access, and trade openness, while the UNDP provided data for the gender inequality index (UNDP, 2020). Data from 2005Q1 through 2019Q4 was used in this research. Yearly data was converted into quarterly data by following the high frequency to low frequency data conversion rule. Statistical software Eviews 10 was used in this regard.

Because this research used time series approaches, the Phillips-Peron unit root test was used to check for stationarity of the data. In addition, the Johansen cointegration test was used to assess the cointegration in this work. The Fully Modified OLS or FMOLS method was used to evaluate the long-run elasticities in this work. Finally, to determine the causal direction, the study used the Granger causality test.

4. Results and Discussions

Table 1 shows the descriptive statistics of the variables, including the mean, median, standard deviation, skewness, Kurtosis, and the Jarque-Bera statistic.

Table 1. Descriptive Statistics

	LNRGDPPC	LNL	LNK	LNAE	LNTO	LNGII
Mean	6.773112	4.080104	3.333049	4.152291	3.699586	-0.526299
Median	6.763596	4.070564	3.341530	4.119037	3.687438	-0.536144
Maximum	7.160707	4.119688	3.452217	4.523960	3.873509	-0.381260
Minimum	6.425748	4.069540	3.251554	3.789403	3.537967	-0.621757
Std. Dev.	0.221946	0.018801	0.067805	0.229946	0.103026	0.074005
Skewness	0.147428	1.489589	0.375901	0.258744	0.274631	0.512738
Kurtosis	1.897877	3.264616	1.799833	1.995564	1.930899	2.173067
Jarque-Bera	3.254039	22.36381	5.014017	3.191713	3.611667	4.338549
Probability	0.196514	0.000014	0.081512	0.202735	0.164337	0.114260
Sum	406.3867	244.8062	199.9830	249.1375	221.9752	-31.57792
Sum Sq. Dev.	2.906338	0.020855	0.271251	3.119626	0.626243	0.323129
Observations	60	60	60	60	60	60

Table 2 shows the correlation matrix, which shows that labor, capital, and electricity access are all favorably connected with economic growth, whereas trade openness and gender disparity are adversely correlated with real GDP per capita. The correlation matrix reveals a significant negative association between LNGII and LNRGDPPC, implying that decreasing gender inequality is linked to rising per capita income.

Table 2. Correlation Matrix

Covariance Analysis: Ordinary

Sample: 2005Q1 2019Q4

Included observations: 60

Correlation	LNRGDPPC	LNL	LNK	LNAE	LNTO	LNGII
LNRGDPPC	1.000000					
LNL	0.688295	1.000000				
LNK	0.977904	0.743838	1.000000			
LNAE	0.974309	0.737880	0.962106	1.000000		
LNTO	-0.056239	-0.502977	-0.097896	-0.109777	1.000000	
LNGII	-0.968433	-0.560654	-0.907503	-0.939893	-0.078061	1.000000

Table 3. Phillips-Perron Unit root test

UNIT ROOT TEST TABLE (PP)							
	At Level						
		LNRGDPPC	LNL	LNK	LNAE	LNTO	LNGII
With C	t-Statistic	1.3418	-0.2761	1.7526	-0.5423	-1.8959	-2.7528
	Prob.	***0.9986***	***0.9217***	***0.9996***	***0.8748***	***0.3321***	***0.0714***
		n0	n0	n0	n0	n0	*
With C & T	t-Statistic	-5.5461	-1.4377	-2.3426	-3.0901	-1.8826	-1.3729
	Prob.	***0.0001***	***0.8393***	***0.4051***	***0.1182***	***0.6509***	***0.8588***
		***	n0	n0	n0	n0	n0
Without C & T	t-Statistic	17.2665	1.0058	4.4739	2.9857	0.1518	3.3925
	Prob.	***1.0000***	***0.9154***	***1.0000***	***0.9991***	***0.7265***	***0.9997***
		n0	n0	n0	n0	n0	n0
	At First Difference						
		d(LNRGDPPC)	d(LNL)	d(LNK)	d(LNAE)	d(LNTO)	d(LNGII)
With C	t-Statistic	-21.2274	-7.6153	-8.7722	-8.3904	-7.4887	-9.7107
	Prob.	***0.0001***	***0.0000***	***0.0000***	***0.0000***	***0.0000***	***0.0000***
		***	***	***	***	***	***
With C & T	t-Statistic	-27.6394	-7.8094	-10.3484	-8.2992	-7.6972	-12.9714
	Prob.	***0.0001***	***0.0000***	***0.0000***	***0.0000***	***0.0000***	***0.0000***
		***	***	***	***	***	***
Without C & T	t-Statistic	-7.5498	-7.5498	-7.5498	-7.5498	-7.5498	-7.5498
	Prob.	***0.0000***	***0.0000***	***0.0000***	***0.0000***	***0.0000***	***0.0000***
		***	***	***	***	***	***

Table 3 shows the findings of the Phillips-Perron unit root test, which shows that all of the variables are nonstationary at their level form but become stationary at their first difference form, indicating that all of the variables studied are I(1) variables.

Table 4. Cointegration test results

Sample (adjusted): 2005Q3 2019Q4
Series: LNRGDPPC LNL LNK LNAE LNTO LNGII

Trace Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.667848	116.8193	107.3466	0.0103
At most 1	0.290682	52.89389	79.34145	0.8287
At most 2	0.194762	32.97367	55.24578	0.8441
At most 3	0.173824	20.40986	35.01090	0.6804
At most 4	0.108351	9.334922	18.39771	0.5461
At most 5	0.045211	2.683347	3.841466	0.1014

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

Maximum Eigenvalue Test

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.667848	63.92544	43.41977	0.0001
At most 1	0.290682	19.92021	37.16359	0.9041
At most 2	0.194762	12.56381	30.81507	0.9772
At most 3	0.173824	11.07494	24.25202	0.8361
At most 4	0.108351	6.651575	17.14769	0.7504
At most 5	0.045211	2.683347	3.841466	0.1014

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

Because all of the variables in this study are I(1) variables, it is necessary to check for cointegration in order to avoid false regression, and the present study used the Johansen cointegration test to accomplish so. The results of the cointegration test are shown in Table 4. The trace test and the max-eigenvalue test both show that the variables in this study have one cointegrating vector. LNRGDPPC, LNL, LNK, LNAE, LNTO, and LNGII are thus cointegrated variables.

The FMOLS regression approach was used in this study to investigate long-term elaticities. Table 5 summarizes the outcoms of the FMOLS regression.

Table 5. Estimation of the Long run elasticities.

Dependent Variable: LNRGDPPC
Method: FMOLS
Sample (adjusted): 2005Q2 2019Q4

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNL	0.501841	0.245020	2.048160	0.0456
LNK	0.615267	0.228709	2.690177	0.0096
LNAE	0.012798	0.046452	0.275500	0.7840
LNTO	-0.040299	0.029996	-1.343477	0.1850
LNGII	-0.497003	0.219601	-2.263204	0.0278
C	2.276580	0.935540	2.433439	0.0184
@TREND	0.007872	0.001450	5.430338	0.0000
R-squared	0.996287	Mean dependent var		6.778999
Adjusted R-squared	0.995859	S.D. dependent var		0.219075

The results show that the labor, capital, and access to electricity slope coefficients are all significant and positive, which is in line with our assumptions. According to the findings, a 1% increase in labor input accelerates economic growth by 0.50 percent in the long run.

According to the report, a one percent increase in capital will boost economic growth by 0.62 percent, whereas a one percent increase in power access will boost it by 0.013 percent, according to the report.

Trade openness has a large negative impact, which is consistent with numerous earlier empirical findings. This study shows that Bangladesh's trade sector is underdeveloped and that authorities must reform trade policies in order for trade to help Bangladesh's economy grow faster.

Finally, gender disparity is found to have a considerable and unfavorable influence, which is in line with our assumptions. A 1% reduction in gender inequality results in a 0.497 percent increase in economic growth, according to the findings, and vice versa.

Table 6 shows the outcome of the Granger causality test. The link between work and economic growth is shown to be unidirectional, implying that labor plays a part in Bangladesh's economic progress. Bangladesh has more opportunities to build the economy by employing its labor in the productive sector because it is a labor-intensive country.

The conservation hypothesis is supported by evidence of unidirectional causality between economic growth and access to electricity. Economic expansion, according to the conservative premise, increases electricity consumption or access. There is also a unidirectional correlation between trade openness and economic growth, implying that greater trade openness promotes Bangladesh's economic growth. Furthermore, capital

accumulation and economic growth have a bidirectional causal relationship. This means that capital accumulation accelerates Bangladesh's economic growth, and growing economic activity further accumulates capital, which fosters growth. Gender inequality and economic growth have a bidirectional causal relationship. Because the relationship between the two is negative, this loop causation indicates that reducing gender inequality will enhance economic growth, which will further reduce gender inequality.

Table 6. Granger Causality tests results

Null Hypothesis:		Obs	F-Statistic	Prob.
LNL	LNRGDPPC	56	5.71324***	0.0008
LNRGDPPC	LNL		1.77958	0.1488
LNK	LNRGDPPC	56	8.40983***	0.0000
LNRGDPPC	LNK		8.71201***	0.0000
LNAE	LNRGDPPC	56	1.16725	0.3373
LNRGDPPC	LNAE		6.79457***	0.0002
LNTO	LNRGDPPC	56	11.2191***	0.0000
LNRGDPPC	LNTO		0.73901	0.5701
LNGII	LNRGDPPC	56	12.9670***	0.0000
LNRGDPPC	LNGII		9.10908***	0.0000
LNK	LNL	56	1.53242	0.2082
LNL	LNK		0.20567	0.9340
LNAE	LNL	56	1.09899	0.3682
LNL	LNAE		0.01188	0.9997
LNTO	LNL	56	0.32402	0.8605
LNL	LNTO		0.29099	0.8824
LNGII	LNL	56	0.70776	0.5907
LNL	LNGII		1.69657	0.1666
LNAE	LNK	56	0.44137	0.7781
LNK	LNAE		1.19298	0.3263
LNTO	LNK	56	0.55562	0.6959
LNK	LNTO		0.95556	0.4407

LNGII	LNK	56	5.15418***	0.0016
LNK	LNGII		3.28540**	0.0187
LNTO	LNAE	56	0.14750	0.9632
LNAE	LNTO		0.94677	0.4454
LNGII	LNAE	56	2.19854*	0.0835
LNAE	LNGII		0.23762	0.9157
LNGII does not Granger Cause LNTO		56	0.96430	0.4359
LNTO does not Granger Cause LNGII			7.51023***	0.0000

5. Conclusions and Recommendations

Inequality between men and women leads to inefficient resource allocation and human capital buildup, which can stymie a country's economic growth. In addition, gender inequality has long-term indirect repercussions on economic growth and development. As a result, a profusion of research studies on the influence of gender inequality on economic growth is necessary. In light of this, the current study makes an attempt, and as a result, Bangladesh is chosen as the study country.

The results show that the labor, capital, and access to electricity slope coefficients are all significant and positive, which is in line with our assumptions. A 1% increase in labor input, according to the findings, accelerates economic growth by 0.50 percent. one percent rise in capital will boost economic growth by 0.62 percent, whereas a one percent increase in access to power will boost it by 0.013 percent. It is consistent with numerous earlier empirical findings that trade openness has a large negative influence on economic growth. This study shows that Bangladesh's trade sector is underdeveloped. As a result, officials must modify trade policies so that trade may help Bangladesh's economy grow faster.

Finally, gender inequality has a considerable and unfavorable influence, which is in line with the expectations. A 1% reduction in gender inequality leads to a 0.497 percent increase in economic growth, according to the findings, and vice versa. Because gender inequality has a negative relationship with economic growth, governments must establish suitable policies to eliminate gender inequality in order to achieve the desired economic growth.

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Effects of natural disaster on aged women: A case study on Chattogram metropolitan coastal area, Bangladesh

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Abstract: Population attributes like health, age group, education and gender are not only dependent on the socio-economic entities but also on the spatial arrangement of the variables. Among population, aged women are always at high risk to natural disaster and climate change related exposure. The study tries to explore the types of natural disaster faced by aged women and assess the coping strategies with their socio economic condition of coastal area of Chattogram metropolitan, Bangladesh. The study was carried out by the combination of both primary and secondary data sources. The primary data were collected from questionnaire survey which consisted of 100 questionnaire. It was conducted through household interview from 65+ Aged women. The study explored that aged women mostly face cyclone, tidal flood, and coastal bank erosion and lose their life and assets. They faces worst situation in disaster time due to unfavorable health condition. Despite of hurdle situation, they intensively involved themselves in various activities in before; during; and post disaster time. So it is the responsibility and duty of society and new generation to take essential steps for their betterment.

Keywords: Disaster, aged women, coastal area, coping.

Introduction

Natural disaster is a distinct and distinguishable occurring event in the nature and community that involves merging of various factors that influence the degree to which someone's life and livelihood is put at risk (Blaikie *et. al*. 1994). This is a frequent event for Bangladesh. Different disasters like cyclones, floods, storm tide, etc. are causing high level of suffering every year in the country (Islam, 2011; Rahman *et. al.* 2017). Comprehensively, Bangladesh is more climate vulnerable than other countries in the world (Harmeling, 2010; WB, 2018). During past 200 years not less than 70 major cyclones have struck the coastal area of Bangladesh and in the last 35 years almost 900,000 people have died because of catastrophic cyclones (PDO-ICZMP, 2004). Women are supposed to be the most vulnerable for many causes namely their vulnerability, mental attitude, physical structure and other social issues (Mitchell, 2007). Half of the total population in our country is women who are considered as more vulnerable group and need to be taken care of in disaster situation (Islam, 2011).

Population ageing is a global occurrence. Growth of aged people in size and proportion has been observed throughout the world (UN, 2019). The term 'ageing' refers the gradual natural process of growing older. This natural process is of course a biological reality, which, no matter how much anyone tries has its own dynamics; something beyond we human can control. Yet each society makes sense of old age derived from its

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constructions (Gorman, 1999). Generally, vulnerability and old people in most developing countries are marginalized. They are often amongst the poorest of the poor. In ancient period women frequently died in childbirth (Hayflick, 1996) and the life span was merely 20 years, let alone they lived long enough to have children (Butler, 1976). Around 1900, the developed countries of that time had an average life span of 45 to 50 years. Now, life span is about 78 years in developed countries and 68 years in developing regions. United Nations refers to older people 60+years (UN, 2017). By 2050, 1 in 6 people in the world will be over the age of 65 (UN, 2019),

Bangladesh is more vulnerable to climate change, and disaster prone than other countries (WB, 2018) with the process of urbanization, industrialization, individualization, and the expansion family planning programs. It has poor management scenario to face environmental problems by aged people specially women. With increasing population, ratio of aged people is increasing with facing many socio economic problems. The environmental problems are ultimately more threatening to the coastal area. It is important to make significant progress in the coastal area of disaster and disaster management for the elderly population (Elahi and Islam, 1995). Poor women can survive on their own with little help from the society and they are enabling to utilized united women power and come forward side with men (Khatun, 2005).

Ageing population: Bangladesh Situation

In its very much vulnerable population and progress context, Bangladesh, which is the seventh largest (152.51 million in 2011) and a densely populated country (1015 persons per sq. km) in the world, has started to experience another evolving issue of population ageing (BBS, 2017). The older section is increasing much faster than total population along with their vulnerability and dimension of problem (Rahman, 2013). Currently, almost 5.2% of the total population of Bangladesh is 65+ and by the year 2030 it will be 7.4% (UN, 2019).

Table 1: The trend of increasing number of aged people in Bangladesh (in thousands)

Age group	Year					
	1974	1980	1990	2000	2010	2020
65-74	1645	1921	2475	3541	4702	5154
75-84	394	506	709	1243	1982	2760
85-94	28	32	59	135	346	650
95+	0	0	0	2	11	44

Source: United Nations, (2019). World Population Prospects, 2019

Table 2: Estimated age-sex distribution of aged population of Bangladesh: 1974, 1980 -2020 (in thousand)

Age Group	Man						Woman					
	Year						Year					
	1974	1980	1990	2000	2010	2020	1974	1980	1990	2000	2010	2020
65-74	915	1060	1317	1851	2439	2 697	730	861	1158	1690	2263	2457
75-84	213	277	383	645	1003	1343	181	229	326	598	979	1417
85-94	14	16	30	69	169	285	14	16	29	66	177	365
95+	0	0	0	1	5	16	0	0	0	1	6	28

Source: United Nations, (2019). World Population Prospects 2019.

Increasing trend in the number of aged persons in Bangladesh also shows that increase rate of women are higher than man (Table 1 and 2).

Aged women are key contributors to household security, through profit from small business, through the growing of agricultural foodstuffs as well as livestock rearing for direct household consumption and sales. The significance associated with the caring of the aged persons is strongly embedded in the Bangladeshi culture and tradition. But as time is passed, falling of joint families and with evolving of nuclear families is more often noticed with urbanization, industrialization, modernization, and poverty & migration process. In this situation older women are more affected than men.

The coastal zone of Bangladesh is mainly perceived to be a zone of multiple vulnerabilities to risks from earthquake, tsunami and above all climate change. A vast majority of the people who are affected by natural hazards in Bangladesh are women. The prime reason behind this situation is deeply rooted in the adverse societal, cultural and economic environment of the country. Women suffer more during the natural disasters like cyclone and river bank erosion in the coastal region of Bangladesh from time immemorial. When disaster strikes, the women especially those women who are households head become most vulnerable. In this context this paper has taken an attempt to understand the situation of aged women in coastal area of Chattogram metropolitan.

Aim and objectives of the research:

The aim of this research is to identify the natural disaster faced by aged women and understanding their coping strategy in the study area. The following objectives are taken for this research.

1. To study the socio economic condition of aged women in the *Patenga* coastal area of Chattogram Metropolitan;
2. To identify various natural disaster faced by aged women in the *Patenga* Coastal area;
3. To assess the different types of adaptation practices performed by aged women in the study area.

Study area:

This study is an attempt to identify the situation of aged women in an urban coastal area portrayed by natural disaster. In order to collect primary data, the area under Chattogram City Corporation (CCC, comprising of 41 administrative Wards) *Patenga* ward (ward no. 41) has been selected as the study area. Study area was selected on the basis of worst situation occurrence due to natural disaster.

Chattogram- The commercial capital of Bangladesh –is the second largest city in the country having the status of statistical Metropolitan Area (SMA) or Metropolitan city. The total area of the city is about 209.67 sq km. (BBS, 2011) with an estimated population of about 6.5 million. The diversified land use characteristics of the city are now under constant threat due to rapid population influx, impact of climate changes and unplanned development activities. The study area consists of 17.26 sq km. and located on the south of Chattogram Metropolitan (Fig-1) area. In the study area, total population is 44084 where males are 52.75% and females are 47.25% (BBS, 2017).

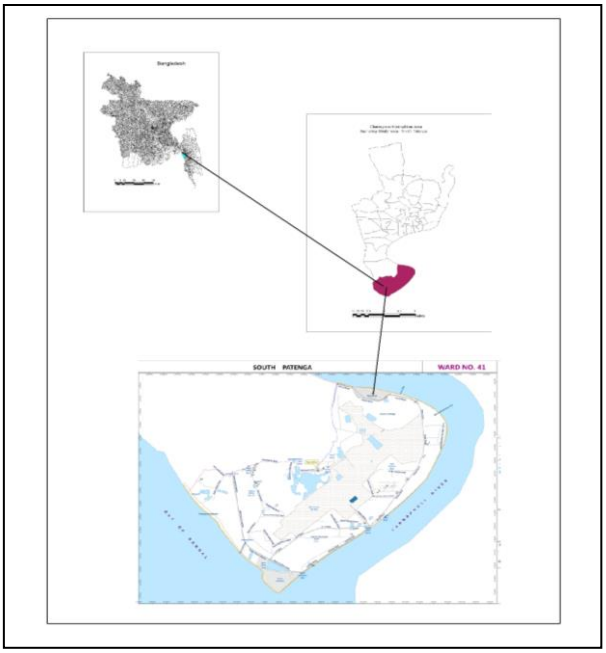


Fig. 1: Study Area location

Data and Methodology

The study is a combination of both quantitative and qualitative method. For the present study, perceptual data have been collected from the primary sources and factual information has been gathered from various secondary sources. First of all a reconnaissance survey was conducted to understand overall scenario regarding research theme in the study area. To collect primary data, 100 household of *Patenga Coastal* area were surveyed using a structured questionnaire prepared on the basis of various selected indicators. Household questionnaire is designed in a manner which extracts information about socio-economic characteristics of respondents, risk exposure level and the

experience they had about the catastrophic impacts of natural disasters on their life and livelihood. For the present study, purposive sample survey was undertaken and selection of the individual respondents is based on stratification i. e., aged women and residents staying in the city for at least ten (10) years. It is decided to take only the aged (65+ age group) women of household as the sample population. In-depth interviews were conducted to identify the various environmental problem facing by aged women with a check list. On the other hand, secondary information collected through books, articles, internet to find out overall status of the study area. Some general statistical techniques were used for table and diagram for showing different types of data.

Result and discussion

1. Socio economic condition of respondents:

Socio-economic information represents the real picture of any society or community. To take any development programme for any area, it is very much needed to collect information about the socio-economic condition of the locality. Otherwise; the initiatives or programmes will not be fulfilled. In Bangladesh women are more vulnerable in all stages regarding socio economic condition. Natural disaster accelerate that condition in vulnerable situation. In this perspective aged women face the worst period during disaster. So the respondents of this study is considered aged women 65+. By analyzing the educational qualification of the respondents, it was found that 70% of the respondents were literate while only 30% were illiterate. Occupation is an important part for the survival of any person in any area. Among the respondents, the percentage of housewife is higher (85%) than the others. These respondents have given valuable information about effects of natural disaster. Besides, there were some respondents who are garments worker, school teacher, small business owner etc. also give essential information from their own experience. Among them, many people are living here by birth. So, they are aware about the condition of disaster and give valuable information. Around 64% of the respondents of this study were from small size family consisting of 2-4 family members. On the other hand, only 13.34% respondents had more than 7 members in their family.

1.2 Health situation and disease:

Due to poor economic condition of the coastal people of *Patenga* doesn't get proper health facilities by Government. There were limited city corporation health complex and community clinic in study area but they don't provide better health facilities. In the third world country like Bangladesh, Our health sector is geared towards maternal, child health and containing infectious diseases, not towards the elderly disabled and sick. According to Abedin (1999), the physical condition of aged women is not as good as aged male; in fact steady with their shorter life span. Respondents of this area suffer various types of health problem and their health condition decreases in absence of proper care and facilities. Social and economic dependency of women also impact on health with poor diet. Figure -2 shows that most of the aged women in the study area suffer from vision problem (32%) even lose their vision; hearing impairment (20%), diabetics (16%), various heart diseases (32%) and their walking become very slowly which they barely manage with the help of a stick.

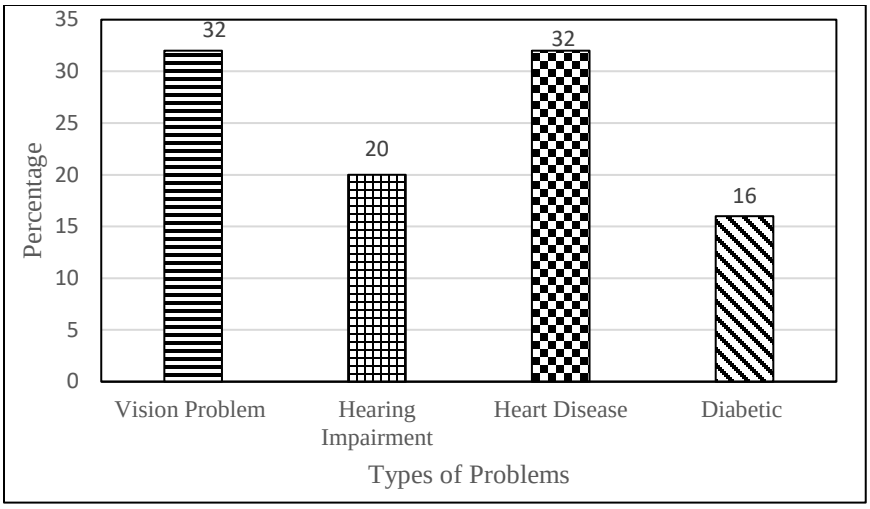


Fig 2: Health Problem of the respondents

Source : Field Survey, 2018

1.2 Treatment:

In Bangladesh, where a large proportion of the population is vulnerable to climate change, health impacts are expected to take place through a variety of ways, including an increase of water and vector borne diseases and of health problems in general. At the onset of disease and sickness maximum of the respondents used their self-knowledge of medication and previous healing experiences to treat themselves and their family members. To take any treatment, money problem is the major difficulty to aged people (CPD, 2000). Maximum aged women believe in Homio medicine (40%) or ayurvedic (24%) but for the developed technology and higher treatment they like to go the hospital (36%) in the study area (Fig -3).

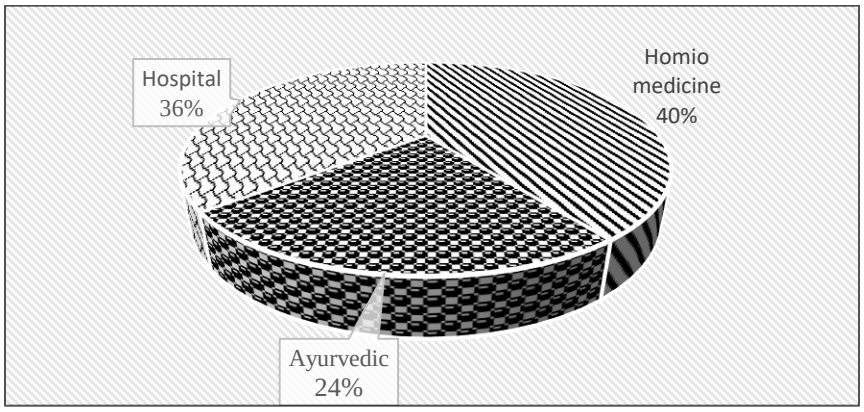


Fig 3: Sources of Treatment

Source: Field Survey, 2018

1.3 Income:

Economic situation of the aged women is very vulnerable. They depend on their family for survival as burden. For their over age, they are physically less active and some are

non-productive. Sometimes they get little amount of money as aid but its ranges between (500-1000) tk. Aged women expressed their desire for more aid from government and NGO.

1.4 Social isolation:

Social isolation is a particular problem for aged women. In the study area, many aged women lack social interaction outside the home environment and experience feelings, like neglecting and loneliness due to restriction on freedom of movement and public exposure. Theses effect on their mental health.

2. Natural Disaster

2.1 Facing of various natural disaster

Natural disasters can have a life-altering impact on the individuals and families fortunate enough to survive them. But the effect of natural disasters can be felt at the community, city and state level, or many times can impact an entire country. In generally the people of coastal area faces various kind of natural disaster every year such as; tidal flood, cyclone, storm surges etc. Maximum respondents highlighted to tidal flood then cyclone (Fig 4.). It is revealed from survey that flood (tidal flood, water logging) 64%, cyclone including tidal surges 24% and embankment erosion 12% respondents express their attitude with multi-answers. During tidal flood/storm surge women's privacy appears to be totally challenged. Sewerage and Sanitation problem becomes worse specifically in case of aged women.

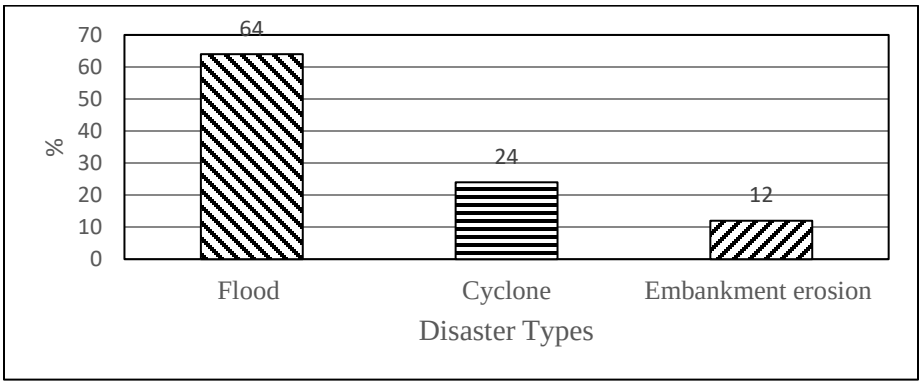


Fig-4: Major Disasters faced by the respondents

Source: Field Survey, 2018

2.2 Level of natural disaster:

Disasters are more severe for the people living in coastal areas. Now its occurrence time and severity level is increasing day by day. According to field survey, about 80% answered that it is more than previous time and 20% said medium level (Table -3).

Table 3: Level of disaster increasing

Type	Percentage (%)
More	80
Medium	20

Source: Field Survey, 2018

2.3 Losses during disaster:

Environmental or natural resources refer to the materials that are made available by nature in this planet. According to Field Survey, it is seen that different types of environmental resources such as vegetation, water, biodiversity, land etc. have lost in the study area due to natural disasters. During disaster losses are great which are showing below as a list with ranking considering multiple answers on the basis of priority. It is arranged by respondent's maximum consent and in depth interview. Table 4 shows the respondents sensitivity about losses of disaster period.

Table 4: Losses from disaster

Category	Percentage (%)
Damage of settlement	24
Agriculture damage	17
Losses of life	14
Damages of trees	21
Water logging and salinity	11
Losses of domestic animals	10
Others (road, electric pole damage, shortage of drinking water, sanitation etc.)	3

Source: Field Survey, 2018

3. Coping strategy

Coping refers to short-term responses to the impacts of events. By contrast, adaptation refers to longer-term adjustments to more permanent changes in the climate. Adaptation options for coping with the natural disasters depend on geographical, social, economic and cultural settings of the region. In coastal zone of Chattogram, respondents are taking different adaptation options to cope with existing natural disasters. Along with the structural measures, non-structural measures can also be fruitful to reduce vulnerability of the coastal livelihoods.

3.1 Sheltering:

The operational plan of cyclone shelters in Bangladesh is not found to be gender-responsive (CCC, 2009). This situation prohibited women to go for shelter in disaster time for safety. In the study area about 56% respondent go to shelter, 28% stay at own home, 16% move to less disaster prone area during disaster period (Fig-5). In

Bangladeshi families most of the important decisions are rarely held by family's elderly person. Consequently, it is an indicator of the status of the older person's in the family. People are more alert now about disaster situation by making, radio, television etc. The study found that even after receiving early warning women remained dependent on the (male) household head to take the final decisions.

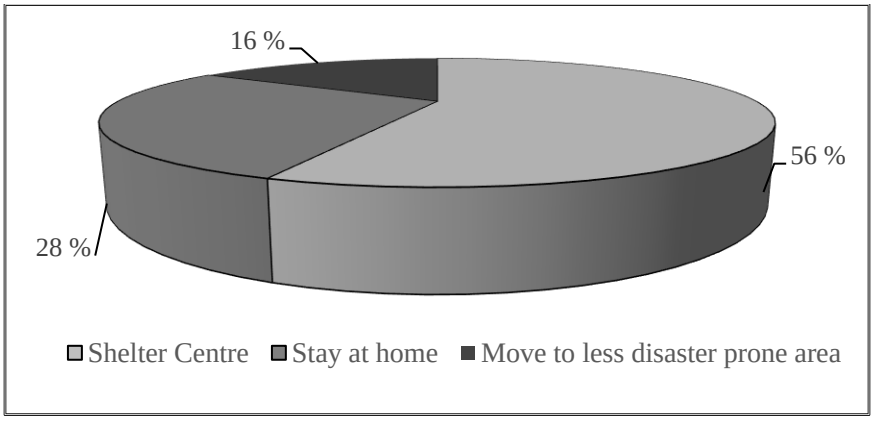


Fig 5: Staying at time of disaster

Source: Field Survey, 2018

3.2 Use of experience for disaster preparedness:

It is found that aged women play a complementary role for disaster preparedness from previous experience. They advise various ways to family members, like having savings, keeping portable cooking stoves, and maintaining a store of dry foods, molasses, and necessary medicines, utensils stored high up, away from the floodwaters, bury jewellery and valuable documents for safekeeping. They also advise to keep cattle in safe place and store their food, planting more fruit and woody trees nearby their houses for reducing disaster affect. This protects the houses from strong wind and flooding, as well as provides food and fuel after the disaster as a part of disaster risk reduction (DRR) approach. It is also the women who advise to cover tube-wells with plastic to prevent saline water intrusion (Table 5).

Table 5: Aged women activities in disaster situation (multiple answer synthesized)

Before disaster	During disaster	After disaster
- Savings from income, loan - Plantation around homestead as protection wall or putting fence around homestead. - Raise home base with mud, brick and uses of plastic cover around the base as well as for tube-well. - Making portable stove (Chula), and maintaining dry	- Suggest go to shelter or near safe site relative house. - Look after small children of the family. - Storing drinking water and food. - Shifting livestock and poultry near high road/ elevated place	- Cleaning house and surrounding homestead area. - If need selling assets. - Helping collecting aid and relief. - Suggest for changing crop pattern as early as possible. - Managing daily

foods. - Store medicine and water purifying pill and utensils, fuel. - Stock/ sell crop, poultry and livestock.	- Helping in collecting aid or relief. - Perform prayer and reciting holy books.	necessities of family members.

Source: Field survey, 2018

3.3 Obtain aid or relief:

Six to seven per cent of annual budget spend on climate-sensitive activities by government of Bangladesh (UNICEF, 2020). The government, NGOs and many other organization afford relief and aid during disaster period (Islam 2011). The development of disaster coordination systems within Bangladesh has improved the relief that affected families receive (UNWB, 2020). It has found from survey that during and post disaster period, aged women along with their family get food (36%), water (32%), and medicine (32%) as aid or relief elements by government and non-government in the study area (Table- 6). Age-sensitive relief distribution approach could be apply in this situation (Help Age International, 2007). During disaster to cope with safe and limited food and water, people change their eating habit and reduce the frequency of meal consumption which is managed by women where aged women play a vital role.

Table 6: Getting relief in disaster time

Elements	Percentage (%)
Food	36
Water	32
Medicine	32

Source: Field Survey, 2018

3.4 Family's support during disaster:

In coastal zones, women control homestead-based livelihoods, livestock, fisheries, trees, seeds and animal fodder. Despite the limited resources in coastal areas women play a significant role in food preservation to combat the adverse situation. Women preserve dry food (such as rice, onion, garlic, puffed rice, etc.), fuels, candle, matches, ropes and medicine at home and prepare portable mud stoves for future use (Islam, 2011). Aged women need maximum care during disaster and they get 100% family's support. It is mentionable that our social norms and ethics always teach us to respect the elders. Moreover in disaster prone coastal areas this practice is normal in most of the families which also founded in study area.

3.5 Opinion to reduce losses:

In Bangladesh, multi-sectoral policies are incorporated regarding climate change adaptation. It could be incorporated into sector-specific policy regarding environment, health and gender (Shabib and Khan, 2014). Aged women's experiences, understanding

and coping ability in adaptation strategies are recognized. Experience and knowledge of aged women could boost up reduction losses in disaster which should be facilitated on a customary basis (MOF).

From in-depth interview it is revealed that the knowledgeable aged women are more concern about our environment losses. During tidal surge the road become muddy and after disaster it destructed. The river bank erosion and inundation situation throw their family and society in losses of land and other property. They have thrown some of their ideas to reduce the losses of their precious resource which is shown in Fig. 6:

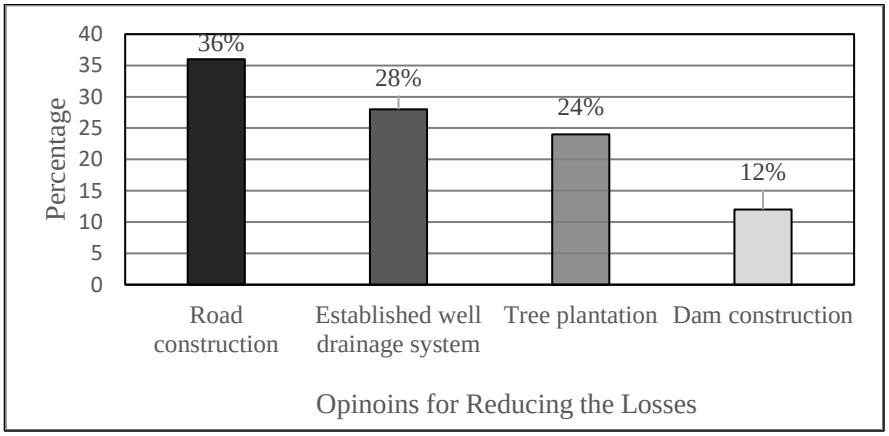


Fig 6: Opinion to reduce losses from disaster

Source: Field survey, 2018

4. Conclusion

Proper guidance or experience from aged women can significantly contribute to reducing the consequence of vulnerability during or after disaster. This increases the confidence level of other women in their ability to protect their property. They are more realistic in evaluating personal and household preparedness- such as water storage, dry food preserve, secured personal material, financial and other documents in a safe place. Most of aged people of Bangladesh cannot meet their essential needs. Vital requirements of the aged people are health (health care & drug), shelter, cloth, income employment or any available resource, healthy environment, expense of funeral and education. The difficulty of aged is not simply about medical matters. It is assemblage of physical, psychological, economical and socio-cultural condition. So a broad and complimentary approach required to face the crisis.

We should take strong steps to relieve the trouble of aged women. This kind of work is an ethical, public, humanistic and sacred responsibility for the residents. The steps incorporate, build community alertness, sustain the usual orthodoxy, initiate long term social security, and establish more health complex for the aged, specialized aged hospital and aged care units in the existing hospital. Ageing issue can be introduced into the different level of educational curricula, so that the new generation can have adequate acquaintance, resource assemblage and solidarity from government, contributor agencies and well-off people for sustainability of all sort of schemes adopted for the aged.

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Ageing in Social and Cultural Context

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Abstract: This paper attempt to explore the social and cultural context of ageing in urban Bangladesh focusing on the perceptions about ageing, the limitations of the aged, the features and stereotypes of ageing, and their everyday experiences. Human life, from birth to death, has been divided into several stages depending on biological, social and cultural constructions. Childhood, adulthood and ageing are the parts of that. Ageing has been categorized again as the young old, the old, the old-old and the oldest old. The understandings of ageing differ on the basis of the physical, social and mental condition of the person as well as socioeconomic status and bonding, cultural values, familial and community network. Ageing is limited by health conditions. It is considered very potential as experienced and intergenerational connections.

1 Background and the Theoretical Perspective of the Study

Every society has an image of human life, from birth to death. Life is a continual process but for convenience, we have divided it into several stages depending on biological, social and cultural constructions. Every society has its own understanding about the role, work, status, taking care of the elders and constructs a socio-cultural image of personality, attitude towards ageing and sharing events with them. Though the process of ageing or senescence is evolutionary inertia of a complex biological system and universal but the environment, nutrition, social factors, and culture influence it. Life stages such as childhood, adulthood and old age vary from society to society and culture to culture. Similarly; elders have a different understanding of society, culture, family and tradition, health and community services.

The common characteristics of elders are not their physical activity rather a combination of physical, psychosocial and cultural perspectives. Erfaim Jaul and Jeremy Brron (2017) clarified that older people are into four categories: '(i) the young old, (ii) the old, (iii) the old-old and (iv) the oldest old' (Jaul and Brron 2017). The oldest-old had been described as the disabled and mostly unable to move and those who are close to death. Christin Hemann (2014) argued that elders have common characteristics about the understanding of discrimination. Erdman Palmore (2001) described that understanding of elders has a stereotype. They believe that their experience and wealth are not depicted or acknowledged well. Many of them think that their perceptions and feelings are not only present unrealistically but also their voices are ignored severely. Robert Butler (1960) criticized the term age and ageism because of its relevance with racism and sexism. Stuart Greenbaum (2010) argued that the ages should be defined with ideas, beliefs, practice and attitude.

Ageing has been analyzed from a different approach. In the active theory approach, Havighurst and Albrecht (1953) explained that the people's perception about the elders such as the retirees should remain in the community during their retired life. They

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conduct community activities, participate in the events and make a meaningful contribution. They believe that this will give them physical and mental fitness and will help to prolong their middle-age. Lemon and Peterson (1972) supported this approach and argued that activity will keep the middle age longer and give them physical and mental satisfaction. This approach was criticized by Birren and Schroof (2001) because of considering physical capabilities, financial involvement and the social resources available to middle-aged people. Schroof (1996) further emphasized the type rather than the frequency of the activities. Thus, the activity theory or approach has little impact on the ageing research in Social Sciences.

The second argument came from the disengagement approach by Cumming and Henry (1961). This approach emphasized the intergenerational connection through the disengagement of adults from regular activities and shifting duties to next adult generation. Gradually, the new adults will take responsibility and connect society forward. A larger group of scholars supported this idea because of adult contributions to society creating new scope and opportunities through their planning for the future. A possibility of increasing life expectancy could be created in this way (Baltes 1987, Back 1980, Birren and Schroof 1996, Adams 2004). On the other hand, Neumann (2000), and Lemon et. al. (19720) had opposed this idea with an argument that this could create an inconsistency in the society and it can make the individual helpless for the society because of socio-economic and other determinants.

The culture-based approach has been discussed by Rose (1965) who argued that aged people always prefer to interact with themselves within the society and their emphasis is on health and mobility than occupation, education and income. This group considered actions of the culture and understanding of the age group in society. McMullan (2000) also argued that older groups should be clearly addressed in the Social Science literature.

In response to previous theory, Havighurst, Newgarten and Tobin (1963) propose a hypothesis that said the satisfaction of quality living is very important for any age and it will help them to build up the personality at old age and consistent living for every adult. Havighurst (1972) considered the task of adulthood on the basis of ‘physical, financial and social decline, contemplating death, developing a personal perspective and their feeling for the end of life’ (Havighurst (1972). He added that finding own group in a new social environment and a comfortable living environment will provide a greater understanding of postretirement.

The perception of the quality of life is based on the positive attitude towards elders by others and that is closely related to demographic features, community and institutional behavioral patterns of the society. Riley (1972) and Riley, Johnson and Foner 1994) emphasized the stratification with an argument that role and status differences are defined on the basis of age group. A similar group has similar experiences, ideologies, attitude, values and social orientation and they understand their life transformation better than others. Life expectancy is very common among similar groups. Uhlenburg (1996), Yin and Lai (1983) supported this idea, as well as Hagestad and Dannefer (2002), expressed that the homogenous and mixed age group can help the society better than heterogeneous groups through the interaction within the family or within the community.

Lawton (1982) placed an argument that successful aging and its function depends on the environment where they live. It is related to many factors such as strength, skill, capacity, and external conditions that are imposed by the environment. On the basis of those elements, the health condition and the satisfaction of old aged people can differ from each other. Wahl (2001) supported this view and he elaborated the relationship between ageing and the environment, institution, residence (home), etc. through his models. J. R. Logan, R. Ward and G. Spitze (1992) identified eight typical characters of ageism such as kindness, happiness, wisdom, dependability, affluence, freedom, internal feeling and political power. He added that some of the aged people enjoy happiness at the aged period than that of their younger period because of their cultural attitude and feelings of stronger mental abilities. Hemann (2014) has disagreed at this point and said ageism is embedded within the workplace, language, media and healthcare and there is a discrimination of Ideas, attitudes, beliefs and practices based on their age.

Katy Gardner (2002) gave an ethnographic description about the senior generation of the Bengali people settling in East London. She analyzed the real-life condition of the understanding of social and cultural boundaries between origin and host countries of the migrant people. Gergen et.al; (1988) explained that old age people generate different types of identities. This identity is based on symbolic, social and liminal. Hazan (1994) claimed that the universal knowledge about the imagery of aging is over contextualized through the circumstances of daily living and the availability of socio-political and economic resources (1994:91). On the other hand, it has been under contextualized the understanding of a *'boundary between life and death*' (1994:92). Thus, different kinds of representation about ageing are present in the policy-making documents, social workers' reports and newspaper features.

The number of the world population is increasing rapidly with the similar ratio of the old age population. Following the United Nations, most of the countries in the world set 65 as their old age line. In Bangladesh, this rate of gradual increase is accelerated by the development of medical facilities and people's consciousness. According to the statistics, 5.18% of the population are 65 years or older in Bangladesh. David Nygaard (1994) predicted that the significant representative of the world population by the year 2050 will be from South Asia. Following India and Pakistan, Bangladesh will be the leader of population density in the world. Following this trend, the public health analysts forecasted a *'older-older age wave*' (Nygraad 1994) in the developed world.

2. Findings and Discussion: Ageing in Context

The primary data sources of this paper were the selected respondents from three localities in Dhaka City; Mohammadpur, Mirpur and Rampura. A total of 21 persons from 21 households were the sources of primary data for this study. Seven (7) respondents had been selected from each of the three areas. The respondents have been categorized into three economic groups in each area. A total of 8 respondents have been found in the category of rich and seven responded were from middle economic status and another six were from the low earning households. In case of educational qualification, eight out of the 21 respondents had the graduation degree or above, four respondents had completed their either secondary or higher secondary schooling, six respondents completed or went to the elementary school only, and the rest three respondents had no educational

background but understand and were able to explain about their lifestyle and the society. In terms of occupation, they are from diversified fields. Three respondents were engaged in manual labor work since their adult ages. A women respondent works as a marketing associate in a company. One respondent retired from the government job and the rest 6 were Housewives throughout their life.

The gender distribution shows that, 8 out of 21 respondents were female. Five out of eight respondents are living with their spouse and family. Three women were widow and were living with the son, daughter, or other family members. Out of these 8 women, three live in Mohammadpur, another three women live in Mirpur and the rest two (02) live in Rampura area of the city. Seven of them are 61 to 65 years old and only one woman is 75 years old. In terms of education, only one woman was graduated from college and others have not completed their secondary school. In terms of health condition, all eight women had mild to severe arthritis problems and six are facing challenges of high blood pressure, three with diabetes and one with kidney disease. The age distribution was very close among the male respondents. The minimum age of the respondent was 62 and the maximum was 75. The male respondents have different diseases at different levels; few respondents have diabetes, 5 had blood pressure (high or low), one was diagnosed with kidney disease and five claimed that they have no severe problem with any disease. They face some minor health problems that are either ignored or not diagnosed.

2.1 Perception of Ageing

The respondents considered ageing as a parameter to classify old and young people. That is a little difference in their understandings in terms of physical activity, structures, and looking condition. They emphasized numerical age, physical structure and stamina. As Abdul (62) explained '*a person with 60 years of age could be assumed 40 or 50. The involvement of daily activities, enthusiasm, happiness and a peaceful mind could create an impression of younger than the real age'*. Ahmed (67), a physician, explained the relationship between the living condition of the seniors and their cognitive and psychological pressure. Limiting of the surroundings can affect mental health. His viewpoint is '*a healthy age rather than age with the disease is important and expected, and it is possible to keep a healthy age by maintaining physical fitness, active metabolic activities, well-planned daily life, a comfortable simple lifestyle and worry-free life*'. A common concern of the respondents was health vulnerability. A unanimous response from them was '*disease comes with age'*. The physical decay and imbalance come up gradually with the age. In some cases, according to their views, the functionality of the organs weakens with age, the function of the heart, liver, kidney, stomach and other parts loses its functional capacity and some of the organs are not viable at age.

2.2 Physical Limitations

Respondents identified hearing problems (presbycusis) as a common physical limitation among the elders. Only two of the respondents had used hearing aids for their listening. In general, the elders have this problem very commonly followed by speaking. The hearing problem is a significant barrier to the quality of life. The speaking and listening problem limit their role in the public meeting and gathering where they are used to

interact. Socialization is very important for old people but the hearing and listening problem creates a difficult situation for them.

Vision loss is another problem for the oldest people.16 out of 21 respondents use spectacles for their vision correction. It is very common that people will lose visual capacity (*presbyopia*) with their age. Visual impairment is common in human life at an old age. They cannot go out and they cannot walk at night. Dizziness (*vestibular function*) is another symptom that has been found among the respondents. They cannot stand or walk in a place for a long time or they cannot do any work smoothly with their full physical capability due to infrequent dizziness. Most of the respondents acknowledged this problem and they try to overcome it with their sense of work.

Memory loss is common among the oldest respondents. They forget most of the daily routine and events in their lives. They even forget the people's names, navigation of any places, and confusion on common faces, mismatch social relations, forget the incidents, maintaining time, sequences of works, and forget to do a proper job at right time. On the other hand, many of the respondents remembered everything accurately and they have a sharp memory. Many can recall past experiences very quickly than others.

The respondents are facing challenges with their speaking capabilities. With the age, they are losing normal talking speed. In most cases, it is difficult to find out the proper word in the proper context and time. Two respondents found trying to continue talking but they were repeating words again and again, which means word-finding difficulty (*slower processing of vocabulary*). At the same time, it was found among the few respondents that they are talking too much and very frequently. They go out of context and start talking which is not totally contextual with the event or situation. Both phenomena are very common among elders. They believe that it will happen because of age and their physical features. The respondents very much care about that but they are accusing their ability which is very natural.

Common problems among the elders are falling and difficulties of daily activities, walking on an uneven walkway, moving at ups and downs, etc. The balance of the body is important at this age. Many elders are facing difficulties to move flexibly. Muscle and joint pain is a very common problem for them. 4 out of 20 of the respondents said that they had the experience of falling once or twice in their aged life. The other respondents said that they have fallen more than twice in the last year which created their problem. They went to the doctor because of some physical problems from those incidents such as losing sense (faint). The stair is another problem for the seniors. Most of the apartments or personal houses have stairs but those are uncomfortable. Going to the mosque five times a day means that they had to go through the stairs many times. A common feeling is that the stairs are not familiar to them. Most evidently they claimed that in many of the houses there are tiles on the stairs that are really difficult for them to climb up or go down because the tiles are very slippery for them.

The respondents identified the decline of muscle mass and decreasing strength. According to their views, immunity, food habits and changes in diet are responsible for it. As Altaf (65) expressed his condition by saying '*due to decaying physical conditions, I am not able to eat anything as I wish, food habits depend on my physical condition, the type of sickness and the medicine I take. The immunity system does not work as it was at*

my young and adulthood'. He added '*the digestive system is not working well. It is difficult to digest any kind of food especially with different types of masala. The quantity of food reduces as well'*. Among other respondents, food restrictions are very common and defined in most cases. Hard and nutritious food reduced considerably. On the other hand, many supplements are added to their daily intake as needed. Vitamins are very common for them. It is very common to reduce the appetite because of taking different types of medicine for diseases and physical difficulties. Lutfa (62) expressed her frustration over the supplement and medicine, '*my stomach became a pharmacy; I am taking 12 to 15 medicine a day in addition to vitamin and calcium supplements. There is no way to take food that I like to eat*'.

The healing process is very slow for seniors. If there is any wound or injury at this time, it is difficult to recover quickly from that illness. Most of the seniors reported that they are very careful about being injured. If they injure once, it takes a long time to recover because of the slow immune and digestive system. Recovery process takes a longer time than that of the young and usual adult people can take. In many cases, they have to take medicine for increasing acidity besides other medicines. Taking different types of medicine creates problems in their digestive and immune system, influences their hormonal conditions and physical activities. At the same time, this has definitely impacted their healing process of any wound or illness from injury.

Respondents expressed that their walking capability has been reduced at a significant level. While they were young and adults, they did their job to distant places but now they cannot go anywhere except walking around the house or very close to the house. Altaf (62) said, '*my walking capability has been decreased gradually in terms of both speed and distance. I need some help if I want to walk for a long time. Even I try to walk slowly but cannot walk much. I walk less than a mile per day. I calculated this distance by going to the mosque and shopping areas from their house. I cannot even think to go to the park or any other place because of a lack of transportation. If I want to go there I need transportation*'.

The walking capability and speed is declining due to the structure and function of the muscles, bones and stamina changed by the age. If aging is correlated with the diseases, then these problems are enhancing much higher. If they walk speedily then there is a possibility to fall down or dizziness, risk of imbalance. Ahmed (65) said, '*if I go longer, it creates some problems in breathing and pain in muscles. It is logical for me to go to the mosque or to the shopping areas and walk around there but I cannot go for walk as exercise because that creates leg and muscle pain*'. To consider the difference between walking for a shorter and longer time, according to the responses, after working a few minutes, they feel uncomfortable and become unable to walk more. Only two female respondents have the experience to walk to distances very frequently because of visiting their relatives. They live in Dhaka and visit relatives each year. After arriving at their hometown, they walk for a long time.

The incapability of going here and there, walking, moving from one place to another, etc. are very infrequent mobility problems at old age. It is common among the elders that the mobility problems increase gradually with their ages. On the other hand, it is expected that people will walk more to keep them capable, physically fit and active. A common complaint from older people is that they are not getting any scope and space to walk. This

has a negative impact on their healthy life with physical fitness. Many respondents were blaming and complaining that their relatives and family members are not inspiring them to walk more because of their afraid of falling problems. Thus, they get a little help from the family members in this case. The family members inspire seniors to do physical exercise. Most of the older males said that the family members are thinking of going to the mosque and return from there is enough walking for them at their age. The distance between the mosque and home in many cases is less than 100 to 200 meters. So, if they go to the mosque five times a day, from 500 to 1000 meters distance they can complete.

In case of the desire of walking or mobility, the elders said they want to walk more especially every afternoon to visit their friends of the same age and meet others such as relatives and their friends. They want to go to the restaurant, tea stalls and parks nearby or even open spaces or they can talk with their friends. The problem with the family members is that they are not sure about the security and the risk of their health there. So, the family members do not approve them moving from here and there without the consent.

Visiting doctors due to personal problems such as physical injury, internal problems, etc. are very common among old people. Few elders said that they have visited physicians only two to four times a year. Six respondents went to the hospital for treatment or taking a prescription from the physicians about 4 to 6 times a year. It was very common to visit a hospital, clinic, or doctor's chamber about 10 to 20 times a year by old person. Two rich elder visited clinics or hospitals more than 25 times the last year. Visiting hospitals is a very tough job in the context of Dhaka city where the patient cannot move alone. They have to take one or more than one assistant as an attendant with them. Sometimes, they need a person who can talk to the physician, has little knowledge to understand that disease, instructions of the physicians, can conduct the medication procedures. Visiting a physician, clinic, or a hospital is not a separate incident but it is followed by several laboratory tests and buying prescribed medicines. Considering time, visiting a doctor takes more than 2 hours at least which can take up to 4 hours. It is commonly said that taking an old person to the hospital or clinic is a matter of day including talking to the physician, taking laboratory tests, showing test results to doctors, getting prescriptions for medicine and buying medicine, and returning home. Traffic, money and time management become more expensive in a single visit. Sometimes, there are follow-up visits as well. If there is a follow-up visit, it makes a terrible situation for the family where there is an older person with sickness. Among the respondents, 8 out of 21 had the experience of being hospitalized for a long time. Everyone had been hospitalized at least once. 4 had been hospitalized more than 3 times in the last year and four others were hospitalized twice in the same year. Two older people visited the hospital and stayed there for more than a week last year but the others have not been hospitalized recently.

2.3 Diseases and Disorders

The male respondents opinioned that most elders are affected by urinary problems, especially, their prostate and bladders are not sterile urine accordingly. *Euromax (tamsulosin hydrochloride)* is a common medicine is taken by seniors. Bacterial infection is very common among men and women. Besides, they need to take different types of antibiotics and antibacterial medicines.

The seniors are very much frustrated over their cardiovascular diseases. It is a common complain that the rate of this disease increased very quickly and they are suffering severely. Two or three decades earlier, they hardly heard that the seniors are affected by cardiovascular disease. Now, it is very common among seniors and in some cases, many adults and young people are suffering from this disease. They are complaining about food and other facilities. The food they are taking is not appropriate to keep them healthy from cardiovascular disease. A 73 years old respondent, Rahman said, '*My parents and grandparents were not affected by this disease even I did not hear that there is a disease named cardiovascular disease (Hridrog) and which is taking people's lives in a significant number. Nowadays, it is very common and I and other sufferers are taking the medicine for high blood pressure, hypertension and cholesterol*'.

Hypertension is one of the common chronic diseases among urban seniors. It creates problems for their mental strength and everyday workability. Most of the seniors are suffering from hypertension. Not only everyday activities of the seniors are affected by hypertension, this also contributes to the decay of bones and creates many other problems which are considered a common disease among old people. The experience a very stressful life for their everyday dealings most of which is created by hypertension among themselves. After all, the least of their thinking is considered reasonable and the social reality does not approve it. It was observed that the seniors do not want to wait for anything after ordering or saying something. Tolerance has been reduced at a significant level. That is why; they become very hypertensive every day. Usually, most of the seniors are waking very early in the morning and they want everyone to wake up in the house at the same time. Besides, they want everyone to do their duties as quickly as the seniors are thinking about it. But the reality is that other members of the family are not thinking in the similar way the seniors are thinking. That is why; the difference in thinking between these two groups is very common.

Most of the seniors are suffering from osteoarthritis or arthritis. It seemed a common chronic condition among elders to have joint pain, knees and ankle pain. A common trend is increasing bone decay. They claimed about the poor habit and the quality of food. They assume that the lower quality of the dairy products they intake is not working for their body properly and they are getting the worst bone density. Among 21 respondents, 18 are suffered from mild to severe osteoarthritis. They take it as their usual complaint of age or seniority. They are very much afraid of moving from one place to another, going through the outside roads and walking through pavements. They are also afraid of walking in a low-light situation. If they become affected once it is very difficult to recover for their age and proper treatment.

It was very common among the respondents that they are not getting proper supplement extracts of calcium tablets from the doctors as medicine to recover from the arthritis problem. The alternative treatment is physiotherapy which is given very common but very expensive. Most of the seniors are unable to take this therapy because of the cost. 30 minutes of physiotherapy costs 400 to 600 taka. If an older person takes therapy 3 times a week, the physiographic cost is 1200 a week and more. Sometimes, it goes up to 5000 a month. Considering the problem and importance in the family, everyone wished to expend the money but it limits by the total income of the family. That is why; calcium supplement becomes their best alternative in most cases. Ironically, it is the common

complaint of the seniors that calcium supplements are the poor treatment for this arthritic problem.

Most of the respondents are suffering from osteoporosis. Osteoporosis is represented by bone decay and loss of bone density with aging. Usually, this starts at 65 years of age but in the case of the respondents, less than 60 years or even young are also suffering from this disease. 7 out of 21 respondents are severely suffering from this. Only four respondents said they have no problem or they are facing the mild problem of osteoporosis (*osteopenia*). The medicine they are taking is very common such as calcium and different vitamins from the different pharmaceutical companies. Most of the respondents are taking one tablet a day and a few of them are taking two tablets a day.

Diabetic is a common disease in Bangladesh. Most of the seniors are suffering from diabetes. It is commonly understood among the people of Bangladesh because there are many hospitals for the treatment of diabetes. A general understanding has been established that now it is very common for older people. It is related to the lack of insulin which regulates blood sugar levels. To manage blood sugar levels, diabetic patients need to take insulin.

2.4 Mental Health Status: The Seniors at Home

Mental health status is a determinant for old people. Without it, it is difficult for them to survive in everyday life. Most of the respondents expressed their frustration over this. Even if they have confidence in their mental ability and understanding with other people, they face confusion among the people around them. Many things are happening around the old people in the family and in the community which influences them to keep their minds peaceful. A respondent named Kasem (62) said, '*my mentality is influenced by the incidents regarding my work, health and earning, wellbeing, health condition of other members of my family, the economic situation of my family, problems with the other families and neighbors, socially unstable situations, etc'*. They face good psychological pressure from their own problems. The problem arises from the sharing condition in their daily life. Lutfa (62) expressed her opinion as '*I cannot share my opinion and feelings with others including family members and community friends. My voice is always undermined by others. Nobody wants to listen to the experiences and examples that I gained and explain from the real experience of society. It is common that I cannot visit my relatives very frequently whenever I want. I have to depend on others' opinions, time and will'*. Few elders faced problems with household appliances and devices. Using cell phones, remotes, washrooms with modern facilities give them difficulties. Altaf (65), Barek (72) and Islam (61) said the common words, '*we are not familiar with the new technology and new stylish washrooms. Traditional devices are better for us. But the family does maintain both together. It is difficult for us to use a remote-controlled TV, smartphone, and we need to ask others very frequently*'.

Staying home for a long time is another problem for seniors. If the family members are going for an outing, shopping, or any other activities then they keep the seniors at home. Thus, seniors have limited access to go to different places. This is a health risk. Staying home situations gives them mental stress and they feel it as a barrier to their everyday life. The seniors are not accompanied by family members during visiting relatives. Ahmed (61) said about his condition, '*it is my family members who decide about me that*

I should go or not, this gives me pain and depression. My family members never wanted to listen to my feelings and attitude. Sometimes, my movements are strictly controlled. It is not an expected experience at old age'. Though, the family members are expressed their concern about the health risks of Ahmed in his late 60s. Another phemeron of the seniors is that they are feeling stress when the family members are thinking of them as a dependent. A respondent Islam (61) said in this context, '*considering a dependent means respect is not enough. When I was an adult, I did everything and earned a lot of money; even I had the house by my name. Now, they are thinking it was my duty to provide all facilities'*.

Seniors are disappointed about ignoring their idea and direction by the family members who are very beloved to them. Sometimes, he is considered as the least evaluated person or his suggestions are not taken into consideration by the other members that give a good pressure on his understanding of society and culture. Seniors used to do everything as quickly as possible and his temper becomes much impassionate unless that is done. It is very difficult for seniors to be tolerant all the time and understand the problems of the society which they did not face at an early stage. They cannot think that change is so quick according to their values and customs. The obeyed social regulations have been changed which is not expected of them.

Many of the seniors expressed their pleasure in the family environment. This is not only a matter of earning or economic solvency. Irrespective of cases of rich middle or poor families, happiness is present among the seniors where they get respect from the family members or the family members are valuing seniors as their guardian and used to listen to advice keenly. They share their views with the seniors at home and every day they explained and expresses the incidents that they observe, examples from their workplace or from the places they travel and move around. A respondent named Islam (61) said, '*I am happy because the family members are asking me for the decision and accept my views mostly'*. Two respondents expressed their confidence that they can take decisions solely and the family is maintained by their own decision. Nobody denies their decision until now.

As senior citizens, many respondents expressed their pride according to their age. They believe that it is better that they got seniority over the other family members and their position in their family is as a respected person. Amin (61) said, '*it is a cycle of human life and the role I play in the family is obvious and it should be as is. I am proud of my family and my current position as a senior. I believe that the family I have formed and taken up to this shape is one of my good deeds in this world. I am happy with this and believe that this system will continue up to the end of this world. As long as society remains, the family will continue in this space'*. On the other hand, many seniors are thinking this age is the last part of their life. It is painful for them because they think the age limits their scope of contribution to the family. If they would get more time, they would contribute more to the family. They had a lot of things to do for the family but they did not reach the target. This situation gives them a little frustration for the age.

Most respondents were found very depressive after thinking about their past including the scope and opportunity that they had to develop their life and contribute to their family, country, or society. As Motin (68), a rich person in the locality said, '*I did not use full stamina, ability, and confidence for society and the family. Now, I understand the value*

of time. I cannot back to the past. I am depressed about the past because I lost a good time that could be utilized for me, family and the community'. Latif (65), another respondent expressed, '*I have nothing to do now rather the witness of the incidents in society. I lost physical, social and psychological confidence and ability to do better in society*'. Very few of the respondents (only two) had expressed their view that they had done enough for their family, society, and the community and they are satisfied with their activities. The other respondent reacted on this that they could do far better if they would utilize their time, though they are not unhappy after believing their fate as a part of life. They believe that even they would try more; they could not do better than this.

The respondents are agreed on happiness and wealth. There is a contrasting relationship between these two categories. There is a difference between rich and poor but there is no difference between happiness and wealthiest. Many poor elders explained their life well, full of joy and happiness. Many rich seniors had expressed their satisfaction over financial solvency and unhappiness. Few respondents expressed their concern and position over their past earning and now their position did not make them happy. Earning a lot of money by the primary members and expensed by others is common. The seniors get less attention from the rich children and members of these families. Most of the family members are busy with their future and work on expanding wealth. One respondent, Monirul (77) expressed his depression, '*I earned a lot of money and have many houses in the city, but now my children and wife are thinking about expanding their wealth but they are not taking care of me or even they do not have any time to talk to me at all. My money and wealth are not working for me rather isolated in the family'*. Barek (72) belongs to a poor family who has five children and lives with his sons. He expressed his happiness, '*children are always waiting for me at the food table/(dine) and discuss for every decision over their livelihood*'. By comparing those two examples of two opposite economic status groups, it is difficult to say which one confirms happiness among people.

Isolation and loneliness are found a greater problem for elders. It is a crucial time when they need accompany of family members, relatives and friends, but the elders stay out of enough contact with the members of their own community. Interaction with others becomes very rare. It creates socio-psychological stress. Views and ideas cannot be shared with others. In some cases, it was observed that the family members try to ignore an elder continuously that could fall the senior into loneliness. Simultaneously, the gaps with friends and community members can create such conditions. Interaction is part of everyday living in society is a necessity for human beings. An elder keeps firsthand interaction with the family members. It is important for elders to talk and share their feeling with the family members every day and each moment. Integrating the social surroundings can help the elders to get rid of isolation. Jahanara (75) narrated her situation as '*the members keep themselves apart from elders with difficulties during family time. This is significant isolation from the family. They do not share the pains with me on time but I come to know it later, it becomes more painful'*. An absence of cooperative interaction between elders and the young members of the family creates a definite isolating situation for the elders. The contact among the elders especially males is welcomed by themselves. The concept of an age-friendly community is found as a vital social need of the older members of society to keep them healthy and active both physically and mentally.

The rich are at the top where seniors are isolated from the family in terms of their economic status because the young boys and girls are busy with their works, economic solvency, and the future of their future generations. In the case of poor families, their vision is not too far and they are not thinking much about their future, rather they rely on fortune. That is why; they have a close tie with their senior members of the family. The case the isolation is happening in the case of the middle class because they do not have enough space to reside all members of the family together. They are always job-oriented and running here and there. They also live in different places, thus, their physical existence is isolated from the part of the family members but their social bond is stronger than others.

3. Conclusive Remarks

Ageing is the constructed phase of human life beyond a numerical figure in years. The aged evaluate their deeds and performances in past with the hope of healthy and peaceful life. The social environment they lived in becomes different from their usual understanding. They are facing challenges of vision, hearing, movement, immunity as well health problems created by diseases. Many aged can make new friends at this stage and share their views and ideas and some find other ways such as engaging in community works, working for religious institutions, social work, local politics, etc. Most elders recall the memories of their childhood and try to share the joys of their earlier ages, recall their parents and beloved whom they lost and have their emotions with them. The most memory concerns with the remarkable events of human life: the birth of a new member, losing family members, memorable days, crucial life turning incidents, sickness, loss of parents, siblings and spouse, and worldly events. Considering the above discussion and information of the respondents, some policy issues is considered very relevant to the senior citizens such as creating easier access to physical exercise, managing healthcare facilities of older adults/seniors, establishing a community or home-based care for the health and social needs, creating social engagement opportunities and arrange community-based cultural activities. The opportunity shoul be increased to the new connections with the ageing communities, new institutions that are serving them, and new activities that are advised, inspired and permitted them to do.

The elders try to share their ideas about life and society, socialization and people's behavior, the future of the children, works, and experiences during their adulthood. In many cases, the successful elders try to adapt to every new situation, enjoy the new setting. On the basis of economic conditions, social status and cultural traits, the images and experiences differ from each other within the society. There is a definite difference between rich and poor elder persons. The sharing and caring of the social work according to their personality is the basis of class, rank, power and dominance in society. Society is very much careful about its members but there is an unequal performance in the case of the aged, for example, there are some special foods for children but no special food for seniors except the physician's diet prescription and restriction. Similarly, there is no geriatric hospital in the country though the number of aged population is a significant portion of the society. Some of the aged are invisible workforce, experienced in agriculture and environmental issues, caregiver of the younger family member through storytelling, caring and helping in their brain development, developing a connection between the childhood and other generations as well as between the family and the community.

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'Life of Uncertainty': Encounter of Childhood in the Brothel

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Abstract: The children living in brothels are susceptible to a range of risks. Some risks are from the physical location of the brothels; some are constructed/caused by children themselves, their mothers and the brothels, and; some are risks constructed/caused by the outside community, broader society, outside institutions like police, political leaders, and the government. In this situation, childhood in the brothel is not adorable rather it is more despicable for the brothel children. They have to face multiple heinous circumstances like accommodation hazard, drug addiction and business, psychological depression, child marriage or weapon of local politics in their juvenescence period which is socially constructed. This process make them untouchable for the mainstream society as well as hindering for their own future life.

Keywords: Childhood, Brothel, Children, Encounter, Life experiences

1. Introduction

The children living in brothel are ostracized from the mainstream society, religion, kinship, local government etc. For survival, the brothel community creates its own society, which is quite different than that of the mainstream one. This is a different world, when anyone enters this world has to forget of outer world as well as has to forget about the past, laws of these area is far more difference from mainstream society. So, living within this society, a child in brothel inherits an "untouchable stamp" on his/her identity, which works very cruelly against him or her when s/he tries to interact with the mainstream society. In this condition, this article will sharply argue that childhood is constructed by the particular socio-cultural ambience as well as it is encompassed by 'uncertainty'. Essentially, due to idiocy or inaction uncertainty arises in partially observable or nonsmooth environments. There is a relation between uncertainty and childhood; when anyone faced with environmental uncertainty, people often respond in different ways depending on their childhood environment (Griskevicius et al., 2013) .

On the contrary, counting this situation it can be interpreted that particular culture has an influential effect on childhood. Though American psychologist G. Stanley Hall (1904) argued that because of biological changes at puberty adolescence people were in the grip of powerful biological changes which they could not control. But an American prominent cultural anthropologist Mead (1928) rejected the idea by claiming that behaviour in adolescence was caused by cultural conditioning rather than biological changes. It also observed that Boas (1912), the father of American Anthropology, stated that the child's

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"mental makeup" must also be affected by "the social and geographical environment". So this article will argue that childhood from brothel children is full of uncertainty as well as unrecognized. In this ground this article will illustrate life experiences of brothel children with different socio-cultural data.

For continuing further discussion, this article will divide into three sections except introduction and conclusion. In the very next section, this article will elaborate the field area and date collection methodology of the research, after that contextualize the paper with relevant literature review, then this article will admit the childhood encounter of the brothel child through different stakeholder's voice.

2. Field and research methodology: A brief evocation

This research conducted in a brothel named Daulatdia brothel which is situated nearby the river port and the rail station at Daulatdia union of Goalanda Upazila of Rajbari district. It is about 86 kilometers far from Dhaka. This area was developed since the British colonial period. That time it was sparkling river port as well as a business hub (Shohel, 2013). This is the largest brothel in Bangladesh. It has its own socio-economic environment, with tailors, beauty shops, cigarette shops, phone shops and food stores and so on. Almost 1,800 sex workers (About 1,400 registered and about 400 non-registered) and 900 children live in this brothel (Asadul & Russell, 2016). In this research the qualitative research methods used for data collection. To understand the situation and issues that children at brothels experience from a holistic perspective, three FGDs have been conducted and FGDs had been conducted with children and adults (both male and female) as well as to receive opinions on situation from an individual perspective, 10 KIIs have been conducted with both male and female children of that particular area.

3. Literature review

As a discipline anthropology has a great attention on conceptualization of 'childhood' and with this continuation in 1970s the anthropology of childhood has emerged as a idiosyncratic field of knowledge in UK. But previously, American anthropologist Margaret Mead pointed children's socialization and cultural imparting process in her theoretical work named culture and personality studies during the 1940s and 50s (Montogomery, 2009). In 'Cognitive Development Theory' Vygotsky's showed that child cognitive development is constructed by society and culture and this development process culture plays a negotiator role (Vygotsky, 1978). That is why different scholars imposed that the experiences of children as well as childhood are determined by certain social and cultural norms, values, history and political economy (Levine, 2008). To understand the childhood, it is important to address the social construction not biological phenomenon (Archard, 1993); have to distinguish between a child and an adult period (Aries, 1982); have to 'break with tradition' regarding childhood notion (James, 2009). In the context of Bangladesh it is difficult to conceptualize the concept of children as well as childhood according to age rather it is understandable as cultural categories of childhood such as *sisukal* (infancy), *balaykal* (childhood), *kaisor* (adolescent), *madhaykal* (middle age), *bridhokal* (old age) and so on (Aziz and Maloney, 1985). Additionally, this is also observed various dimensions of childhood according to gender, age, class, religion and so on in Bangladesh (Blanchet, 1996).

Child rearing is a challenging responsibility for a mother who live in a brothel. Being a single parent, mother has to go through social stigma as well as maintain odd working hours because of her professional nature (Pardeshi & Bhattacharya, 2006). The children from brothel also face social and cultural difficulties because of mother's profession as well as society treat as a social burden (Sircar & Dutta, 2011). In Bangladesh, the children of sex workers are culturally and socially excluded from orthodox society because of their social identity, cultural background and their living environment (Shohel & Howes, 2008). Lack of supportive environment and mother's professional status, at an early stage of life the children of sex workers have to face social negligence and this consequences push them into different socio-cultural insecurities (Shohel, 2013). On the other hand, for the brothel it is a common scenario that children hide under the bed whilst their mothers engage in sex with their customers on the bed as well as girl child become exposed to early sexual activities and have to shear their mother's clients. To do so, girls are given extra food (and sometimes harmful drugs) to make them healthy and attractive by their mother (Khan & Azad, 2013). In the brothel, both boys and girls are experienced to physical abuse, gambling, drugs, and the underworld and their socialization process merged with drugs, alcohol and sex (Habib, Amanullah, Daniel & Lovejoy, 2001; Amanullah & Huda, 2012).

Context of Bangladesh, a lot of scholars work in different brothels to understand the socio-economic condition, health situation, trafficking, education of sex workers as well as their children. Hossain & el (2010) addressed sexual lifestyle and socioeconomic condition of sex workers who live in Dauladia brothel, Rajbari in their paper. They found that most of the sex workers have no knowledge of literacy, monthly income various from six to twenty five thousands, most of them are young and unmarried but among them almost 50% had child. They engaged with this profession because of financial insolvency, willingly or born in the brothel and they have little knowledge about sexually transmitted disease. Khan (2010) described that trafficking is the main factor for engaging one in sex trade in Bangladesh though other influencing factors like education, poverty or unemployment, marital status, geographical area can be counted. Sultana (2015) argued that from feminist pro-sex-work perspectives both sex worker activism and HIV-prevention initiatives find some results and this initiatives emphasized to give importance on individual and collective agency. In her article she showed a relationship between HIV-related discourse and sex worker activism in Bangladesh. Haq & Chowdhury (2012) described the safe sex practices among the brothel sex workers. They showed that overall condition of condom use in brothel satisfactory but bonded (those who are under the control of a Sordarni) sex workers cann't maintain this practice for all the customers because of *Sordarni.*

4. Children life in the brothel: Childhood encounter through life experiences

4.1 Accommodation used as business hub

In the brothel, dwellers rent a room for their living and they share this place with all of their household members. They also use this place as their business hub (take their client in the same room) because the room rent is very high (the rent varies from 6000-7000 per month). One of the respondent said, that *when mothers take their customers in their room then children stay outside and move hither and thither because they have no place/room*

to stay. The foremost victims of this uncomfortable situation are children. It is observed mothers taking clients either leaving their infants unattended or keeping them in the same room with them. Relatively older children (6/7 years old), especially boys spend their time outside the house and they fraternize with different types of people. Many get involved in criminal activities at the early stage of their life and also mothers lose the control over them. This kind of problem is a common scenario in the brothel.

4.2 Drug addiction and business

Drug addiction is a common problem in the brothel. Most of the 10-12 years old children are addicted to drugs. One respondent said, *drugs and alcohol are easily available in brothels. 6-18 years old children are involved in drug transportation and selling. From their early age they are used to see smoking biri, cigarette, ganja, heroine and wine by customers as very common. They often bring these products for customers. Customers make children happy by giving some money. Further, customers give children drugs to take. Both male and female children become addicted to drugs. Female children who are forced to take customer as child prostitutes are the worst victims of drugs as well*. Most of the cases main reason of addiction is acute depression among sex workers and their children. Also, children are regarded as the safe careers of drugs as police do not usually suspect a child. This also provides the children with a handsome income. On the other hand, a sex worker wants her male child start earning money as soon as possible to increase the household income. However, it also observed that most of the children of the landladies and leaders do not face this problem as the mothers can afford to keep them outside of the community by renting a place outside or keeping the children with extended family.

4.3 Psychological problem

The environment of the brothel is not in favor for children's psychological development. Their mental health is fragile because in their childhood they observed that their mothers take different people in different times as sex partners. Sometimes, they have to buy *condom* for their mothers' clients and also sometimes they watch their mothers having sex. These types of exposure cause profound risk for male children. This mental stress in turn compels the male children of the brothel to take drugs and engage in crimes.

The female children living in the brothels become the worst victim of different psychological tortures. First, they experience abusive languages inside the brothels, mostly because of the profession of their mother. One respondent from female children regretted that *have we committed a sin by being born? Why do we always hear, 'you the daughter of a whore'?*. Second, after a certain age, the male children can form a friend circle and go outside the brothels but the female children cannot. If they somehow manage to go outside the brothels again they hear that they are daughters of whores. Thirdly and most importantly female children always live in intense fear of getting involved in sex trade. Therefore, the female children living in the brothels are more psychologically fragile compared to the male children living in the brothels.

4.4 Children used as commodity

In brothels, often a sex worker sells her child to earn money. In cases of pregnancy of bonded sex workers, their *shardarnis* (the brothel managers who rent house and employ

sex workers) also force them (mothers) to sell their children. On the other hand, brothel is a place where selling of children, especially young girls is a common phenomenon. One of the sex worker said that *I had a dream to be a mother. My dream came true when I gave birth to a healthy child. But as I was a bonded sex worker, I had to sell the child as instructed by my owner to a broker. I did not even get a share of the sale proceed as it was divided between my owner and another influential pimp. So, my dream came true to be a mother, but the brothel turned me into a childless mother. Selling of children is a booming business in the brothel.*

In this process, male children are the most vulnerable victims. When a mother conceives then it is difficult for her to take clients as before so she falls in economic crisis. At this stage, they are forced to sell the unborn infant to survive through the months of pregnancy and post childbirth period. In our research we found that most *Chukris* (a young sex worker) and poor sex workers sell their children while the well off and free ones can keep theirs.

4.5 Victim of child marriage

Though child marriage is a common problem in our entire society but it is marked a new dimension of child marriage in brothels. Here child marriage is used as a technique to legitimize sex trade and the victims of this technique are female children. The mother of a female child would arrange a *"marriage"* of her daughter often conspiring with the "to-be son-in-law". She would send her daughter to her in-laws' house. But the she would become victim of physical and mental violence by her husband, in-laws and other community members due to her identity as a sex worker's daughter. Very soon, it would become too difficult for her to survive in the mainstream society. Then the mother would bring her back to the brothel and advise her to start working as a sex worker. At this stage, the daughter has no way so she involves in her mother's occupation. This process actually keep both the mother and daughter content as they can motivate themselves that have tried to live a normal life, but the society did not allow them to do so. Almost similar experienced 17 years girl said that *I am a daughter of a sex worker. My mother married me off two years ago. My husband is a garments worker in Dhaka. I use to live with my mother. My husband used to send 2000 Taka per month to meet my costs. But he stopped sending money after a few months. So that time I had no option so I registered my name in the prostitute book and after some period I came to that basically my marriage ceremony was a puppet show as well as my husband was a puppet and my mother was the show director. Now this is a common phenomena in our brothel*. Additionally after retirement most sex workers try to expose their daughters to the clients. Often mothers influence their clients to abuse their daughters. The older sex workers expect that their daughters will support them in future by registering their mane as sex workers.

4.6 Weapon of local politics

Children of brothel especially the male children are used as a weapon of power politics. The political leaders of that particular area use the children living in brothels for their own business; one respondent said that *political leaders provide patronage and shelters to the children for their own interest*. The children living in brothels are easy prey to fall in traps of political leaders as they are already vulnerable due to the endogenous risks that

they endure in brothels (as discussed above). One respondent said that *female children in brothel are treated as assets and are taken care of, on the other hand male children are left to fend for themselves. Taking advantage of this situation, the political leaders, local influential people and drug businessmen use them for their need*. They (children) do not receive proper guidance, proper economic means and proper family attention. So, at the age of 12-15 they become their own guardian and the politicians take this opportunity to lure them to work for them in exchange of money and power.

4.7 Child labor

In the mainstream society parents try their best to keep their child away from income generating activities in their tender age. But in the brothel context the mothers of the children especially want their children earn money. So they welcome child labor. On the other hand, when a mother cannot provide basic needs to the children then the children try to meet those needs on their own and for this they engage in odd job and become child laborers. In these circumstances, mainly the male children are the main victims of child labor while the girls start working as a sex worker. One respondent said that ....*children (boy) of brothel are involved in risky work such as- work as a shepherd in the cattle market, feeding cows oil cake, chaff and straw. They also guard the cows at night and doing such a work children often get injured by the cow's punch of horn and kick of feet. The children also work as a helper of dockyard and boat worker. They work for transporting and selling drugs*. They also work in port, dockyard, local restaurants etc. Mainly, the children of *Chukris* and poor sex workers are involved in such kinds of activities.

5. Conclusion

Socialization of a child is a linear process. In this process every step is very important. Any disorder of this process ruins a child's proper development. But in the context of children living in brothel, different types of inner and outer social factors interrupt this process. Destruction starts from a mother's womb. They live on the sinful occupation of their mothers, their biological fathers often refuse to recognize them as their children let alone take the responsibilities of raising them. They have to face unpleasant situations to get national identity card because it is essential to mention the name of their father to get a national identity card. In brothels, children live in an extremely vulnerable situation which turns their childhood as a social curse that cannot be easily changed.

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Desperate Time Calls for Desperate Measures: Exploring the Coping Mechanisms of the Rohingyas in Camps

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Abstract: The Rohingyas have escaped one unbearable situation only to end up in other where they barely 'staying alive', and caged up in limited space, with minimal access to social and financial capitals. This prevents them from enjoying a desired 'livelihood' mode since they have hardly any control over any of their livelihood elements. Although 'entitlement' and 'enfranchisement' are preconditions for a livelihood and several International Human Rights covenants, refugee conventions and protocols confirm certain rights and entitlements of the Rohingyas; however, they are unable to exercise those rights. This study explores some of the prevalent challenges of economic activities of the Rohingyas and share several coping strategies regarding their livelihood mechanisms in the camps. The study also recommends certain strategies which can serve them better and simultaneously discourage them to partake in any illegal activities. The findings might be helpful for the Rohingya communities, governments, humanitarian, and development agencies and those in the international community, actively working to alleviate the Rohingya refugee crisis. The outcome of the article is result of a small-scale study carried out in Kutupalong camp only in Teknaf Upazila.

Introduction

Since August 2017, approximately 742,613 Rohingyas have arrived and currently. At present, nearly 1.3 million of them are living in 34 camps in Ukhia and Teknaf Upazilas of Cox's Bazar district (UNHCR 2020). Among the new arrivals, an estimated 6.7% are females, aged between 12-17 years. Several studies depict that this group is highly immobile and are more involved in household chores compared to the males in the camps. Although various educational and skill training programs have been offered by national and international NGOs in the camps, this group is deprived of education that could have made them earn some skills that again could be used for gainful employment inside the camp. Additionally, womenfolk are often subjected to trafficking and forced marriage not only in Bangladesh but also abroad. Several media sources reported on these matters in the past. Education for the Rohingya females is of paramount importance because 'useful' education should prepare them to 'take responsibility of their own stuffs'. Whatever types of education (formal and informal) they receive in the camps, these do not contain any skill training therefore womenfolk have to depend on the community to cope up with external stressors coming from traffickers and often from their own family members. This study finds that among many tracks in the prevailing education system in the camp, the UNICEF approved Nonformal Primary Education (NFPE) model has been widely applied in grassroots educational development in

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Bangladesh in the past, which could be of some value for the females in the camps. It is a popular and economically sustainable model which is led by BRAC (Bangladesh Rural Advancement Committee), Grameen Bank and their partner NGOs. The NFPE model is also customizable, meaning it can include skill training, low-resource-intensive, and locally grounded.

Aims and Objective

This study would highlight economic hardship and related coping strategies of Rohingya females, considering their cost of living in camps, income sources and indebtedness, livelihood challenges of single mothers, and dowry payments for marriage.

Research objectives are:

i. To explore the major economic crisis of Rohingya females in the camps.

ii. To share the strategies they adopt to meet the existing economic challenges (i.e. coping mechanisms).

Methodology

This study was based on a representative survey of 150 camp households and 25 in-depth interviews with selected camp residents in Kutupalong camp. Respondents were asked to share information about their livelihood strategies within the camps. Field research was conducted in two phases: phase one (January 1-15, 2021) and phase two (March 1-15, 2021). Collected data was analyzed through qualitative software (nVivo12).

The research team was composed of two researchers (one from JU, one from Conflict and Resilience Research Institute Canada-CRRIC) and 5 students from JU. Survey forms were first developed, followed by semi-structured questions for the qualitative part of the research. The quantitative data (numbers) was stored in MS Excel while qualitative data recorded and transcribed into English. Two interpreters helped in transcription. Mixed methodology was used to collect and analyze the data. A detailed coordination was done through Camp in Charge (CIC) prior to field work.

Study area

Rohingya camps are located in Teknaf of Cox's Bazar district, Bangladesh. The study was conducted at the Kutupalong camp.

Result and discussion

Livelihood is defined as "a composition of capabilities, assets (including both material and social resources) and activities required for a means of living. A sustainable livelihood refers to the one that can cope with and recover from stress and shocks. Additionally, livelihoods should also maintain or enhance its capabilities and assets both current times and the future, while not undermining the natural resource base" (Chambers & Conway, 1992). Even after 3 years of the massive exodus in 2017, there is still no visible effort on the repatriation of the Rohingyas to Myanmar. With the bi-lateral initiatives nearly failed and the multilateral actions almost having not results, the Rohingyas continue to live and adapt to the lives in the camps. Despite having to come to

Bangladesh for a seemingly short time, they are getting more entrenched into the camp environment. Since their arrival, they have been supported by the government and local NGOs to meet their basic needs. However, with the passage of time, the Rohingyas are gradually seeking various unconventional methods to earn their livelihood. It is now common to witness sprawling grocery shops selling a wide range of products within the camps. According to the initial fieldwork, there is a growing demand for such goods from within the camps as the small businesses are becoming more popular amongst the Rohingyas. Although this is a single and simple aspect of formal business through which livelihood is earned, there are numerous not-so-transparent and illegal businesses (including drug and human trafficking) which are becoming lucrative options for earning money. Partaking in such activities is a coping mechanism of the Rohingyas given they see no immediate end to their situation.

Economic Hardship

The living conditions of the Rohingyas are characterized by two main features, an absence of the 'freedom of movement' and 'absence of the right to work' as they deem fit. Given these two prevalent characteristics, it is deduced that the Rohingyas are pretty much a 'ghettoized' community with no entitlement to land of their own from which livelihood can be earned. The internationally approved principles of human rights include freedom of movement, right to work, and citizenship and identity. Although there is an abundance of information on the camp life of the Rohingyas, however, this particular section, specifically focuses on micro social organization - the households - and families therein who seek for a household-based solution to livelihood crisis of the Rohingyas.

Back in 1993, the Government of Bangladesh signed a Memorandum of Understanding (MoU) with UNHCR. One of the most important conditions in this MoU was that 1) refugees should be restricted to the area of the camps, and 2) should refrain from engaging in economic activities [HRC, 1999] (Office of the High Commissioner for Human Rights, 1999, p. 9). On the basis of this agreement, Rohingyas are bound to live under restricted movement and space, which indicates the absence of freedom of movement. Even though several international instruments including the International Covenant on Civil and Political Rights (ICCPR) that Bangladesh is a signatory to, do not suggest curtailing the right to earn livelihood as Rohingyas seem practical. According to the Human Rights Committee, once the foreign citizens' and aliens' status is regularized, they have the right to move freely. If 'registration' is considered as a regularization process, in that case, the registered Rohingyas are being deprived of this right to a large extent.

The *Freedom of Movement* of the Rohingyas is prohibited by a special government order. However, this restriction has detrimental consequences ranging from lack of self-worth, self-esteem and confidence leading to stress and trauma, mental health issues and the subsequent loss of human capital that could be used to engage in meaningful livelihood earning scheme. Although refugees are entitled to seek a one-day pass to go outside camps for movement or medical care or for visiting other refugees in other camps, passes for more than one day are rarely issued. By policy, the passes should be provided free of cost, however, in practice, refugees are often charged for the passes. The unregistered stateless Rohingyas may enjoy better freedom of movement since they do not require

official permission for movement. However, this freedom involves the high risk of being arrested and jailed under the Foreigners Act, which implies their complete confinement as neither can they apply for passes, nor do they have any legal means to go out.

Desperation for a better life often forces the Rohingyas to adopt high-risk measures. From 2012 to 2015, more than 170,000 people travelled (unsafe route) by boat to Thailand, Malaysia, and Indonesia from the coasts of Myanmar and Bangladesh (UNHCR, 2015). Given their 'stateless' status, they are unable to apply for visas and end up risking their lives by bribing human traffickers and corrupt officials with their hard-earned money to move to Thailand, Malaysia, Indonesia, and Philippines by sea. In 2015, a 10-member family with children desperate to row across to Thailand became stranded in the Andaman Sea with no food and water (BBC, 2015). The Human Rights Watch (HRW) recorded that many of them, upon arrival at the coast of Thailand, were pushed back into the sea by the patrols and Thai Coast Guards. The HRW advocated the Thai authority to display humane values by sheltering the stateless Rohingyas (Phasuk 2017). By 2015, "around 2000 people died because of hunger, dehydration, drowning and beating by smugglers or traffickers" (ERT 2017:83). Except only a fortunate few who enter the mainland, most others become arrested and thrown in different prisons and detention cells. Many fall victims to extortionists and goons asking for ransom money from the captive's relatives. Evidence of this was reported back in 2015, when police discovered 30 mass graves of the Rohingyas killed by their traffickers and buried in deep jungles around the Thailand-Malaysia border (Hutcherson & Olarn, 2015). Active transnational criminal networks pry upon the vulnerable Rohingyas, since they are easy to manipulate and are sources of making large profit by trafficking. According to UNHCR estimations, this illegal trade garnered around US $100 million in revenues at its peak (UNHCR, 2015). It is also reported that around 50, 000 Rohingyas possess illegal travel documents and now live outside Bangladesh (Bdnews24.com, 2015).

Desperation might lead to violence in and outside camps. As mentioned before, as per the 1993 MoU between UNHCR and the Bangladesh government, income generating activities are strictly prohibited within or outside the camps. This condition contradicts with the natural human desire to strive for livelihood and innovation. Since 2018, there has been a proliferation of shops in both Kutupalong and Balikhali camps including the establishment of several markets inside the camps. UNHCR is to establish new markets in 2019. As 'livelihood' is a contested term in policy making circle in Bangladesh about Rohingyas, the UNHCR chief Filippo Grandi expressed his concerns of ignoring 'livelihood' as he said, "Rohingyas should have [at least] the minimum access to livelihood. Otherwise, it is very risky to create a dependent population'. In April 2019, the government issued a notice to close the jewelry stores in an effort to halt income-generating activities. UNHCR and NGOs including BRAC, administer a variety of skill-development projects, specifically focusing on homestead agriculture inside the camps.

Livelihood challenges

Livelihood assets encompass all cash and non-cash properties, savings, investments, and capacities and opportunities that make livelihood secured. Assets comprise five capitals: 1) *human capital* meaning skills, knowledge, health and ability to work; 2) *social capital* i.e., social resources, including informal networks, membership of formalized groups and

relationships of trust that facilitate cooperation and economic opportunities; 3) *natural capital* signifying natural resources such as land, soil, water, forests and fisheries; 4) *physical capital* delineating basic infrastructure, such as roads, water & sanitation, schools, ICT; and producer goods, including tools, livestock and equipment; and 5) *financial capital* meaning financial resources including savings, credit, and income from employment, trade and remittances (IRP-UNDP, 2015, pp. 1-12). In recent years, development activists also add a new attribute—*political capital*—access to, control over, decision-making capacity and participation at the micro-level such as household level, and transparency, accountability, good governance at macro development contexts which usually involves many partners and stakeholder such as public-private partnership *per se*.

It must be noted that assessing the livelihood of the stranded and marginalized groups like the Rohingyas are much more complex since they do not have any social organization and are continuously forced to live under pressure of further displacement and uncertainty. For them, livelihood is more of a constant struggle for mere survival rather than making efforts to uplift their current living conditions. As a survival instinct, the first priority for a Rohingya is to live, followed by making efforts to secure the lives of the immediate family, which may include children, spouse and parents. Therefore, a 'household' serves as the most effective and efficient micro social organization to their survival strategy.

People's access to favorable conditions, as well as their confidence and strength to adjust, adapt, and cope with new surroundings, especially in unpleasant, abrupt, and unplanned changes, are all part of the livelihood context. In particular, livelihood contexts refer to: 1) Social relations: how gender, ethnicity, culture, history, religion, and kinship influence the livelihoods of different groups within a society. 2) Decision-making processes, civic bodies, social standards and norms, democracy, leadership, power and authority, and rent-seeking behavior are all examples of social and political structure. 3) Governance: The structure, power, efficiency, and effectiveness of government systems, as well as rights and representation. 4) Service delivery: The efficiency and responsiveness of government and private-sector entities providing services such as education, health, water, and sanitation. 5) Resource access institutions: the social conventions, customs, and behaviours (or "game rules") that govern people's access to resources; and 6) Political policy and processes: the procedures for determining and enacting policy and law, as well as their implications for people's livelihoods (IRP-UNDP, 2015).

Surviving strategies

As Livelihood strategies refer to how people organize and plan their actions and strategies to access and utilize their assets. Devising a strategy in this case entails combining social, economic, political and environmental contexts. In order to strategize, one must take into consideration the diversity, analyze the variety of livelihood choices and attempt to reap the maximum benefits through an action plan. The planning integrates individual needs, and best ways to meet them. On a micro-level, the basics of livelihood strategies begin with the family or household through financial budgeting and division of labor.

Livelihood vulnerability represents inability of the Rohingyas to cope with calamity, disaster, and adversities using their own means. The livelihood strength refers to being able to come up with productive outcomes by successfully overcoming adversities, not by

avoiding shocks and stresses. Humans are vulnerable to natural calamities like seasonal floods, landslides, drought, famine or other disasters like accidents, fire, unprecedented violence or even introduction of a new technology and many other unforeseen and untoward adversities. Livelihood vulnerability, therefore, needs to be analyzed and considered in any livelihood development planning. Appropriate livelihood planning and strategies make a population more resilient to shocks and seasonal changes since they are predictable and prepared. This calls for attention to many forms of accommodation, adaptation and adjustment in line with available resources and capabilities.

Livelihood Interdependencies is an essential ingredient of any livelihood system. 'Livelihoods is interdependence' (IRP-UNDP, 2015, p. 12). Inclusivity lies at the heart of livelihood interdependencies since it is almost impossible for livelihoods to exist in isolation and exclusion. The principle of social inclusion is to encompass a wide array of prospects, which may be commonly overlooked or remain unexplored. The interdependencies include broadening the horizons of communication, outreach and stakeholders of diverse nature as a means to cope with shock and adversities in livelihood planning.

Rohingya refugees present a gross denial of the above conditions. Our focus group discussions revealed a Rohingya perception of the presence of 'lies' in every aspect of social organization. This overarching use of the word "lie" represents both a deepest frustration and an acute hopelessness, implying that all the promises of the governments and the NGOs are made to be broken. Many Rohingyas describe their entire life and life-cycle as a farce, and consequently, the course of refugee life they are forced to embrace is 'a lie' as well. This acute negative perception of the worldviews may lead to intense mental health problems and debilitating life-long trauma. Their self-evaluation of the life-cycle makes an impression that they do not have 'livelihood' but 'livelihood', a state of living in a constant circle of lies.

Rohingya's resilience, problems, and problem-solving suggestions: An anecdote

Since the 'livelihood' approach is widely considered an effective tool for policy analysis, this discussion of social organization utilizes it on policy-focused grounds. When the Rohingyas arrived on the camps, their life took shape of a disentitled and disenfranchised social organization as compared to their historical-cultural Rakhine livelihood of peasantry-fishing, which was their usual life despite systematic political exclusion and being stripped off citizenship rights in Myanmar.

The complex survival experience of the Rohingyas in the recent past decades in Myanmar and post-exodus prison-like confinement in refuge has significantly shaped their responses to their host country. The denial of their economic right, freedom of movement and citizenship and identity spark their responses to five refugee social organization dynamics which, in brief, are: 1) crisis response dynamics, 2) camp dynamics, 3) camp administration dynamics, 4) livelihood dynamics, and 5) livelihood problem dynamics.

Rohingya livelihood dynamics: As described by a Rohingya woman, their livelihood is "as fragile as living in a cracked glass window". In absence of the three important aspects of livelihood that set motion to six capitals, and assets and capability mobilization it is

evident that the Rohingyas do not meet 'livelihood 'conditions. Rather, they are forced to live within a compromised social organization. This social organization is far from ideal and is often characterized by larger problems and no immediate solutions. A comprehensive social impact assessment was conducted by the United Nations Development Program (UNDP) and UN Women in order to capture aspects of Rohingya social organization for generating policy-friendly direction (UNDP-UN Women, 2017). This UNDP-UN Women study provides the most significant and all-encompassing Rohingya livelihood scenario. The living conditions of the Rohingyas, highlighted in the report, are as follows:

1) Atomization, traumatization, anger, lack of political leadership, lack of education, extreme deprivation. As most Rohingyas are determined about not going back to Myanmar "without citizenship and guaranteed security" the recommendations made were: a) Civil Society Organizations' (CSOs) role enhancement in mediation and cohesion, b) community-based response system; and strengthening of support to stakeholders for women and children' trauma recovery.

2) Hostility between the local people and the Rohingyas are emerging fast due to the prevalent conflict of interest. The report recommended a) environmental and host community assessments, and creation of "an evidence-based framework and system for measuring satisfaction, perceptions, track trends, etc." on an urgent basis.

3) Trafficking and gender-based violence (GBV) are identified as a significant human security threat, especially victimizing women and children. Consequent recommendations are a) support "NGOs working on legal protection for victims for trafficking and domestic violence", and b) expand women's development forums "as an early warning mechanism for conflict". Interestingly, the report placed "extremism" as a "limited risk in the near term" and emergence of anti-Rohingya narratives as a burning issue. Consequently, development of an "inter-communal approach" is recommended.

Other problems identified are: a) tensions flowing from insufficient or inaccurate information, b) confusion and life-style mismatch caused by transition from a military-enhanced emergency operation to a civilian-led recovery system, c) erosion in host community's sense of security and community integration, d) rapid loss of quality road communication, and e) extinction of local natural resources, vegetation, flora and fauna due to over-extraction for everyday use.[i]

Income and debt Imbalance is prevalent at every aspect of the regular Rohingya life. Although employment entitlement and right to employment are two principal preconditions of 'livelihood', the restrictions and prohibitions in Bangladesh put Rohingyas into a vicious circle of financial constraint and eventual destitution. Due to employment restrictions, 93.5% Rohingya households reported a decrease in income and increase of indebtedness in a year after arriving in Bangladesh. 80% of the household lost any means of income., 36% became newly indebted to money-lending NGOs and informal moneylenders, 40% of the informants became indebted in their bids to purchase food and about 50% households suffered a decrease in income compared to the level of earning in Myanmar. Their mean household income also dropped from 14,015 to 12,955 Taka [Harvard XG-BRAC 2019]. Additionally, about 70% of the households accumulated more than 20000 Taka (Bangladesh currency) debt in a year. In reality, the

debt burden may be much higher due to the prevalence of informal money lending businesses spreading undercover, both inside and outside the Rohingya community. Their presence is often beyond sight and surveillance of the law enforcement agencies. As per a UNHCR representative, UNHCR led small scale cash-for-food programs ended by mid-2018 and no NGOs are allowed to run microcredit programs of any sort. The Rohingyas who were interviewed, showed extreme caution in disclosing information about borrowing criteria and operators or lenders of the moneylending chains. If this development goes unchecked and uncontrolled, the informal moneylending chains may turn into crime syndicates for human trafficking, organ black-marketing and drug rackets.

Drug trafficking and trade related activities are feared to be plummeting. Many Rohingyas become involved in drug trafficking just to maintain their basic livelihood. Al Jazeera's Alsaafin (2018a) provided a glimpse of drug trading and trafficking as a livelihood strategy of the Rohingyas. The report mentions that members of the Rohingya population are used as the drug-peddlers by the traffickers, to cater to the booming yaba usage in Bangladesh, comprising about 4.6 million yaba users. In late 2018, Bangladesh government launched an armed anti-drug offensive against the trafficker in the yaba-infested coastal areas which killed about 90 drug dealers (Bengali, 2018).

Another report mentions the murder of 300 drug-peddlers and also highlights the fact that women and children are often used as safe carriers, (Banerjee, 2019) since they are soft targets and often are not perceived to be involved in this trade. A member of parliament popularly known as the 'yaba godfather'is of Rohingya descent who settled in Bangladesh decades ago. According to a number of local people in the host community, the Yaba trade may form the crux of organized crime, and help generate required funds for Harakh-Al-Yakin's activity. They report that the camps often become mobilization ground for the Al-Yakin—a radical Rohingya Islamist group—an offshoot of the ARSA. However, most Rohingyas deny the local view, and assert that most traffickers are from the host community and that the Rohingyas are blamed unduly.

Conclusion

The response to the Rohingya crisis is a top priority for all the stakeholders in the Cox's Bazar district. Since October 2017, the crisis has drawn significant attention of the international community with generous participation and contribution of the international actors. However, majority of the response initiatives focused on 'crisis response', 'relief and rehabilitation', 'basic needs response', and 'emergency preparedness'. International funding priority areas comprise of 'food security', 'disaster response' 'shelter', 'basic health and hygiene', and 'water and sanitation' programs. This study team recorded 56 National and international NGOs (See Annex) and international donor organizations using the term 'joint response' in lieu of 'livelihood' support, since the use of the word livelihood is prohibited in the camps. The immediate help they provided and continue to provide focus on 'life-saving supports' than 'livelihood supports'. This implies that the support enables the Rohingyas to 'live for today', but does not necessarily help in providing any long run solution for survival. Given 'livelihood' comprises assets, resources and capabilities of the humans toward a sustained, desired and deserved living condition- all of the criteria are largely absent for the protracted Rohingyas. The Rohingyas reiterated the fact that, their survival in the camps is barely a "breathing

management" needed for physical survival, but without piece of land to call a country, a space to call home, an identity to be treated as 'citizen', and a life to call 'self'—everyday life survival is neither a 'livelihood' nor a 'crisis response.

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Challenges of Ensuring Medical Facilities to Rural Poor People: A Case Study on Boalia Union of Chapainawabganj District in Bangladesh

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Abstract: The rural poor people always struggle for their livelihood. When a rural poor person is affected by a chronic disease, he and his family's sufferings know no bounds. Spending money for treatment for a long time, the poor family becomes poorer and in some cases it turns into a beggar family. The state, for the sake of its socio-economic development, has to take steps to standardize its healthcare system which is one of the prerequisites of becoming a welfare state. Though the healthcare system in rural Bangladesh is gradually improving, still, it is not satisfactory. This research paper tries to go into the depth of the sufferings of those people and to find out how these crises affect the socio-economic conditions of the country. Through the questionnaire, interview, and observation, it is attempted to depict the picture of those rural poor families of which, one or another member is affected by the chronic diseases, how they try to collect money for treatment, what are the difficulties they face in receiving a loan, what are the procedural hazards to get help from the Social Welfare Departments of the government. It is also attempted to find a way of solving the crisis with the limited assets of the government. The suggestions include personal or health insurance, provision of granting loan with zero or minimum interest and taking improvised healthcare systems to union level.

Keywords: Chronic Disease (CD), Money for Treatment (MT), Government Regulated Health Insurance (GRHI), Treatment Aid Bank (TAB), Union Health Multipurpose Complex (UHMC), Database of Poor People (DPP),

1. Background

1.1 Introduction:

Healthcare is one of the basic needs which determines the overall activities of every human being. The overall health condition of the citizens of a country has a great impact on the socio-economic, cultural, and political field of a country. Like almost all the countries all over the world, medical care is considered to be a fundamental right of every citizen of Bangladesh and it is also guaranteed in article 15(A) and 18 of the Constitution of the People's Republic of Bangladesh. It is a fundamental responsibility of the government as well as the state to ensure medical care for all citizens and to ensure nutrition and improvement of public health as its primary duties. Article 16 of the Bangladesh Constitution also reported that the state shall adopt effective measures to improve rural areas and to improve public health. Moreover, Goal number 3 of Sustainable Development Goals (SDG) is " Ensure healthy lives and promote well-being for all at all ages" that means, we have to take action to ensure healthy lives and well-being for all. According to the World Health Organization (WHO) , health is not merely the absence of disease or infirmity. Rather health is a state of complete physical, mental, and social well-being. It is also stated that every citizen has a basic right to adequate healthcare and the state and the government are constitutionally obliged to ensure healthcare for its citizens. The government is trying its best to address the demand for

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medical care of the people and to a great extent, the government is successful in this field. The present government has established a community clinic at the ward level, and Union Health and Family Welfare Center (UHFWC) at the union level. At the union level, a health sub-center has also been established. Besides these the government is taking 'My village- my town' program to transform villages into towns. That means all the facilities of towns will be provided in villages which will also include healthcare.

Nowadays the dimension of human disease has undergone a great change. Chronic diseases that were very rare among rural working people have become common at present days in villages such as diabetes, kidney disease, joint pain, high blood pressure, stroke, eye disease, cancer, etc. There is no adequate treatment of these diseases in rural areas. Even at the Upazila level, scopes of treatment are very limited. To get minimum to moderate facilities, people have to go to Medical College Hospital which is situated at the division level. Now the government is taking steps to establish medical colleges in districts. But the new medical colleges cannot ensure standard treatment facilities due to lack of professors (doctors), nurses, technicians, supporting staff, equipment, and other facilities. In this context, patients and attendants have to go to divisional towns, the capital city Dhaka and sometimes to a foreign country. And while doing this, village people suffer mentally, physically, and economically a lot and thus the government efforts are considered to be unsuccessful. Health service is mostly dependent on government sectors and though the private sector and NGOs have also a great role, these two sectors are also regulated by the government sectors. And ultimately any defamation or failure goes to the government.. Under these circumstances it is very important to provide healthcare facilities to the rural poor people at their affordable cost.

1.2 Objectives of the Study

The main objectives of the study are:

1. To analyze the sufferings of those rural people who live from hand to mouth and affected by chronic disease.
2. To identify how this problem is affecting the socio-economic condition of the country.
3. To find out the mechanism of ensuring healthcare facilities to the village poor people within their capability.

1.3 Justification of the Study/Rationale

Bangladesh's health sector has undergone a notable improvement in the last few years but still, we have many things to do. With the increase in population,the dimension of human disease has undergone a great change. Chronic diseases that were very rare among rural working people now have become common nowadays such as diabetes, kidney disease, joint pain, high blood pressure, stroke, eye disease, cancer. There are no adequate treatment facilities for these diseases in rural areas. Even at the Upazila level, scopes of treatment are very limited.

Raton Mia was an agro laborer in Kashiabari village under Boalia Union, his wife Ruby Khatun was a housewife, they have one son named Sohag and two daughters Joly and

Poly. Joly reads in class Nine, Sohag reads in class Seven, Poly is dumb and deaf. In 2018 Raton had a Stroke disease. He had high blood pressure for a long time but he was not aware of the danger of it. After the attack he received treatment in the divisional town, Rajshahi but later he had no money to continue treatment. Gradually he deteriorated and he was unable to move. Sohag stopped going to school and became a child laborer. Joly also dropped study and she was given in marriage at her child age. After one year Raton died. By this time, the cervical cancer of Raton's wife was diagnosed. Now the sufferings of the children know no bounds. This is the scenario of many families in rural areas. We have to think deeply and find a way to protect such families. This paper attempts to do the same.

The Government alone cannot solve this problem with its limited wealth because there are thousands of such distressed families. So we have to find out the way. Earlier many research works have been conducted related to rural healthcare, that is, 'Limitations of Rural Healthcare System', 'Maternal and Child health', 'Immunization', 'Community Clinic', 'Nutrition' ' Necessity of Comprehensive Healthcare' etc. But this paper deals with the cases of those rural chronic patients who have no money for treatment on the one hand and one the other hand their earnings have been stopped due to disease.

If it is possible to carry out the research successfully and to present some recommendations to address the problem, the Bangladesh Government, as well as the Ministry of Health and Family Welfare, other concern ministries, Directorate General of Healthcare Service will be able to know ins and outs of the said matters. It will help concerned authorities to adopt necessary policies and take effective measures to eradicate these problems and thus ultimately the rural poor people will be benefitted. This may bring a great change in the rural health care system.

1.4 Scope and Limitation of The Study:

The methods which have been adopted here are interview and questionnaire methods because it is easier to find samples since there are huge patients in rural areas. Patients and relatives are very much interested in expressing their bitter experiences. Another thing is that village poor people are not too busy to avoid interviewers and they think if they enlist their name anywhere, they may get help from the government.

The problem is that it is very much difficult to find out the actual economic condition of village people. Sometimes people don't want to disclose their economic status, such as, how much acre of land they have, or what is the actual monthly income of the family. Because they think that if they disclose everything, they will not get the Government help from the Social Safety Net Program. In some cases, patients don't want to disclose their health conditions, especially people with infectious disease. Diabetic patients are also unwilling to disclose information. In many cases, the symptoms of diseases are revealed to some extent but the patient does not care or he thinks that it will be cured. Sometimes a patient dies being uninvestigated. A person is involved in various professions simultaneously. Moreover, people don't want to understand the limitations of health care institutions. So during giving their opinion, they think something is their right but that is their illegal demand.

2.1 Literature Review

A number of research papers, books and articles related to healthcare, health administration, universal health coverage and rural health have been reviewed such as:

Shakeel Ahmed Ibn Mahmood in his paper **'Health system in Bangladesh'** presented the success of Bangladesh Health Sector and analysed the challenges of this secor. In the sub-title 'Challenges of Bangladesh's Health Sector' he depicts the scenario of human resources, Doctor, Nurses, Informal Healthcare provider, healthcare Governance, political commitment and leadership, public private partnership etc.

Aasha Mehreen Amin, in her article **'Getting Health to Rural Communities in Bangladesh'** focused on how rural people are benefited by the healthcare provided by the Non-Government Organizations like The Gono Shashthya Kendra headed by Dr. Zafrullah Choudhury. She says " While government-run hospitals offer low cost medical care, they are often inaccessible, crowded, understaffed and lacking medicines". This article mainly presents the contributions of various Non-Government agencies in the rural healthcare sector.

Attitude of Rural Community towards Health Care Utilization at Primary by Md Ziaul Islam, Assistant Professor, Department of Community Medicine, National Institute of Preventive and Social Medicine (NIPSOM), Mohakhali, Dhaka, and 3 others.

In the research book "**Tackling Noncommunicable Diseases in Bangladesh" by** Sameh El-Saharty, Michael M. Engelgau, Karar Zunaid Ahsan, Tracey L. P. Koehlmoos, and

Michael M. Engelgau, the healthcare system of Bangladesh has been presented and it has been analyzed how Bangladesh is fighting against noncommunicable diseases. According to the researchers, the objectives of their research are as follows:

- ➔ To develop an NCD burden and risk factor profile,
- ➔ To assess the health system's capacity to prevent and control NCDs,
- ➔ To take stock of ongoing NCD activities and identify remaining challenges, and
- ➔ To develop a range of policy options and strategies for the prevention and control of NCDs.

Khaleda Nazneen (August 2001) **Governance of Healthcare Sector in Bangladesh**, CPD

This book critically examines the existing healthcare delivery system in Bangladesh and its outcome. It also deals with quality of healthcare and healthcare governance in Bangladesh. Data were collected at random from two hospitals: Dhaka Medical College Hospital and Bangabandhu Sheikh Mujib Medical University Hospital

In the article "Quest for a Healthy Bangladesh: A Vision for the Twenty-first Century Bangladesh" by Henry B Perry deals with the healthcare situation of Bangladesh and current status of health,population and family planning programmes with an emphasis on primary health care services.. It reviews some of the major initiatives in health, population and nutrition which are emerging and considers how primary health care services can be strengthened in Bangladesh so that health for all can become a reality in Bangladesh .

Taufique Joarder in his article entitled "**Universal Health Coverage in Bangladesh: Activities, Challenges, and Suggestion"** focuses on the attempt to ensure universal health coverage in Bangladesh and finds out barriers. He also puts some suggestions on how to overcome those barriers to ensure universal health coverage.

Almost all these researchers are objective and focus on the healthcare, health administration, universal health coverage and rural health, nutrition and family planning of the country. But no research has yet been carried out on this subject matter, that is, what are the hazards village poor people with chronic diseases have to undergo in healthcare institutions, what are the difficulties in collecting treatment money, what the socio-economic losses the state has to carry due to the shortcomings of treatment and which measures should be taken by the state to minimize the sufferings of people and the loss of the state.

But my study is new and quite different from the research works mentioned above. My study deals with the particular rural poor people with seven chronic diseases. It emphasizes on the hazards village poor people with chronic diseases have to undergo in healthcare institutions, their difficulties in collecting treatment money, the socio-economic losses the state has to carry due to the shortcomings of treatment and which measures should be taken by the state to minimize the sufferings of people and the loss of the state.

2.2 Operational Definition of Key Words

a. Union: 'Union' usually referred to as 'union council' or 'union parishad' is the smallest unit of local government in Bangladesh. In this study union means union territory or the area under this administrative zone. In this writing whenever the Boalia union is mentioned it indicates the total area of that territory.

b. Poverty: The World Bank defines poverty[1] in absolute terms. The bank defines extreme poverty as living on less than US$1.90 per day. (PPP), and moderate poverty as less than $3.10 a day. If a family's total income is less than the family's threshold, then that family and every individual in it is considered in poverty. When a person's income is too small to spend for the basic necessities of life such as food, nutrition, healthcare, clothes education, housing, he is considered to be poor. In rural Bangladesh, the landless farmers, agro-labors, rickshaw pullers, abandoned women, maid servants, sales-associates and other day-laborers etc. A person is beyond poverty line when,

1. He has the capability to buy food for himself and his spouses and to fulfill the demand of nutrition.
2. Has the capability to spend money to receive medical care when he is ill.
3. He has a house which is safe and comfortable.
4. He has the ability to spend for the education of him and his spouses/children.
5. He has employment either in any organization or on his own.

[1] The World Bank Group October 7 2020 (https://www.worldbank.org)

According to the Bangladesh Bureau of Statistics, in 2018, Bangladesh has 21.8% people below the poverty line and 12.9% people below the extreme poverty line [2].

c. **Chronic Disease:** Chronic diseases are defined broadly as conditions that last 1 year or more and require ongoing medical attention or limit activities of daily living or both. Chronic diseases such as heart disease, cancer, and diabetes are the leading causes of death and disability. In another term a disease that persists for a long time is called chronic disease[3]. A chronic disease[4] is one lasting 3 months or more, by the definition of C. Chronic diseases tend to become more common with age.

3. METHODOLOGY

3.1 The Study Area:

My study area is the total Boaila union territory. Boalia Union is in Gomastapur Upazila under Chapainawabganj District. It is situated 35 kilometers north of Chapainawabganj district town and 5 kilometers western side of Rohanpur, the Upazila headquarter. Gomastapur Upazila is located in between 24◦ 44' and 24◦ 58' north latitudes and in between 88◦ 13' and 88◦ 58' east longitude. The basic information of Boalia union is given below[5]

Serial No.	Description	Quantity
1	Total Village	27
2	Total ward	9
3	Total population	34240
4	Total Voter	19449
5	Total Family	8890
6	Population Per Family	3.85

Before forming district administration at Chapainawabganj in1984, GomastapurUpazila as well as the whole Chapainawabganj district was under the Rajshahi district. From the British period, the people of Boalia, as well as Rohanpur, feel comfortable going to Rajshahi for treatment, education, or for other purposes.

[2] Bangladesh Bureau of Statistics Report 2017
[3]U.S. National Center for Health Statistics
[4] Source: https://www.medicinenet.com/chronic_disease/definition.htm
[5] Papers supplied by Secretary, Boalia Union Council

3.2 Health Institutions in Boalia Union

Serial No.	Description	Number	Remarks
1	Total Community Clinic	3	
2	Total Sub Center	1	
3	Total Health and FWC	1	
4	Total pharmacy	35	
5	Private Clinic	1	
6	Charity HealthCare Center	1	MKMS Manobik Sebakendro
7	LMAF/ Polli Chikitshok	51	
8	Diploma in Medical Faculty	5	

3.3 Places/ Institutes Where Village people Receive Treatment

When a poor person in a rural area gets affected by a small disease, he hardly cares about it until or unless he feels severe pain or his normal movement is hampered. Though nowadays some conscious and rich people rush to town when they notice unusual symptoms in their bodies, the number is very low. When a rural poor person feels pain or get physically troubled, he goes to the nearest medicine shop or a village doctor, and if it is nearby, then he goes to the Community Clinic (CC), Health Sub-Center (HSC), or Union Health and Family Welfare Centre (UHFWC), takes a few tablets or syrups. Then when he gets a bit of relief, he stops it. Again when he feels troubled, he goes to the same place, and thus when the condition gets worsened, the village doctors or medicine sellers advise him to go to Upazila, district, or divisional towns[6]. Then anyone or other places/institutions they choose to receive healthcare.

3.4 Diseases taken in consideration:

Seven chronic diseases have been included in this research, these are,

(1) Heart disease, (2) Neurological disease/Stroke, (3) Diabetes, (4) Orthopedic disease/Joint pain (5) Eye disease including cataract and glaucoma, (6) Kidney disease. (7) Cancer.)

3.5 Method

The research is based mainly on the data collected from the root level people. Both qualitative and quantitative methods for this study have been adopted, but qualitative elements are more prioritized than quantitative elements. To carry out this study, Primary data was collected from various villages of the study area, sitting in tea-stalls, Union Council Office, Community Clinic offices, and the residences of the sample group. To collect data from primary sources, the questionnaire method, interview method, and observation method, Group Discussion method has been adopted. For the questionnaire method, several question forms were prepared and it was supplied to the sample group. The question pattern was prepared based on research objectives. All the aspects of the question paper have been explained to the common sample groups. Another technique

[6] Opinions of a few doctors(LMAF), Reference 6.7

was interviewing individuals. For the interview, some parameters related to the subject matter were set and with the course of the interview, other related questions were asked to collect more information. The questionnaire, interview methods were considered suitable because the sufferers are interested in expressing their feelings and to disclose the facts. The observation method was effective in this study because receiving healthcare is a long time process and it was not difficult to observe everything and to gather experience as patients and attendants were interested in disclosing everything. Group discussion approach also helped to understand the crises and find out the solutions. Secondary data was collected from books, research works, articles, reports, essays, journals, newspapers, television, different websites, online news portals, etc.

3.6 Sample Group, Data Collection and analysis

The sample was selected on a random basis and it was selected from all the regions of the research area and all sorts of people young and old, educated and low educated, patients and attendants, etc. The sample group included people such as Patients with chronic disease, relatives of the patients, family members or attendants of the patients, village doctors, public representatives, medicine sellers, Social Welfare Officer, Doctors of Upazila Health Complex.

Mainly descriptive analytical method has been adopted in this study. After collecting data from both primary and secondary sources, all data were processed, analyzed, and explained. Data were included-interviews, table of information, related news, media reporting, patient visit, observing the hospitals and clinics, written and verbal applications of the patients seeking financial help, etc.

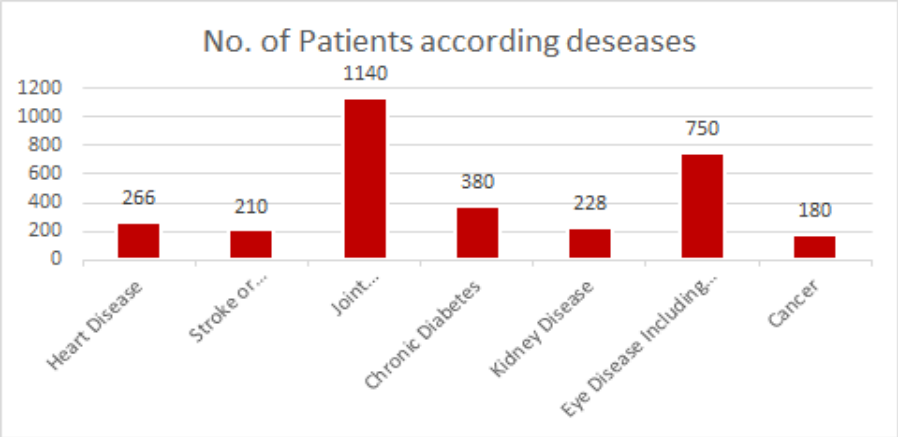
Information on the tables was explained, other data were analyzed and explained. Interviews were reviewed. By these analyses, explanations, investigations, and overviews, the sufferings of the poor patients with morbid diseases were found out and how the society and the state are losing workforce were investigated and solutions were presented. The whole analysis process was descriptive and qualitative.

4. Data Analysis and Findings

4.1 Huge Sufferings Of Rural Poor Patients With Morbid Disease:

The people of the Boalia Union area who were affected by or suffered from the 7 morbid diseases mentioned below from January 2019 to 31 August 2020 were taken in this study.

Sl. No.	Name of Disease	No. of Patients	Died during the period	Became incapable of working
1	Heart Disease/Heart Attack	266	75	150
2	Stroke or Neurological disease	210	80	110
3	Joint Pain/Orthopedic Disease	1140	20	750
4	Chronic Diabetes	380	85	250
5	Kidney Disease	228	38	160
6	Chronic Eye Disease	750	0	610
7	Cancer	180	20	130



Out of the population 9.20% have suffered or have been suffering from 7 morbid diseases and 7.24% people die or become incapable within the considered period. But the death rate is the highest by stroke, heart attack or diabetic related complexities.

4.2 Loss of Workforce and Influence in Economy

A survey on Boalia union showed that, among 34240 people, 3154 are affected by seven morbid diseases. Among them 2250 persons are incapable of spending money for treatment. These 2250 people somehow earn their livelihood but they do not have savings to spend in crisis moments. Among them, 1530 persons died or became incapable of working due to lack of proper treatment. These incapable persons would have worked more than 20 years. If they would work worth taka 500 per day, an estimated **loss of economy of Boalia union** is shown below:

Total loss = Number of Incapable or Deceased Person x Income Per Day x
Approximate Working Day per Month x Study Time Duration

=NIDP x IPDx AWDMx STD

= 1530 x 500 x 25 x 20

= 382,500,000 /-

So total loss for one year is=382,500,000/20 x12

=229,500,000 taka

This loss is only for seven 7 diseases and if we incorporate all other diseases then projected loss would be much higher. It is noted that normally a rural poor person works 25 days a month. This is only about monetary loss. Other losses are as follow:

- The person would have make his/her son /daughter efficient human resource
- His experience / intellects would benefit the family and nation

Under this circumstance if the government uses this amount, that is, 229,500,000 taka per year in Boalia union as a loan or grant for poor patients, the government will not have to bear any loss.

4.3 Socio-Economic Scenario of the Study Area: Economic, Social and other conditions of the study area are discussed below (4.1.1 to 4.1.3).

4.3.1 Profession of Household Heads

The number of total households is 8890 and each household contains 3.85 members on average.

The same person is engaged in various professions and so summation is not applicable here.

Sl. No.	Description of Household	Households	%
1	Agro-based households (Land Owner)	5156	58%
2	Agro-based households (Landless)	2223	25%
3	Service holder's Having Income Less than 16000/-	800	9%
4	Service holder's Having Income More than 16000/-	445	5%
5	Business based households (Monthly Income Less than 20000/-)	1245	14%
6	Business based households (Monthly Income More than 20000/-)	178	2%
7	Agro family having <5 Bigha land	4445	50%
8	Agro family having 5 – 10 Bigha Land	889	10%
9	Agro family having 10 – 20 Bigha Land	445	5%
10	Agro family having >20 Bigha Land	533	6%
11	Agro Labour Family (Also involved in other works)	2223	25%
12	Labour other than agro (Also involved in other works)	1778	20%
13	Maid Labour	178	2%
14	Workless family (having no worker)	178	2%
15	Others	1778	20%

This table[7] clearly indicates that most of the people or households are dependent on agricultural activities either through owning land or working on other landowners' land. It is the most common occupation in the union. The second most common occupation is business. But small business owners are the majority. It is important to notice that most of the land owners have a very small portion of land. It is notable that many household heads or other members are involved in multiple professions simultaneously.

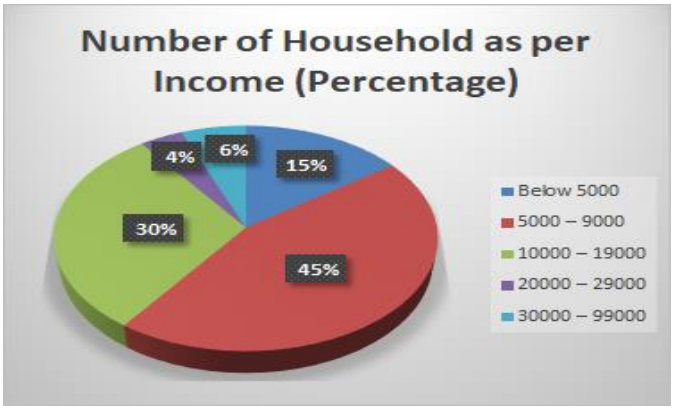
The families mentioned only in serial number 4, 6, 9 & 10 have economic capability of receiving health care facilities.

[7] Data collected from research area.

4.3.2 Number of Households in Respect of Income:

According to the income of every household of Boalia union, a classification is shown in the following table.

Gross Monthly Income	Number of Households	Percentage	Remarks
Below 5000		15%	
5000 – 9000		45%	
10000 – 19000		30%	
20000 – 29000		4%	
30000 – 99000		6%	



The above table and Pie Chart are pretty self explanatory. Almost half of the population's earning range is between 5000 to 9000 taka per month. 30% of the people earn 10000-19000 taka. So when this portion of people seek treatment, they are quite helpless in collecting treatment funds.

4.4 Absence of Online Database of poor people: For poverty alleviation and implementation of any plan, adequate and appropriate information is the precondition without which it may come to failure. But the most important matter is that any ambitious Government must have multidimensional data. The data should be reliable and open to all so that people can put comments and complaints and it can be corrected. Now is the age of information technology, so if poverty alleviation and implementation of any plan, adequate and appropriate information is the precondition without it may come to failure. It will help the government and other authorities to a great extent. During crisis moments it will reduce the hazards. But, an online database is yet to be formed by the government from which people can get information easily.

4.5 Absence of Government Regulated Health Insurance:

Health insurance can play a great role to address the treatment crisis of poor people with chronic diseases. Every citizen should have been brought under the compulsory health insurance scheme. In Bangladesh, there is no provision of health insurance. That is why rural poor people suffer a lot. Because every citizen has the ability to deposit 50 or 100

taka per month but they cannot spend a large amount at a time for treatment. Besides this, without a compulsory system they cannot deposit money rather they spend all the amount. In many countries in the world, there are health insurance systems.

It must be government regulated because the poor people will not be interested to deposit installment as they have no faith in non-government insurance companies.

Compulsory health insurance system was introduced in Madhupur, Ghatail and Kalihati upazila of Tangail district but it could not attain optimum success. Because pre-requirement initiatives such as establishing collecting authority, making infrastructures, appointing necessary manpower, forming a specialized bank, creating online databases, formulating policy, rules and regulation etc. have not yet been implemented. It is notable that depending on other agencies/offices, it is not possible to make compulsory health insurance successful.

4.6 Urgency of Treatment Aid Bank /Treatment Fund:

It is a setup of economic activities which will ensure the success of compulsory health insurance programs. This bank will collect installment of insurance, provide loans to poor patients, allot grants of the government and simultaneously it may regulate other financial activities of social safety net programs of the government.

The total number of patients of Kashiabari village who received treatment at various places and various hospitals during the said period is 20. The helpless poor patients and relatives collect money from the following sources:

Serial No.	Description	No. of Patients	Percentage
1	Deposited money, bank/hand	2	10%
2	Loan from the bank or NGOs	11	55%
3	Loans collected from relatives	8	40%
4	Loans collected from Usurers	4	20%
5	Land sale	2	10%
6	Ornament, Cattle, or Crop sale	10	50%
7	Collective donations	5	25%
8	Others	4	20%

The table shows that the majority of the people are getting a loan from local NGOs and relatives and they are also forced to sell their cattle, crops or family ornaments.

When a family head becomes critically ill and cannot not earn a living, his family cannot cope financially, especially to pay bills, buy food, clothes, bear school expenses for children and other day to day expenses. Then the family has nothing to do without selling land, deschooling children, engaging children in child labour or placing their family members in hopeless condition. A workable person has a contribution to the economy but when a man falls ill and is unable to work, he becomes the burden of the state, his family members may become derailed and may be involved in crimes or unethical activities. Sometimes they take loans from NGOs or village usurious or village creditors at a very high rate and capital including interest become high and at a certain stage, they are bound

to sell their small land and other valuables. All these matters hamper the healthy atmosphere of the society. In Boalia Union, 18 NGOs are working with microcredit activities. So far information can be collected, no scheduled bank gives a loan to any person for treatment. Even no NGO gives loans for treatment purposes, but it is very essential to have a provision of sanctioning loans to the rural poor patients, even without any mortgage or guarantee. Under these circumstances, it is demanded by the respondent groups to establish a specialized bank.

4.7 Low Scope Of Government Grant or Help for

The government has taken steps to help the poor people affected by chronic diseases. The help is given through social welfare departments. A person with chronic disease gets 20 to 50 thousand taka at a time. But the process of getting this grant is very difficult and sometimes proper vulnerable people do not get help. All the poor chronic patients could not be incorporated in this program and sometimes selection of beneficiaries could not be impartial because there is no perfect database to identify actual poor people. Sometimes poor people also do not know about government help properly.

4.8 Suffering of rural people because of ineffective Healthcare Administration.

The government is trying to improve the health care system but the supervision system is not satisfactory. Apart from healthcare, a strong set up is needed to be established which will run the healthcare administration. In many cases it is observed that doctors are absent for a long time. Sometimes he goes to the office once a month and the rest of the time he is busy with a private practice in the town. If there is strong supervision, this cannot happen. The government is supplying medicine free of cost but the poor patient does not get it. In some cases, it is observed that the government has supplied investigation machines and other instruments but it remains unused for a long time and sometimes the machines couldn't be installed or if installed, due to lack of technicians, it could not be operated. Chairperson of BRAC Hossain Zillur Rahman [8]says, ''health sector needs reforms, eradication of misuse of money and improved management''.

4.9 Sufferings of rural people because of inefficient Hospital/Bed:

It is not possible to establish all kinds of hospitals or medical facilities in rural areas, people have to go to towns, but due to Shortage of hospitals and beds at upazila /district level**,** rural people have to suffer. Upazila and district level hospitals are also suffering from a shortage of specialist doctors, nurses, equipment, and infrastructure. To provide health care smoothly the following manpower and bed are needed both in rural and urban areas[9]:

[8] The Daily Prothom Alo 16 May 2020
[9] Interview of Sumeet Aggarwal, MD, Midmark India The Daily Prothom Alo 22.02.2018

Serial No.	Name of Post/ Facility	Required number per 10,000 people	Existing Numbers
1	Doctor	10	6
2	Nurse/midwives	30	10
3	Technician	10	3
4	Paramedics/Ward Boy	15	7
5	Bed	30	8.7

According to the World Bank, in Bangladesh there are only 8 beds per 10,000 people, while in the USA 29, in the UK 25.4, in China 43 and in Bhutan 17. So it is clear that Bangladesh has a very low number of hospital beds in comparison to other countries. In this study area, there is no government or private hospital except a community clinic and doctor-patient ratio is absolutely minimum.

4.10 Sufferings of rural people because of Shortage of Doctors at upazila /district level:

It is not possible to establish all kinds of hospitals or medical facilities in rural areas, people have to go to towns, but due to Shortage of Doctors at upazila /district level or due to unequal distribution of doctors/nurses, rural patients are being deprived of treatment facilities at minimum/reasonable cost.

The international unit of manpower in the health sector[10] is 10000 people. According to the World Health Organization for every 1000 people, a doctor is needed. Doctors available per 10000 people in India 9 in the USA 51, in China 20, in UK 28 in Srilanka 10, while in Bangladesh 6.

Keeping pace with the huge population, the number of doctors is very less at Union and Upazila level. To provide proper healthcare to the rural poor people which is also the goal of the government, a sufficient number of doctors should be posted at Union and Upazila level. The government is trying to send doctors at Upazila and Union level but somehow doctors can manage to be transferred or to be posted in big towns with deputation.

Health workers are concentrated in urban secondary and tertiary hospitals, although 70% of the population lives in rural areas.

4.11 Sufferings of rural people because of limitations in Upazila Health Complex (UHC)

In most cases, the people of remote rural areas don't want to go outside the union area to receive health care. But when the disease goes beyond tolerance level most of the poor people at first go to Upazila Health Complex (UHC).

Most of the Upazila Health Complexes are running with insufficient and inoperative medical equipment and acute shortage of doctors, nurses, and other staff. The posts of Upazila Health and Family Planning Officer (UHFPO), Resident Medical Officer (RMO), remain vacant very often.

[10] World Health Organization Global Health Workforce Statistics, OECD 2018,

In most of the UHC, there are only 2 or 3 doctors and 5/6 nurses posted. Medical equipment like the ultrasound and the ECG machines are lying inoperative for months, hampering diagnosis and treatment due to the shortage of operators and technicians.

To know the service delivery condition in UHC and to identify whether patients/attendants are satisfied, a questionnaire is supplied to each 20 number of patients and attendants who received services from UHC during the said period. In that Question paper there were mainly 3 questions as follows:

Question no 1- Are you satisfied with the service you received in the UHC?

Question no 2- If you are satisfied, then which service or services/matters pleased you?

Question no 3- If you are not satisfied, then which matters displeased you?

In answer to question no 01, 85% samples are dissatisfied and 10% are satisfied where 5% people are in a dilemma. (Annexure- 01).

Regarding the causes of dissatisfaction, they mentioned the reasons bellow:

1. Lack of devotion of doctors and nurses.
2. Weak monitoring and management
3. Lack of Doctors concentration because of excess private practice.
4. Absenteeism and Irregular Attendance
5. Carelessness of Doctors to Patients
6. Hurry of Doctors in examining or talking to patients
7. Referral tendency of doctors
8. Shortage of doctors and Nurses in comparison to patients
9. Shortage of proper instruments
10. Shortage of technicians
11. Lack of professional expertise of doctors
12. Shortage of bed in UHC
13. Dirty Atmosphere (Beds, bathroom, toilet, compound).
14. Influence of middlemen/ brokers
15. Lack of Grievance Redress system

Among the stakeholders of UHC, 82% are dissatisfied with the lack of devotion and professionalism of doctors. 80% said that doctors are tired with private practice and they find no interest in the government hospital where they get no money from patients. 85% stakeholders said that doctors tried to find a way to send the patients to private hospitals or higher level hospitals to escape his/ her duty. 35% stakeholders said that because of shortage of doctors and other manpower, fewer doctors become tired in rendering service.

5. Conclusion and Recommendations

After analyzing all the data, it can be mentioned in the conclusion that a chronic disease can devastate the personal and family life of the rural poor people. When the family head is affected by chronic disease, he and his relatives at first become anxious of collecting money for treatment.

Not only that they also become anxious for their livelihood if the patient is the only earner of the family. They cannot collect loans from government agencies as there is no provision of treatment loans. They collect loans from usurers at high interest rest. They can collect loans from NGOs but the interest rate is high. Moreover since they have limited income, they cannot pay the installment and at last they are bound to sell their valuable lands, cattle's or ornaments and the whole family becomes helpless and school going children and females are bound to work in others' house or farming land. So it also brings harm to education. In healthcare institutions they also face hazards. The brokers/ middlemen harass them. As they lack awareness, they are neglected by most of the people in hospitals and clinics. They also become the victims of monetary exploitation. Under these circumstances, this paper presents the following recommendations which may play a great role to solve the crisis.

5.1. Government Regulated Health Insurance:

Health insurance can play a great role to address the treatment crisis of poor people with chronic diseases. Every citizen should have been brought under the compulsory health insurance scheme. In Bangladesh, there is no provision of health insurance. That is why rural poor people suffer a lot. Because every citizen has the ability to deposit 50 or 100 taka per month but they cannot spend a large amount at a time for treatment. Besides this, without a compulsory system they cannot store money rather they spend all the amount. In many countries in the world, there are health insurance systems.

The first thing that must be ensured is the trust of the people in this scheme. It must be government regulated because the poor people will not be interested to deposit an installment as they have no faith in non-government insurance companies. Generally, people have the presumption that at the time of maturity of the scheme or when the beneficiary becomes eligible to get the fund, the authority or the insurance company plays various tricks so that they don't have to pay the due money. So it is better to run the health insurance by the government-owned organizations.

The government has to categorize people in various groups depending on the basis of their economic condition. Insurance premium, benefits and how many diseases will be incorporated must be fixed by the government. To formulate all these systems, an expert committee should be formed and finally law, rules and guidelines must be formed. The management officials and staff should be chosen from efficient, honest and integrated persons

When a household does not pay the premium, the amount should be collected from the electricity bill, mobile recharge or other bill or from the social safety net allowances which are provided by the government. In this field, the government will not conduct business rather it will try to save the poor citizens.

One thing we must remember is that the success of every project depends on firstly the system or mechanism and secondly on the fair dealings of the employees. With a corrupted mind no project can be successful. So the key persons launching health insurance must be selected by the government with care and prudence.

5.2 Treatment Aid Bank (TAB) / Treatment Fund and Zero Interest Loan Facility

Under the circumstances described in 4.6, the government should form a **Treatment Aid Bank (TAB)** to aid the poor people affected by chronic disease and to make the system transparent and convenient to common people.

It is a setup of economic activities which will ensure the success of compulsory health insurance programs. This bank will collect installment of insurance, provide loans to poor patients, allot grants of the government and simultaneously it may regulate other financial activities of social safety net programs of the government. A guideline should be prepared by the experts of banking sectors, economists, and medical sectors to run the Bank. The interest rate should be 0% or near this. The beneficiaries will be selected from the online database of poverty which is stated in 5.3. The loan sanctioning procedure should be easy. The bank will have other businesses from which it will survive. The government will also give subsidies to the bank. No mortgage should be demanded. People of the community will be the guarantor. Later if it is proved that the debtor is not paying the installment despite having the capability, exemplary punishment will be imposed.

5.3 Create an online Database For Rural Poor:

For poverty alleviation and implementation of any plan, adequate and appropriate information is the precondition without which it may come to failure. But the most important matter is that any ambitious Government must have multidimensional data. The data should be reliable and open to all so that people can put comments and complaints and it can be corrected. Now is the age of information technology, so if we upload the information online then it will be the most effective. To provide Medical help or any other help, an online database of poor people will help the government and other authorities to a great extent. During crisis moments it will reduce the hazards.

People/ The Poor should be Categorized in the following way

Group: Pv2- (Poor Two Minus, Pv--), Very Poor, Extreme Poor,

Group: Pv1- (Poor One Minus, Pv-), poor,

Group Sv1+ (Solvent One plus)- Solvent +

Group Sv2+ (Solvent two plus)- Rich ++

While enlisting a family in the poverty list, three things should be considered.

[1] Firstly, his or her economic conditions,

[2] Secondly, his or her parents' economic condition,

[3] Thirdly, his or her parents in the laws' economic condition.

Final decision:

Category of the Considered Family: P2- /P1-/Sv1/Sv2

a. Date of Evaluation:…….

b. Notify with a date if any change is made by a complain……

a. Any comments/ Complaints by any persons

b. Signature of verifier and authority with date

5.4 Establishing Union Health Multipurpose Complex

To materialize the vision "My Village, My Town" a health complex should be established and this complex may be named Union Health Multipurpose Complex. The complex should be established on an undivided land and at the middle point of the union so that people of the whole union get maximum benefit with minimum hazard. The plan should be prepared to keep in mind the demand for the future 100 years. If necessary, land should be acquired which must be not less than 5 acres. In it there should have the following establishment:

A) A Full-fledged Hospital, B) Herbal/ botanical Garden,C) A Herbal Medical Center, D) Health Awareness Center cum library, E) Residence for Doctors nurse and others, F)Union Health-Statistic and Information Center

5.5 Establishing Union Health-Statistic and Information Center (UHSIC): To collect and preserve all kinds of information related to health, UHSIC should be established.

5.6 Enrich Infrastructure: Sufficient wards, beds, office space, doctor chambers, lab rooms. If necessary, multi storied buildings can be built.

5.7 Appoint Sufficient Doctors, Nurses, Technicians and other Manpower: If necessary, separate organizations like PSC should be established to appoint doctors, nurses, technicians etc.

5.8 Proper Utilization of Government Fund: Misuse of Government is a great obstacle towards the development of health sectors. A Monitoring authority has to be formed who will supervise development activity including proper utilization of funds.

5.9 Establish Sufficient Medical college/University/Specialized Hospitals and other institutions: At district or regional level, Medical college/University/Specialized Hospitals and other institutions should be established so that rural people can easily go and receive treatment.

5.10 Code of conduct for private practice: Rural people has to go Upazila and district level and seek treatment from private practitioners. With a view to preserving the interest of the common patient, Code of conduct for private practice should be prepared. Section 4 of the "Medical Practice and Private Clinics and Laboratories (Regulation) Ordinance 1982" allowed the private practice of doctors employed in the public health services except for the office hours. The ordinance prescribes a fine of Tk 5,000 only for any Government doctor involved in private practice during office hours. Though Article 21(2) of the constitution says, 'Every person in the service of the republic has to strive at all times to serve the people'. The constitution is the supreme law; it will be considered

effective over other law if any contradiction arises. The question arises on the legality of the private practice of government doctors. Moreover, the private practice of government doctors is illegal according to the service rules that prohibited public servants from engaging in other professions.

In this context, it has become very urgent to frame a complete guideline on the private practice of government doctors fixing their duty hours at government hospitals. Moreover, it is important to fix their fee and behavioral code during private practice. While doing this, the government should also hear the doctors because with this the interest of many patients is correlated[11].

5.11 Improving Grievance Redress System:

In Bangladesh, while receiving healthcare service, people often become aggrieved by the mismanagement, misbehavior, carelessness, or wrong treatment of healthcare staff. Sometimes healthcare providers also have some complaints against the attendance or any member of the health system. Sometimes even it is complained that the patient has died because of the mistreatment or carelessness of doctors or nurses. It is not like that all the complaints are true but it is important to investigate the complaints. There must be an authority who will have a hearing with both parties present, find the truth, and let both parties know the facts and the action taken against the accused. The Authority will have the right to work independently without any interruption.

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Responding to the Pandemic in Tertiary Education: A Unique Case of Crisis Management

Tasnima Aziza*

Abstract: The closure of educational institutes worldwide as a result of COVID-19 has led to an education crisis. The situation exacerbated the learning loss in the developing countries as their educational institutes could not shift to e-learning quickly like their counterparts in the developed nations due to different limitations. As the pandemic has created a unique situation, these institutes didn't get the opportunity to prepare or plan to manage the disaster. Jahangirnagar University (JU), one of the oldest public and the only fully residential university in Bangladesh, faced different challenges during this pandemic. This paper aims to narrate the challenges the university's students, teachers, and authority faced and its initiatives to manage this crisis. The most significant challenge was transitioning to online classrooms, which was a new experience for both teachers and students, resulting in various constraints. This case can be helpful for the other public universities of developing countries to manage the COVID-19 education crisis or other disasters in the future.

Keywords: Crisis Management, Education during COVID-19, Online Learning, Jahangirnagar University, Online Student Assessment

Introduction

The unprecedented COVID-19 pandemic has affected almost all the sectors across the world. Considering the alarming level of spread and severity, WHO declared COVID-19 as a pandemic on 11th March, 2020 (WHO, 2020). To prevent the spread, countries all over the globe have taken different kinds of initiatives like lockdown, quarantine, shut down, general leave, etc. Sectors like education that require face-to-face interaction are severely affected due to these measures. About 1.2 billion students of different countries have faced negative consequences by the closure of educational institutions (UNESCO,2020). The government of Bangladesh first closed the educational institutes from 17th March, 2020, and has extended it in several phases to 30th June, 2021. The government also canceled PEC, JSC, HSC, and all equivalent public exams of 2020 ("Closure of Schools Extended to 30th June," 2021). Bangladesh is among the countries with the most extended full closure of educational institutes (UNICEF,2021). To reduce the learning loss, educational institutions across the globe started e-learning (Paudel, 2020). Higher educational institutes of almost all the countries also started to conduct academic activities virtually (Gewin, 2020). On 30th April 2020, University Grants Commission (UGC) asked all the universities of Bangladesh to continue educational activities using digital platforms. However, 63 private universities and only very few public universities among 151 universities started online classes before this decision (Alamgir, 2020). To shift the activities from in-person to digital, both the public and the private universities faced different challenges. Universities take various strategies to cope up with these challenges (Huque et al.,2021b). Besides the academic activities, these universities and their stakeholders face different difficulties during this pandemic situation. While some problems are common, others are unique to the individual university.

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This article portrays a selected case, Jahangirnagar University, the solely residential public university in Bangladesh, which faced different challenges during the pandemic and faced the situation with unique solutions.

COVID-19 Scenario in Bangladesh: A Special Context of Public University

Jahangirnagar University was established in 1970 in Savar, 32 kilometres away from the capital city Dhaka, and operated under the Jahangirnagar University Act of 1973. It is the only fully residential university in Bangladesh that means every student has accommodation in a residential hall of the university. At present, this public university has 36 departments under six faculties, four institutes. More than five hundred teachers and fifteen thousand students are the main stakeholders of the university. Sixteen student dormitories, including eight for females, accommodate all the students (Jahangirnagar University, n.d.).

The university is operated according to 'The Jahangirnagar University Act,1973'. According to the act, the President of the People's Republic of Bangladesh is the Chancellor of the University. The Vice-Chancellor is appointed by the Chancellor for four years from a panel of three persons nominated by the 'Senate' and is eligible for re-appointment for a further period of four years. According to the act, the 'Syndicate', the Chief Executive Body of the University, has the general management and superintendence over the university's affairs, concerns, and properties. Senate of the university amend and ratify the Statutes on the proposals of the syndicate. However, the principal academic body of the university is the Academic Council is responsible for the maintenance of standards of instruction, education, and examinations have the right to advise the syndicate on all academic matters (The Jahangirnagar University Act, 1973).

It is a point to be mentioned here that almost all the educational institutes of the world are affected by the COVID-19, and Jahangirnagar University is not an exception. The first covid case was diagnosed on 8th March 2020 in Bangladesh. 10,00,543 confirmed cases and 16,004 deaths were reported to WHO on 9th July 2021 (WHO, 2021). In response to that the government announced the closure of all educational institutes from 17th March 2020, and from 26th March 2020, it implemented a lockdown in the name of general leave. The government has extended the closure in different phases. According to the government directives, Jahangirnagar University suspended its academic activities from 17th March 2020 and vacated all the student dormitories. In response to the general leave announced by the government, the university paused the administrative activities from 26th March 2020.

This paper shares the initiatives taken by Jahangirnagar University during the COVID-19 pandemic situation. The university requires to simultaneously consider the learning loss, challenges of various stakeholders, campus safety against COVID-19, and government and UGC directives.

Methodology

A case study is appropriate to answer how and why questions (Yin, 2003). It helps a researcher to study complex phenomena, too (Baxter & Jack, 2015). The study emphasizes a unique case, Jahangirnagar University, the only residential public university

in Bangladesh, to handle the pandemic crisis and mitigating challenges. Yin (2003) classified case studies into three types: exploratory, descriptive, and explanatory. The exploratory research deals with uncovering underlying issues among the sample group that might lead to descriptive and finally to explanatory research or causal research. The study used the exploratory research approach confining both qualitative and quantitative tools to collect information from the sample frame. In-depth interview method was used to uncover the underlying crisis and challenges of the teachers from Jahangirnagar University. A group of 10 teachers from different departments was chosen in this case.

Moreover, a survey was conducted among 117 students from Jahangirnagar University from 8th March 2020 to 15th July 2021 to identify the pandemic crisis and challenges with a qualitative mindset. However, the mode of primary data collection method from the students was Google Form which was disseminated among the students. Furthermore, the study independently collected the published internal circulars from the authority of the Jahangirnagar University, which was somewhat an effective way to compare Jahangirnagar University's situation with other public universities running under the 73 Act of University Ordinance in Bangladesh. Finally, the newspaper articles and circulars from the government of Bangladesh were also being collected to find out the policy-related issues in respect to education at the tertiary level during the pandemic crisis.

Review of Literature on Responses of Universities to COVID-19

COVID-19 has affected all spheres of life across the world, including education. Governments closed schools, colleges, universities, and other educational institutes in almost all countries to curb the rapid spread of the disease. This closure disrupted the academic calendar of these institutes, which made the students and their parents anxious (Izumi et al., 2020). Educational institutions of these countries accepted different mechanisms to reduce learning loss. Various stakeholders like the government, NGOs, and other concerns work for student well-being and the continuation of learning activities. Socio-cultural status and technological advancement influence the application and success of these initiatives (Fitzpatrick et al.,2020). Izumi et al. (2020) found that changes in teaching methods and work from home also create challenges for the students, teachers, and universities. They opined that inadequate preparation for this type of crisis causes the situation worse. These findings are commonly discovered from the researches conducted on different universities around the world.

Banki (2021) realized the necessity of appropriate measures to face two main challenges of tertiary education during the pandemic: deprioritization of study due to the COVID-19 context and disengagement of the students in the online classes. She suggested adopting a pedagogy with care, flexibility in teaching, engaging lectures, and the correct use of COVID-19 as context. Along with other initiatives, higher educational institutes offer different supports to the students to reduce the digital divide. The supports include access to digital resources, skill development courses, flexibility in teaching and assessment, etc., which reduced the frustration among the underprivileged students (Webb et al., 2021).

Perceived challenges and awareness of COVID-19 of the learners influence the perceived usefulness and ease of use of e-learning, which again affects the intention to participate in e-learning among the Finnish students during the ongoing pandemic. However, female

students perceive more challenges than their counterparts which negatively influences the discretion to accept e-learning. Though several studies show the lack of preparedness of the institutions as a cause of dissatisfaction among the learners and the academics, this study has shown no effect of this factor on the perceived usefulness, ease of using e-learning, and the intention to participate in e-learning (Nikou & Maslov, 2021).

Chen et al. (2021) surveyed the College of Business of California State University Long Beach students to learn about online classes' experience, satisfaction level, and challenges. The institution announced a mandatory shift of teaching modality on 12th March 2020, in response to the COVID_19. The researchers found content coverage and interaction of learning technologies are highly correlated with the satisfaction level of the students. Face-to-face classes have the highest level of satisfaction, followed by hybrid and online classes.

The success of online classes in Africa varies depending on socioeconomic status. An African university, the National University of Lesotho, continued its academic activities through its own Learning Management System (LMS), making the online transition smoother and quicker. The University Senate also took timely transition decisions, which prevents academic loss. With negotiation with proper authorities, the university made zero-rate student access to learning platforms (Mbambo-Thata, 2020). Lack of preparation and training, financial challenge, expensive internet connection, lack of device and constant internet accessibility made it challenging to adopt online learning for the university students of Ghana. These lackings also led digital divide among the learners. Proper initiatives by the universities, government, and donors are recommended to eliminate these barriers (Agormedah et al., 2020). Both the students and the teachers of Nigeria suffer from poor internet access and low interactions to participate in online classes. The main challenge from the teachers is the student assessment and poor concentration of the students in the virtual modality. They faced malpractice in the examinations and found it challenging to get a proper evaluation. Besides, they faced trouble teaching the complex concepts on the digital platforms. Supports to get the students' required devices and internet connections, training to participate in online classes, and ensuring student engagement are recommended for effective university learning (Ebohon et al., 2021). Azubuike et al. (2021) also found a digital divide among the Nigerian learners between public and private institutions and financially able and challenged families. Literature is showing the lack of student engagement as a prominent drawback of online learning. El-Sayad et al.(2021) found that student self-efficacy and satisfaction levels significantly positively influence engagement. The study was conducted on Egypt's university students and categorized engagement into behavioural, emotional, and cognitive types. Cognitive engagement is not influenced by self-efficacy and satisfaction level. Besides the self-efficacy, Chinese students' satisfaction also depends on the perceived ease of use and usefulness of digital platforms (Jiang et al., 2021).

In Asian countries, as online classes are novel experiences, the transition causes the universities many challenges. Sia and Abbas Adamu (2020) examined the challenges and impacts of COVID-19 on higher education in Malaysia. To maintain social distance, the universities transformed to online instruction in which teachers and students had to be adaptive. The main barrier to e-learning is the poor internet connections in some areas of

the country. The government provided financial assistance for university students and postponed the tuition fees for six months. Changed teaching and assessment mode, lack of proper training and internet connections, and high screen exposure made the teachers anxious and stressed. On the other hand, poor internet connection, less interaction with teachers and fellow mates, and huge assignment burden are the significant challenges from student part. Though commence of e-learning faced the same challenges in the universities of Singapore, the academicians are optimistic about grasping opportunities like learners' independence, improved teaching, and enhanced interaction during synchronous teaching sessions. The preference for on-site learning and the emerged opportunities have created a high prospect for blended learning (Müller et al., 2021). After the first confirmed COVID case, all universities of Brunei Darussalam were asked to prepare the Business Continuation Plan (BCP) to minimize the loss in the COVID outbreak. In anticipation of the massive spread of the disease, these universities quickly made provision to continue teaching, learning, and assessing using different online platforms. Their time in this planning is very short, ranging from three days to three weeks after the first confirmed case. With some previous online teaching experience, the universities prepare guidelines for delivering the lectures fully online. Ministry of education formed a task force that took different initiatives to make the internet accessible to the stakeholders and ensure the teaching-learning process in this small Southeast Asian country. The institutions prepared the students for online assessment by arranging some trials and feedback after the online examination. Quick decision, prior online teaching experience, and supportive initiatives of the university authority, ministry of education, alumni, telecommunication industry made the continuation of academic activities without disruption (Shahrill et al., 2021). In Jordan, the satisfaction level among university students regarding remote learning is low. However, 20 private universities have more satisfaction levels than ten public and two regional universities. Internet self-efficacy, self-regulated learning, interaction with other learners, instructors, and content, work as predictors of satisfaction. Though there is no gender difference among the students of these universities, higher-level students have more happiness than lower-level students (Hamdan et al., 2021). Ministry of Education (MOE) of Kuwait launched its platform, "the electronic gate," to commence online education during the pandemic and asked the teachers and the students to activate their accounts. The main two reasons for education loss during this time were lack of technological infrastructure and procrastination of proper decisions (Alhouti, 2020). In Oman, presentation and multiple questions were preferred to assess the students and reduce academic dishonesty (Guangul et al., 2020).

Countries of South Asia shares almost similar socio-cultural environment and the universities also have some common experiences of COVID-19 pandemic. In India, around 993 universities faced different difficulties in transforming the teaching mode. The main challenges on the part of the teachers were disruption during work from home, lack of technological know-how and insufficient institutional supports, negative attitude, and lack of motivation (Joshi et al., 2020). Rizvi and Nabi (2021) identified poor network and internet connectivity, inappropriate home environment, lack of personal interaction, and excessive screen time causes fatigue among students and teachers. The university's success will depend on overcoming the challenges and adapting to the change quickly, maintaining the education quality. On the other hand, the government and the other

stakeholders should take the necessary steps to ensure the resources and support to restrict the digital, gender, and class divide. Business schools of the country also have adopted e-learning and face financial challenges during the pandemic. These schools may take the necessary strategies to reposition themselves to become successful and grasp the emerging opportunities (Rana et al., 2020). Another South Asian country Nepal also has faced challenges to change the learning mode due to lack of preparedness, resources, positive perception of students and teachers. Technological support, perception of the learners and the teachers, and infrastructure availability are the determinants of the effectiveness of online learning of the universities. The absence of personal interaction made the teachers unable to read the students' mental state and understanding level, which is vital in the teaching-learning process (Gautam & Gautam, 2021). Teachers of Pakistani universities reported teaching stress due to lack of preparedness, technical skill, work-life balance, student engagement while conducting online classes. To meet the challenges, the teachers went through pedagogical and technological adaptation. However, they also recognized a need for training to boost student participation in the classroom. (Abid et al., 2021).

Like all the developing countries, universities of Bangladesh also have faced challenges to continue the learning activities. They have to shift to online classes without preparedness, resources, and skill. All the students do not have the financial ability to afford the proper device, internet connection, home environment, etc., to participate in online classes. Besides these, less engagement, inadequate interaction, and difficulty in student assessment are significant challenges like most other countries (Al-Amin et al., 2021; Tanni et al., 2021). Fixed class schedules, short duration classes, more effective lectures, institutional supports, uploading the recorded lectures, better internet connection, regular classes, proper online evaluation are recommended for the continuation of online classes (Shuchi et al., 2021). Nur Ullah et al. (2021) mentioned that the government, University Grant Commission (UGC), and the university authorities provided different supports, especially to financially challenged students. The initiatives include loans, financial support, reduced and flexible tuition fees, special data packages, training, unique online teaching and assessment software, etc. Along with other challenges, Khan et al.(2021) pointed out students' mental health problems due to online classes during the pandemic, which should be considered. Universities face a significant challenge transitioning to online classes from traditional in-person classes, affecting teachers, students, and families. Besides, financial challenge is another problem, especially for privately-owned institutions (Huque et al., 2021a). Challenges and coping strategies are somewhat different between the public and private universities, mainly due to the difference in ownership, mode of operations, student segment (Huque et al.,2021b).

Responses of Jahangirnagar University to COVID-19

As the COVID-19 pandemic is a novel experience for all the educational institutes, Jahangirnagar university had no scope for making a plan before the crisis. It has to take steps considering the emerging situation, students' uncertainty, challenges, etc.

Closure of University

Complying with the government direction, the university stopped all its academic activities from 17th March 2020 and vacated all its residential halls. Suddenly, the

students had to leave the halls, and all the ongoing exams also were stopped for an uncertain period. Later, the university has extended the closure in different phases according to the government decision.

Financial Support to the Under Privileged Students

The university faced different challenges from the students and the teachers. As a public university, it has many students from middle-class and marginal families. Many students bear their own cost of living and education and contribute their income to maintain the family. For this, they mainly depend on providing tuition. Due to the pandemic, these students lose their income which has created financial uncertainty.

Moreover, in some cases, other family members also lost their source of income during the pandemic. Some departments and institutions provided some financial supports to their students. Jahangirnagar University authority also made a list of these financially challenged students and provided Tk.3,000 to each of such 3000 students through bKash, a mobile financial service.

Physical and Health Support

Closure of the University for an uncertain period, loss of the academic year, uncertainty about the job market, trauma about COVID-19, infection, and death of near ones hurt the students' mental health. Considering the situation, the Student Welfare and Counselling Centre of JU organized several webinars to reduce the students' mental health problems. Moreover, to monitor and formulate policies regarding COVID-19 on the campus, a high-powered COVID-19 control committee was formed. Psychologists also provide regular counselling to the different stakeholders of the university.

The shift in Teaching Modality

Many private universities also started online classes, but public universities were waiting for the directions of the UGC (University Grant Commission). Few institutes and departments of JU informally started conducting online classes after some days of closure at their initiatives. The University authority had suspended all online classes to ensure parity among all departments and institutes. Moreover, it began planning to move to a new form of the learning platform, when it would receive directives from the apex body,

University Grants Commission (UGC) established the Bangladesh Research and Education Network (BdREN) as part of the HEQEP funded by the Bangladesh government and the World Bank. The objective of BdREN is to ensure connectivity among higher education and research institutions of the country (BdREN, n.d.).

By July 2020, teachers from over 140 institutions had begun to use expensive BdREN Zoom licensed accounts, which were overgrowing. BdREN asked the teachers to register a front-end web application called "BdREN vSession" to improve costly Zoom Licensing efficiency before 04th August, 2020 and ceased the direct access to Zoom Application for scheduling meetings with Licensed Account. "BdREN vSession" provided the user with almost the same features as the licensed version.

On 2nd July 2020, the University authority circulated an email requesting the teachers to prepare for online classes. In another mail of 8th July 2020, it distributed a notice to start online classes from 12th July 2020. The authority formed a six-member technical

committee on 07th July 2020, named "Online Class Management Technical Committee" to give necessary support and guideline for this new mode of teaching.

Challenges, Adaptation, and Supports regarding the Online Classes

The university's stakeholders faced various issues due to abrupt changes in teaching and learning methods. Implementing this unanticipated shift resulted in many problems that students, teachers, and administrators must deal with using various strategies.

Commencement of online classes made the financially challenged students more helpless as most of them do not have the proper device and internet connection to join the class. As they have to leave the halls, most of them reside at their home. Some students live in remote areas where internet connection was too poor to continue the entire class. Some students also suffer from a lack of proper environment to join the class. As the modality is new for the teachers, the students did not find the classes effective in some cases. The university authority made the class attendance flexible considering the problems. UGC also had a guideline not to make attendance mandatory. But this consideration made the students more reluctant to attend the classes initially. Lack of proper device, negative attitude, flexible attendance, poor network, improper home environment, absence of assessment mainly initially restricts some students from joining the online classes. These problems also negatively affected the students' mental health, and there was a chance to face the digital divide among the students. Besides, students also faced physical problems due to high screen exposure like sight problems, headaches, back pain, etc.

Again the department and institutes came forward to support the students. Department and institutes individually assist with their students' financial help, loan, data package support, etc. UGC announced support in the form of Tk. Eight thousand interest-free loans to the students for purchasing a smartphone. Out of 750 applications, Jahangirnagar University granted loans to 253 students in February 2021, who must repay the loans before receiving their certificates from the university. The students are required to repay the loan either in one lump sum or in four equal instalments. Agrani Bank also offered Tk.60,000 loan with low interest to the students to purchase a laptop.

The university authority also considered the financial challenge of the teachers during this pandemic situation. The university syndicate decided to grant interest-free loans of Tk.50,000 to 100 teachers repayable at 20 equal instalments. The loan was sanctioned to purchase a laptop to conduct online classes.

The guidelines formulated by the technical committee set the time, number, and duration of the classes, which was positive for the students' health.

Findings from Student Survey regarding online classes

An online survey was conducted to reveal the students' experience and significant problems in October 2020. Survey forms were disseminated among JU students in a google form, and 117 responses were received. Most students were found to (49%) both Wi-Fi and mobile data to attend the classes .

Table 1 reveals that, although most students were used to communicate using Grameen Phone (GP), they preferred to use Robi to attend the online classes.

Table 1: User number and percentage of different mobile operator

	For Communication		**For Attending Class**	
Service Provider	***Frequency***	***Percentage***	***Frequency***	***Percentage***
Banglalink	22	19%	11	9%
Grameen Phone	44	38%	31	27%
Robi	38	32%	35	30%
Teletalk	13	11%	7	6%
Not applicable	0	0%	33	28%
Grand Total	***117***	***100.00%***	***117***	***100%***

Most of the respondents (76%) mentioned poor internet connection as a problem to attend online classes, followed by exam anxiety (62%) and mental health hazard (62%), and physical health problems (54%). Responses regarding other issues are shown in Table 2. Many students (44%) did not have the proper environment at their home to attend the class without disturbance or attend the viva voce or presentation. Until the survey, there was no decision about the student evaluation for which students feel uncertainty regarding academic loss reflected by 33% of responses. They were also concerned about the fairness of the exam is conducted online (32%). Anxiety regarding attending online assessments and submitting scripts on time due to inadequate internet connections and mobile networks also found a significant problem.

Table 2: Problems faced by JU students to attend the online classes

Problems	**Frequency**	**Percentage**
Poor internet connection	89	76%
Mental health hazard	73	62%
Exam anxiety	73	62%
Physical health	63	54%
Cost of Data	59	50%
Lack of learning supportive environment	52	44%
Lack of reading materials	40	34%
Non interactive class	39	33%
Lack of examinations	39	33%
Fairness in exam	37	32%
Other	17	15%
Lack of device	10	9%

Source: Student Survey

Students were also asked to mention the initiative, which would be helpful to participate in the online classes and continue the learning process during the pandemic. The majority of students (81%) recommended uploading recorded lectures after class. To upload the

reading materials was also a significant suggestion. As they found difficulty in having the reading material during this pandemic, this initiative would be helpful, especially for the students of remote areas. The response regarding the other suggestions can be found in Table 3.

Table 3: Suggestions to overcome the problems regarding online classes

Overcoming Strategy	Frequency	Percentage
Uploading lecture videos after class	95	81%
Uploading reading materials in advance	81	69%
Providing financial support for data	47	40%
Reduce the duration of the class	45	38%
Providing device support/financial support for device	40	34%
Increase the interval between classes	24	20%
Others	19	16%
Stop the online classes	10	9%
Total Respondent	117	100.00%

Source: Student Survey

Challenges faced by the teachers

To know the challenges from the teachers' side in-depth interview (IDI) was taken with ten teachers of different disciplines. Teachers also mentioned poor internet connection as the main problem of the new mode of classes. Lack of interaction and student engagement also demotivated them. Moreover, teachers from science faculty found problems teaching complex issues and lab classes using the digital platform. Some were frustrated about the poor student attendance in the class. High screen exposure and prolonged sitting posture created different types of problems like headache, migraine, neck pain, back pain, etc. They also have to make an effort to redesign the lectures and assessment tools. Some teachers, especially female teachers, face trouble maintaining their work-life balance due to unscheduled meetings, family disruptions, and the absence of household helping hands. Along with these, the overall COVID-19 context created anxiety and frustration among them.

Special Arrangement for Final year Students' Assessment

All the stakeholders of the university were worried about the academic loss. There was no decision from UGC regarding student assessment. Classes of next semester or year of some disciplines have stated keeping pending the previous final exam. Students, especially the last year students, suffered from anxiety as they have to face session jams. This anxiety magnified as there was a circular of Bangladesh Public Service Commission for Bangladesh Civil Service jobs. As the students have to appear at the final exam to qualify for applying, they faced uncertainty to grasp the opportunity. To resolve the situation, the 'Online Class Management Technical Committee' worked and recommended an online assessment mechanism for the students of that batch (Academic

session: 2015-16 and 45th batch of JU) only. The mechanism is fine tuned with the opinions of the deans' committee. Later, the academic council discussed the recommendations and approved in the university syndicate on 8th December 2020. The departments and institutes were asked to complete the final assessment of this session consisting of class evaluation, viva voce, and assignment. Accordingly, the final exams of the last year of undergraduate programs were held. The JU authority also gave an exemption for the examination fees and introduced a procedure to submit the examination form online considering the convenience of the students. That was a milestone for the public universities of the country. This initiative reduced the grievance and uncertainty of those students and their parents and made them eligible to apply for their desired job. The Examination office also published the result of these examinations within a short period.

Skill Support to the Teachers

It was a great challenge for the teachers to conduct classes in a new mode without preparation and training. The senior faculty members acutely faced the problem. The technical committee provided skill supports and guidelines to the teachers to conduct classes using digital platforms. Two faculty members were assigned in each discipline to help the other teachers with the necessary skills.

Online Student Assessment

JU authority circulated a notice to the students to take institutional email ID to make the online learning and assessment more effective. In another mail, the authority forbade the teachers to take any form of student evaluation until a policy was formulated for the online evaluation. To develop the procedure in this regard, the university formed a committee named 'Committee for Examination Policy during the disaster.' As there are different approaches for student assessment in various departments and institutes, it was challenging to develop a separate procedure for them. In all departments, the student evaluation is divided into two parts: class evaluation and final exam, but the weight varies among these two parts. The committee created a uniform method for all the departments and institutes during this new normal situation. The method was discussed in deans' committee and in academic council and got their consent with some modifications. The syndicate, with some modifications, approved the suggestions of the committee titled "Examinations Policy During Disaster-2021" on 2nd June 2021. According to the recommendations, all the student assessments will be held online during the pandemic. The total marks allocated in the final exam is 50 and should be assessed into three groups: written test (10), assignment (10), and viva voce (30). These 50 marks then will be converted into the assigned final marks allocated for the specific department or institute. This converted test score and the tutorial/in-class evaluation will be utilized to establish a student's final grade in a given course.

The policy considered the different challenges students might face to appear at the examination and submit the script. Teachers are requested to consider the unavoidable situations that the students may face. After approval, individual departments have started to make preparations to conduct the pending final examinations. Students were provided proper guidelines, review classes, Q&A sessions, and mock tests to get the necessary skills required to appear at this new assessment form. Different departments and institutes started to conduct the pending examinations in approved format from 27th June 2021.

Though the teachers have to spend more time and effort in this form of evaluation, this system is approved only for this crisis period where proctoring during examinations is difficult. That is why there would be a chance of improper assessment based only on written tests. The new format is good enough to assess the students as well as to avoid the COVID-19 exposure. Departments were given autonomy to conduct the practical examinations using the online platform. Upon the approval of the vice-chancellor, departments/institutes are granted the latitude to develop a strategy to complete and evaluate thesis work for thesis students. JU authority decided not to take any examination fees considering the financial condition of the students during this crisis. Exam Office has commenced an online marks submission system to process and publish examination results quickly.

Like some other public universities Jahangirnagar University also had to comply with the government and UGC directives regarding the closure and starting online classes and assessment. But the way it conducted the assessment of the final year students' assessment, online assessment of other students by formulating and implementing "Examinations Policy During Disater-2021, maintaining campus Safety and Hygiene, providing mental, financial support to the students are unique for a public university of a developing nation. With proper leadership, support from all levels of administration and cooperation from the teachers and students, these initiatives are being implemented without major grievance and problems.

Conclusion

Though the pandemic has caused lots of suffering globally, it has created some opportunities and learning. JU and all the universities of Bangladesh got the first-time experience of online classes, which may be later used as a blended form. Besides, online classes can be used in any disaster or political uncertainties and thus reduce the chance of academic loss due to the closure of universities. So, training can be arranged for the teachers for a more interactive and engaging class environment, ensuring effective learning for the students. Moreover, students can be benefitted from the lectures of different expert persons, researchers, and academicians from other areas of the country and abroad. To reduce the cost of data, universities and UGC can approach the telecommunication industry.

The crisis management of JU during COVID-19 has some limitations and procrastination. As a public university of a developing country, the University has to consider different hurdles and consequences, government and UGC directives. That is why it is pretty challenging to adapt to any change very quickly. But the authority of JU has managed the crisis considering all the situations carefully and taking the necessary steps to continue its academic activities and reduce the students' uncertainty. Now, the university must prepare for the challenges they will confront when resuming educational activities after a long hiatus. They have to create a proper environment to ensure adequate hygiene, and in some cases, they have to renovate the resources and purchase new machines and equipment. Besides, they have to adjust to the academic calendar and other initiatives to overcome the learning loss. Other public universities of the country and the public universities of other developing countries can also get the idea from this crisis management case and use it to manage any disaster in their future learning process.

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Impact of COVID-19 on the Supply Chain of Poultry Industry, Dairy & Livestock Industry in Bangladesh

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MIP Model: An MIP model for production, transportation, and distribution problem has been developed by Pirkul and Jayaraman to represent a multi-product tri-echelon capacitated plant and warehouse location problem. The model minimizes the sum of fixed costs of operating the plants and warehouses and the variable costs of transporting multiple products from the plants to the warehouses and finally to the customers. The model simultaneously maximizes the difference between return and investment.

System Dynamic: System dynamics is a vibrant methodology based on developing simulation models to improve decision-making, forecasting, or problem-solving performance.

The Simulation Model: The simulation model has the capability to assess the volume of wastes that can be used as the input of by-products.

TTP- Triple Triangle Framework.

BRAC- Bangladesh Rural Advancement Committee

SD-System Dynamic

DLS- Department of Livestock Services

MoLF- The Ministry of Livestock and Fisheries

Abstract: The study explores the effect of COVID-19 on the supply chain of the poultry and dairy industry of Bangladesh. Primary data was collected from Chapia Upazila of Brahmanbaria, Kumarpur, and Badlagachi Upazila of Naogaon Zilla, Rajshahi. The study finds diversity in the supply chains of these industries. To understand the supply chain of the above markets, a survey was conducted with 36 participants for each branch from three different districts. Descriptive statistics analysis was the key method for analyzing the data. While the hypothesis of the study claimed that a change in the supply chain of the poultry and livestock industry occurred due to COVID-19, it was found that the poultry industry remains intact in the supply chain whereas changes are seen in the beef market. The findings of the study also show that large farmers have faced tremendous amounts of pressure during this COVID-19 in both the poultry and livestock industries.

Keywords: Supply Chain, Poultry Farm, Dairy Farm, Players, COVID-19, Impact.

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Introduction

The poultry, dairy and livestock are sectors have been adversely affected in the COVID-19 pandemic in Bangladesh. Livestock accounts for 1.7% of the GDP of Bangladesh (Rasha and Liza, 2018). Poultry accounts for 14% of the total value of livestock output. Poultry meat alone contributes 37% of the total meat production in Bangladesh and 22-27% of total animal protein. There are around 1,50,000 poultry farms in Bangladesh (Hamid and Rahman, 2017).

Poultry farming is a form of animal husbandry. It is a process of different types of birds such as ducks, turkeys, chickens etc for meat, egg, feather or for sale. More than six million people are directly or indirectly involved in poultry production. Poultry employs 14% of the country's labor force (Mahmud, 2020). Dairy farms account for 12% of the agricultural GDP. There are around 58,590 dairy farms in Bangladesh. Each of these farms have 10 or more cows (Rashid and Kamruzzman, 2018). Dairying, also called the dairy farming, is a branch of agriculture which means the raising, breeding and utilization of dairy animals for the production of milk and various kinds of dairy products are processed from it at dairy plants. The financial impact of the COVID-19 crisis on the country's dairy sector has shaken up the milk market. Loss in this sector is approximately $470 million as farmers could not market milk since mid-March (World Bank, 2020).

In the context of the COVID-19 pandemic, this paper therefore aims to analyze the supply chain of the poultry and dairy markets. As the pandemic has caused a tremendous amount of change in the supply of these goods and their agents in the supply line.

The Rationale of the Study

This paper aims to find the changes in the supply chain of poultry and agro markets, which have an effect on the rural economy of Bangladesh. The findings of this paper will help to determine the extent of the effect of COVID-19 on the rural economy. Previous studies could not address extremities such as COVID-19 (Shamsuzzaman & Jahan, 2017). The current study will therefore seek to add to an understanding of the effect of the COVID-19 pandemic on the supply chain of poultry, dairy and livestock in Bangladesh. The objective will be to pass on experience and findings for more post-COVID-19 studies in similar areas in future.

Objectives

The objectives of the study are to understand the change that occurred within the supply chain of the poultry and dairy industry due to COVID-19. The study also seeks to know what a supply-chain is and how it works; who the main players are; and what differences are there in the supply-chains in the different industries.

Literature Review

The poultry and livestock industries hold great significance in urban life. In this regard, there has been a considerable amount of dependency on these industries to meet up the protein requisite (de Bruyn & Wong, 2015). Explaining why there is a greater demand for poultry in urban society and hinting towards the urban supply side, the paper moves away from explaining the entire supply side. In contrast, our paper covers the whole production

chain from the root-level producer to the retailer. As more villages are heading towards townships, the necessity of poultry to meet up the food scarcity increases (Larive International, 2020). The study focused on the development of the poultry industry, which has led to the exploration of the challenges and the opportunities related to poultry sector development. Whereas, the paper does not reveal information about the supply chain of the poultry industry or the adverse effects that have been faced by the stakeholders which have been addressed in our study and the impact of COVID-19 has been brought to light. A more accurate approach to the development of the sector indicates the development of SME hatcheries, which happens to be an important sector of the supply chain (Shamsuzzaman & Jahan, 2017). This study however incorporates the Triple Triangle Framework on the poultry industry of the country. Although challenges and issues of the industries are indicated in the paper, extreme issues such as pandemics have not been addressed. This is where our paper fills in the gap and explains such extreme conditions as COVID-19. When the first lockdown was implemented in Bangladesh, businessmen were facing a huge loss. A report revealed that these businessmen were not able to sell eggs or poultry products, while the cost of production of 1-day-old chicken was 35 Taka but the selling price was one Taka, the production cost of broiler chicken was BDT 70 per kg, and production cost of the egg was 6 Taka. It was assumed that they would be forced to make a loss worth 100 Crore a day (The Business Standard). The report dives into the financial condition of the poultry farmers and retail sellers who were facing the initial time of the first imposed lockdown in Bangladesh but misses out on crucial information on the overall condition of the supply chain. Even though the financial condition of some of the stakeholders, mostly retailers, are addressed, the report side-lines the entirety of loss faced by the supply chain whereas our paper discusses the impacts based on all the actors of the supply chain.

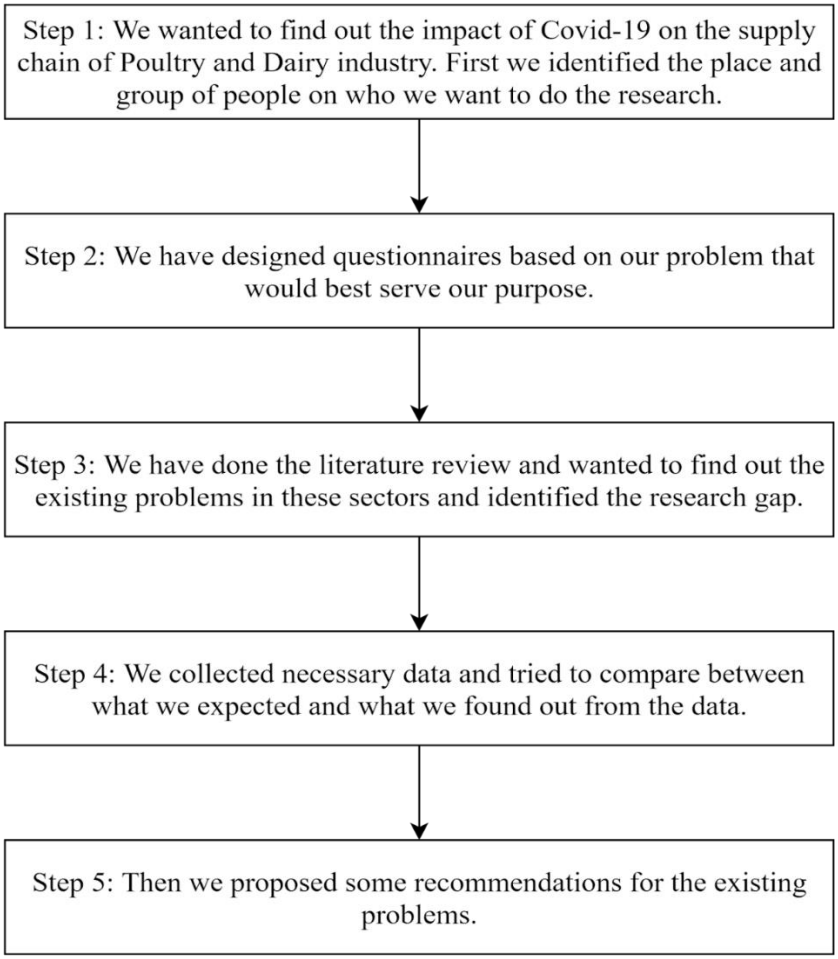
Addressing the consumption, production, and marketing of the dairy industry and ways of improving the conditions in these sectors and patterns of utilization of the labor has been discussed (Halder and Barua, 2003). But have not shown which player has benefitted the most, while our paper exclaims such issues through quantitative data. Whilst the dairy industry was suffering from the effects of COVID-19 indicating disruptions in the supply chain (ADB, 2020). The report encompassed project implementation and investment to recover from losses but has not shown the stakeholder-wise impact in the supply chain which we have included in our paper. In the input side of the market it is seen that the raw materials of animal feed such as soy and maize couldn't be imported (Light Castle Analytics Wing, 2020). But it fails to explain the supplier side of the story, leading to a gap in the segment that we cover in our study explaining the impact on the suppliers. The misconception of transmission of coronavirus due to the consumption of chicken caused the consumption of chicken and eggs to fall drastically (Poultry World, 2020). But the report does not show any impact on the stakeholders of the sector, while our paper illustrates the impact on the supply chain.

On the dairy side, there has been a huge amount of unsold milk in the market during lockdown (The Business Standard, 2020). However, there was no word about the loss of the stakeholders at different stages. Adding to the issue, spillover effects take place (The Financial Express, 2020). The report seemed to bring out the causes as oversupply and

frequent price fluctuation with large price gaps between the urban and rural markets of the country. But did not seem to shed light to the middlemen in the supply chain, which was covered in our research.

It seems that most of this literature addresses the sectors in the fields of development, significance, and even current situations but does not identify the impact on the supply chain. Most of this literature does not address the COVID-19 situation or have been written prior to the situation, as a result, these papers lack relevant information based on COVID-19. The supply chain does not seem to appear as a whole in these papers. Rather these studies indicate only a segment of the supply line or focus on the industry overall. Even though this literature is confined to such topics, it gives a clear idea of the industries. However, the current research tries to accumulate information re-introducing and defining the supply chain which is sidelined in the prior literature. Since the topic of COVID-19 is rather new, addressing the matter and relating it to the supply chain helps give a different perspective to the supply chain.

Framework



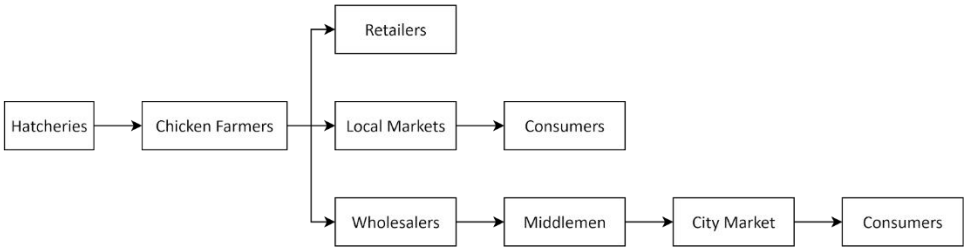
Methodology

The research is a descriptive research. Descriptive statistics analysis has been done. We have taken data for three particular time periods noted as pre-lockdown time (before March 2020), during the lockdown (March-June, 2020), and post-lockdown time (after June 2020). In both of the sectors (poultry and livestock) for each player in the supply chain, the sample size is 36 and for consumers, it is 31 as we have collected data from Badalgachi, Kasba, and Mohanpur Upazila, and the data of consumers was collected from Dhaka city. The sample size was selected by random sampling and the total population size was 525. Data was collected from these three Upazilas and Dhaka districts as we had limitations in collecting data. Because of COVID-19, data couldn't be collected from various districts and regions. Both qualitative and quantitative data have been collected. Qualitative data regarding the definition of the supply chain, what the researchers have already said, which policies have already been suggested- these helped us to know that what steps had already been taken by the government and quantitative data regarding the contribution to the development of these sectors in our economy, how many farms are there and the amount of profit or loss they were making: before, during and after the lockdown-this showed us the impact of COVID-19 on these industries for the above mentioned three time periods, the number of received stimulus packages-whether they have received any or not and if they have received, what was the amount-proper questions were asked to the players regarding all this. This helped us to know the plan of government and the ways and challenges of implementation of these plans regarding stimulus packages. For each of the sectors, wholesalers, retailers, producers, and consumers were asked questions and separate questionnaires were there for each of them and we have conducted the field survey and only the data of the consumer was collected through google forms. We have collected the primary data through proper questionnaires for the above-mentioned three time periods to see the changes in their socio-economic condition and by visiting the field, an interview of the players was taken by us. That is how the questionnaires were structured in accordance with the objectives of the study. As the objective, We have also gathered the data of consumers by preparing a google form. The secondary data was collected from existing literature, articles published in some newspapers and journals of our country, and also from different websites. Both open-ended and closed-ended questions were there. Around 15-20 minutes was taken to fill up the questionnaire. And we have shown the results through charts. We have done the t-test to see the significance of the value of the stakeholders of each market.

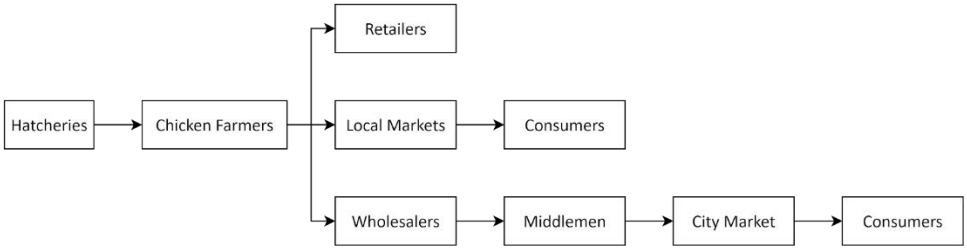
Supply Chain

The supply chain shows the process of how good is reached from the beginning stage of sourcing raw materials to the end stage and how value is added at each stage between the firm, suppliers, and the final customers. It can be of different types and the number of players in a particular supply chain again is determined based on the demand of that product and how they want to supply the product and how many industries are actually involved in the market. The more a firm can predict the functions of a supply chain, the more they study and analyze it and take proper steps to modify it from time to time, the better the firm is doing. An industry can have different types of supply chains based on their customer and location. Different kinds of supply chains are shown here.

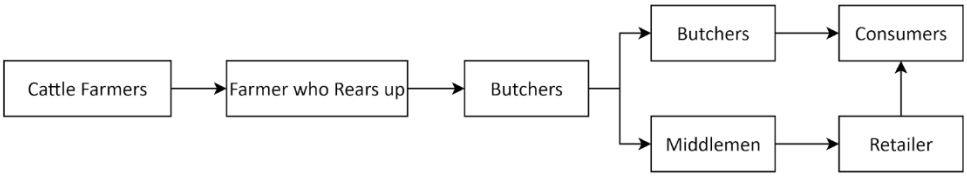
The supply-chain(poultry) we got from the primary data



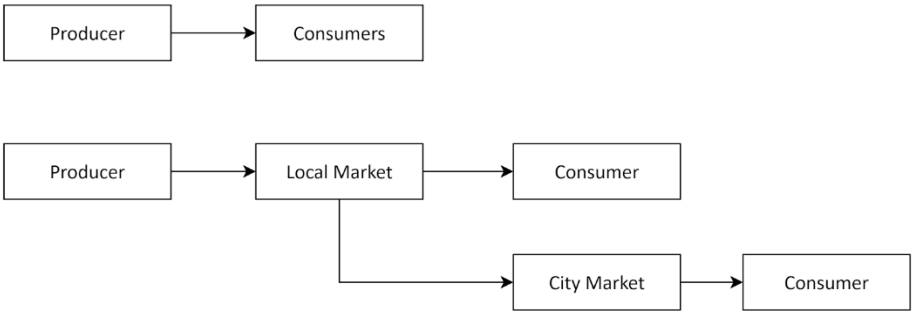
The supply-chain(egg) we got from the primary data



The supply chain(Beef) we got from the primary data



The supply chain(Milk) we got from the primary data



Importance of Supply Chain:

The objective of a supply chain is to reduce costs, ensure efficiency and predict demands. Manufacturers depend on the supply chain to reliably transfer their products. Retailers can avoid the cost of unnecessary inventories through the supply chain. Consumers know the exact location of a product. This saves time and money for the consumers. It reduces the costs of the firms. Products are diversified in these sectors, especially in the poultry sector. Firms have to know the demand of these types in their locality and outside the locality. They have to make sure their products reach in time and know-how many players to involve to supply it in the final market, in which market and profit will be maximized. When a change occurs in these sectors, such as, due to COVID-19, they have to know about the changes in the supply chain. Due to this pandemic, firms realized that they cannot make their desired amount of products to reach the market. They took alternative steps. The supply chain was narrowed down. Looking at their steps and also the amount of information they have and the stories they shared, it will be easier to understand the importance of the supply chain. Due to COVID-19, supply chain disruptions led to huge losses to the players of this sector. This is discussed below.

Stimulus Packages for These Poultry and Dairy Farms

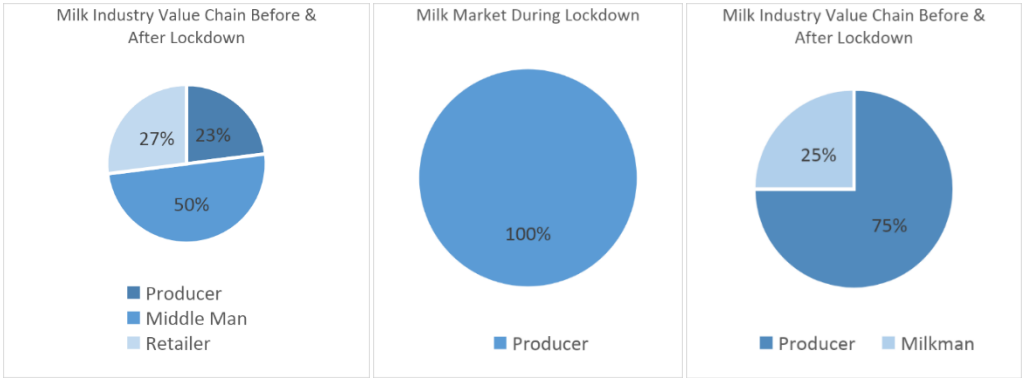
On April 12, 2020, the prime minister announced a stimulus package of 5,000 Crore Taka for small and medium enterprises (Business Line, 2020). DLS and MoLF also came to their rescue. In total 2,00,000 poultry and 4,20,000 dairy farmers in 61 districts are about to receive financial support from the government (The Business Standard, 2020). From the survey in both the poultry and dairy sector, it is seen that some of the farmers have only heard about the announcement but did not receive any, while some others claimed that they did not even hear about the announcements.

Survey Findings

The findings of the paper are based on a sample of 36 observations in four different sub-sectors. And three timelines could be distinguished, namely: Pre-Covid (Before March 17, 2020), During Lockdown (March to June of 2020), and Post Lockdown (Rest of 2020).

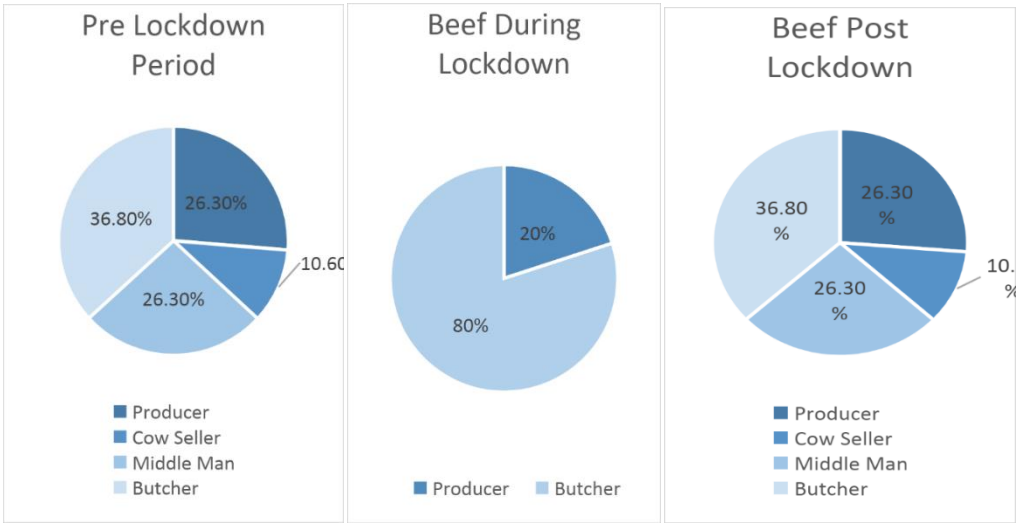
Milk Market

Since the study tried to find out individual findings, it is found out that for all three periods of pre lockdown, during the lockdown, and post lockdown the p-values are less than 2.2e-16 rendering our sample statistically significant. In the Milk Market, the average price was BDT 50 throughout the country before the lockdown was enacted. For simplicity of representation and calculation, an average amount has been shown for all three values. During the lockdown phase, the price of Milk fell to BDT 30. Survey findings show a reduction in movement of consumers and retailers in the market caused a significant amount of changes to the milk market leading the market to bid down the price. However, it is seen that, during the Eid season in our country, the market rejuvenated and the price was higher. The post lockdown period has milk prices even higher than before. During this period, however, due to decentralization, the most affected were the middle man and the retailer class. In some cases, the milk industry has a supply chain of milk producers and milkmen. Here the milkman earns the biggest share of profit. Whilst, the milk producer earns just a small portion of the profit.



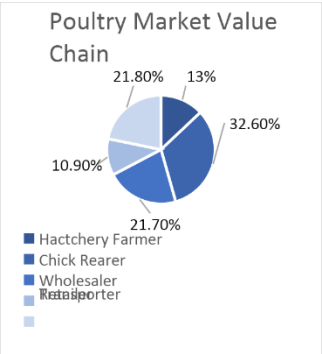
Beef Market

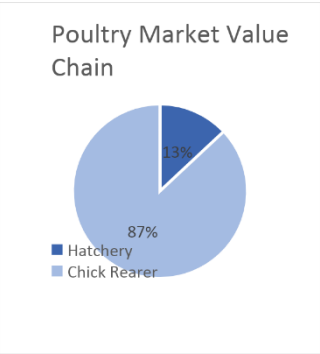
Conducting a t-test gives us a significant result for all three timelines, where the p-value in the pre-lockdown period is less than 2.2e-16. For the lockdown period, it is 0.0135, and for the post lockdown period, it is less than 2.2e-16. Thus we deem it statistically significant.

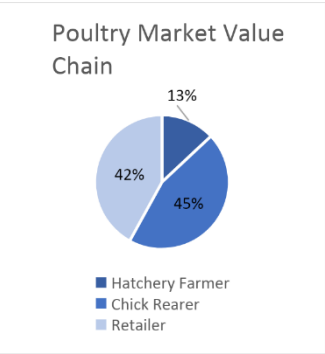


In this market it is seen that there may be different types of supply chains. The most commonly found in the area of Rajshahi and Bramhanbaria has four major agents; Cow Farmer, Cow Seller, Cow Broker (Bepari), and Butchers. During the lockdown period, the supply chain shrank, profiting the butchers or the retail class. As they could now directly deal with the producers. Another group affected were the middlemen of the first and second stages. They suffered a loss till the Eid-Ul-Adha and Eid-Ul-Fitr. During these two seasons, a lot of customers buy cows and the price hike in the beef market occurs as a result, the market was able to sustain itself as the livestock market had a liberal lockdown during that time.

Poultry Market

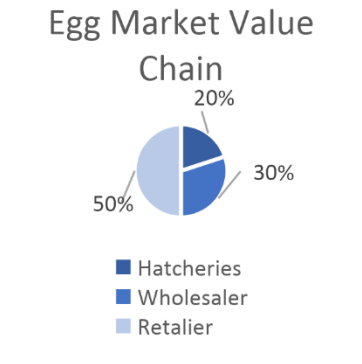






The value of the supply chain is distributed. It seems that the value chain has not been altered much in the market. The lock-down temporarily took them out of business for a few months. But none of the agents from the poultry industry seem to be permanently affected. Even though there have been losses incurred in the market, the chicken market didn't seem to have been affected much in the regions. The study reveals that the middle man or the wholesaler just bore additional costs.

Egg Market



The value chain of this field is related to that of the chicken market. In this sector the profit margin was already very minimal as a result this chain was not disrupted.

The market did not seem to suffer huge margins of loss. While the price of rural egg went down to 70 Taka during lockdown the price of farmed brown eggs remained constant

Conclusions

The study tried to analyze the impact of COVID-19 in three different time periods on the supply chain of the poultry and livestock industry. From the analysis, it is seen that in the poultry market temporary, but sustainable loss has been incurred by small farmers while large hatcheries and farms suffered more. But surprisingly, innovation helped few farmers to survive-which was very prominent among the livestock industry (Dairy Industry). Even though all stakeholders may not be present during the lockdown period, recovery was achieved after lockdown. Whilst the livestock (and dairy industry) suffered the most, permanent losses were incurred in the middlemen class of the stakeholders. The paper tried to address the supply chain as a whole. Moreover, COVID-19 being an extreme issue faced in the sector has been illustrated in the paper. Since COVID-19 is a recent issue, the previous papers did not hint at such occurrences. This also caused not to direct towards extreme situations. In such situations, guiding steps or actions have not

been indicated. Moreover, the complex structure of the supply chain has not clearly been illustrated that may help to know the modern-day functions of different players. Whereas the paper tries to address the supply chain and re-introduce different parts of the supply chain in both industries. In addition to that, the values and impacts on different stakeholders of these industries due to COVID-19 seem to give a detailed understanding, which is relatively a new concept. Reactions of different stakeholders through surveys bring a realistic picture of the COVID-19 scenario, which seems to be a different scope of the study.

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Quest for Parliamentary Ombudsman in Bangladesh: An Analysis

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M. M. Ashaduzzaman Nour[**]

Abstract: In an effort to entrench democracy and instil practices of good governance, Governments and administrations the world over have been pressurised to be transparent and accountable. While there have long been executive complaints procedures and the possibility to judicially review maladministration, none of these options offer the impartiality, flexibility, speed and cost-effectiveness of an Ombudsman. The effectiveness of this institution has meant that more than a 100 countries now have such an office.

The need for an Ombudsman in Bangladesh has been felt ever since Independence. When the *Constitution of the People's Republic of Bangladesh* came into force on 4 November, 1972, it provided than an Ombudsman may be established under Article 77. In pursuance of this article, the 'Jatiyo Sangshad' (National Parliament) passed the *Ombudsman Act, 1980*. However, the office of Parliamentary Ombudsman has not yet been established and the provisions of the Act have remained dormant and grown stale. This has acted as an impediment to national aspirations for transparent, accountable government.

This paper provides an overview of the nature of Ombudsmen in general, its genesis in Bangladesh and analyses the role a Parliamentary Ombudsman may play in facilitating 'good governance' in the country, if established.

Keywords: *Good Governance, Ombudsman, Parliament*

Introduction

A former Parliamentary Commissioner for Administration, Sir Cecil Clothier once mused about where Ombudsman would rank in professional priority if stranded on a desert island with a doctor, policeman, carpenter, fisherman and farmer. He was of no doubt that in such a primordial state, the Ombudsman would not rank very highly but, in the midst of a complex, modern democratic government it is hard to overrate its importance.[1]

It is commonly held that the cornerstone of 'good governance' is democracy and representation of the will of the people[2], however, for such principles to have tangible, beneficial results it is necessary for a country's public service to be efficient, its judicial system reliable and its administration accountable to the public.[3] Issues concerning administration have become increasingly prevalent as, in many countries around the world, the development of the welfare state has caused the expansion of the

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3 Sarker, Md. Masud and Md. Bayezid Alam. 2010. *Ombudsman for Good Governance: Bangladesh Perspective*. Journal of Management and Social Sciences. Vol. 6, No. 1, (Spring 2010), pp.13-23 at p.14

administration and has deepened the interaction between the public and State: it has increased people's rights to benefits; it has complicated planning procedure; government intervention in industrial matters has regulated employer and employee rights; so on. This escalation in State interaction has also often led to crises in governance, marked by "an absence of openness, lack of checks and balance with regard to exercise of power and discretion…lack of institutional opportunities for raising [the] citizen's voice against abuse of power, maladministration, violation of rights, negligence, nepotism and corruption."[4] To resolve the disputes that these have caused, numerous mechanisms have been adopted worldwide through which the decisions and actions of public authorities can be challenged. The four main avenues are the courts; statutory inquiries; administrative tribunals; and ombudsman. Courts are traditionally the last resort in any dispute. Statutory inquiries and tribunals have limited scope in terms of categories of complaints and cannot cover cases relating to maladministration, particularly those arising particularly out of the exercise of administrative discretion. This leaves a considerable space for a body that is impartial, has a flexible procedure, broad terms of reference and is relatively inexpensive to engage: an Ombudsman. The effectiveness of this institution over the years has meant that more than a 100 countries now have such an office, as indicated by Annex 3.

Governance in Bangladesh has also become increasingly complex and continues to be beset with allegations of maladministration, nepotism and corruption. While there are traditional avenues for tackling such irregularities - such as the judiciary, legislature and inquiry commissions and they are also present in the country - it is evident that they are not able to address all the discrepancies that arise. Litigation is costly, complicated, time consuming and not easily accessible; the Parliament is constrained by party interests and can be seen to lack impartiality and the findings of Inquiry Commissions rarely reach the public eye.[5] Ombudsmen in contrast are less costly, flexible in procedure, widely respected and are able to make recommendations beyond the scope of ordinary courts. As Sarker and Alam attest, "the development of the concept of Ombudsman has, in many countries, helped reinforce democratic principles for good governance and restored a climate of confidence between governments and citizens"[6], which can be invaluable in the Bangladesh context.

This paper will first provide an overview of the nature of the Office, its general scope and functions, before honing into the existing scenario in Bangladesh and considering the benefits of having an Ombudsman. This will be followed by a reflection on the possible pitfalls of doing so, particularly given the current laws regarding Ombudsman, and recommendations will be made on how to overcome them.

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4 Iftekharuzzaman (2007) *Ombudsman for Good Governance in Bangladesh: Why Now, and How?* (The presented at the Seminar organized jointly by *Manusher Jonno* Foundation and Transparency International Bangladesh, Dhaka, 15 May, 2007), p.3

5 Bangladesh Law Commission (2000) *Report on The Ombudsman Act, 1980 (Act XV of 1980)* Available online at: <http://www.lawcommissionbangladesh.org/reports/31.pdf> (accessed November 22, 2012), pp. 2-3

6 Sarker, Md. Masud and Md. Bayezid Alam. 2010. *Ombudsman for Good Governance: Bangladesh Perspective*. Journal of Management and Social Sciences. Vol. 6, No. 1, (Spring 2010), pp.13-23 at p.17

What is an Ombudsman?

The word 'Ombudsman' originates from the Swedish word 'Ombuds'. It means 'officer' or 'spokesman' or 'representative'. Though the office of Ombudsman was first formally conceived in Sweden by the *Swedish Constitution Act, 1809*[7] it is evident that the idea of such an office has much older roots. Sultana notes that within the Islamic legal system, during the Abbasid era, complaint handling agencies called *Diwan Al Mazalim* were established under the aegis of a senior judge while the Turkish had a *Quadi al Quadat* ('the judge of judges') exercising a similar function.[8] However, since the establishment of Scandinavian Ombudsman in Sweden, Finland and Denmark, the model has been replicated widely, from Spain and Portugal to New Zealand and Canada.

In the UK, the Parliamentary Ombudsman was established in 1967 following the *Whyatt report 1961* where it was recommended that an ombudsman system based on the Scandinavian model of trouble-shooter should be introduced in the United Kingdom, to investigate citizen's complaints concerning maladministration.

A number of countries in Eastern Europe[9] and sub-Saharan Africa[10] have begun offering Ombudsman services as part of their shift to more democratic systems of government. As Hossain observes, "Among…neighbouring countries Pakistan has successfully adopted this institution. In India Ombudsmen are known as *Lokpal* and *Lokayakta*…Sri Lanka…has one Ombudsman known as Parliamentary Commissioner for Administration, which was introduced in 1981."[11]

In its modern manifestation, an Ombudsman is an independent, high-level official, usually with legal training, who is authorised to (1) redress individual grievances, (2) improve the quality of administration and (3) help the legislature to supervise the bureaucracy.[12] However, it is important to note that they cannot be considered a 'watchdog' in the traditional sense as they do not have the 'teeth' to enforce their recommendations through sanctions.

Doyle & Fenn identify various types of Ombudsman and ombudsman services but the focus of this article will be on 'Parliamentary Ombudsman', who are empowered to investigate into maladministration by the Prime Minister, Cabinet Ministers, MPs and central bureaucracy.[13]

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7 Rowat, R. C. 1986. *The Ombudsman, Citizen's Defender*. London: George Allen and Unwin.

8 Sultana, R. (2007) *The Ombudsman Question* The Daily Star. 10 July 2007

9 Reid, C. T. (1986) *The Ombudsman's Cousin: the Procuracy in socialist states*, Public Law, Summer, pp. 311-326

10 Hatchard, J. (1986) *The Institution of the ombudsman in Africa with special reference to Zimbabwe*, International & Comparative Law Quarterly, 35(2), pp. 255-270

11 Hossain, M. A. 2002.*Ombudsman for Bangladesh: Theory and Reality*. Available online at:<http://unpan1.un.org/*intradoc/groups/public/documents/Other/UNPAN014483.pdf* > (accessed November 22, 2012), p.7; Siddiqui, K. (1996) *Towards Good Governance in Bangladesh: Fifty Unpleasant Essays*, Dhaka:The University Press Limited.

12 Encyclopedia Brittanica, *Article on Ombudsman* 15th Edition, Vol. 16, 1986, pp. 960-961

13 Bangladesh Law Commission (2000) *Report on The Ombudsman Act, 1980 (Act XV of 1980)* Available online at: <http://www.lawcommissionbangladesh.org/reports/31.pdf> (accessed November 22, 2012), pp.1-18; Hossain, M. A. 2002.*Ombudsman for Bangladesh: Theory and Reality*. Available online

Functions of a Parliamentary Ombudsman and Investigation Procedure

To understand the importance of an Ombudsman it is necessary to first learn the traditional functions of a Parliamentary Ombudsman, as evinced by the PCA:

- Investigate complaints within their Terms of Reference made by aggrieved persons regarding the actions of MPs;
- "Promote early, mutual settlement of complaints where appropriate"[14];
- Assist aggrieved persons elucidate their grievance intelligibly and clearly;
- Direct the aggrieved persons to the appropriate body or person to lodge a complaint when the complaint is beyond the Parliamentary Ombudsman's jurisdiction;
- Present regular reports to Parliament/Head of State as to the complaints the Ombudsman has received;
- Present to Parliament/Head of State a summary of the cases the Ombudsman has supervised, along with their recommendations as to corrective remedies;

The general procedure followed by most Ombudsmen is that when a complaint is received by them, they first establish whether a complaint is malicious or trivial. If it is not, they then "seek to achieve an early, mutually acceptable settlement of a complaint"[15] if appropriate. If it is not resolved through such a dispute resolution mechanism, they investigate by inquiring into the matters involved.[16] They can call for evidence and files on the matter and investigate the fairness and justice of the administrative action on which the complaint lies and thereby propose a remedy.[17] There is no formal hearing as there would be in the court system but the body investigates whether there was any evidence of maladministration in the form of "bias, neglect, inattention, delay, incompetence, ineptitude, perversity, turpitude, arbitrariness"[18]. Similarly, there is also no appeals process as there would be in the court system. The only manner in which an Ombudsman's actions can generally be challenged is through judicial review, which can only be sought on limited grounds.

The investigation and any remedies proposed are then elaborated in a draft preliminary report, this allows for the relevant parties to comment. After the parties have had an opportunity to comment, the report is finalised. A host of remedies and recommendations may be made in the report, some of which, like an apology, explanation or changes in policy or practice may be obtained only from an Ombudsman and not the court system. When a remedial action suggested by the Ombudsman is not followed through, it can publicize the incident and report it to Parliament. Crucially, however, an Ombudsman can

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at:<http://unpan1.un.org/*intradoc/groups/public/documents/Other/UNPAN014483.pdf* > (accessed November 22, 2012), p.15

14 Doyle, M and Fenn, P (2003) *Ombudsman*, Arbitration, 69(4), 243-251, p. 246

15 Doyle, M and Fenn, P (2003) *Ombudsman*, Arbitration, 69(4), 243-251, p. 247

16 Raj, Gagan (1998) *Dictionary of Public Administration*. Mumbai: Himalya Publishing House.

17 Birkinshaw, P. (1994) *Grievances, Remedies and the State*. London: Sweet and Maxwell.

18 Seneviratne, M. (2000) *Ombudsman 2000*, Professional Inaugural Lecture, Nottingham Law School, April 17, 2000, *Nottingham Law Journal*, p. 18 available at www.bioa.org.uk

only make recommendations whereby he relies on censure, his prestige and "upon the reasonableness of his views to persuade the agency to alter its position"[19].

This highlights that the success of any Parliamentary Ombudsman is contingent on the cooperation of both the legislature and the establishment of a country. While concerns may be raised about whether parliamentarians or civil servants will support and assist such an endeavour, given that the entity will scrutinise their actions, established examples from across the world indicate that cooperation in this regard is usually forthcoming and an Ombudsman is not required to "exercise his formal power to compel evidence and testimony"[20]. For the same reasons, an Ombudsman does not generally require a large staff as "the bulk of investigative work is done by the agencies themselves"[21].

Ultimately, Ombudsman must strive to ensure that their services are accessible and impartial. As Doyle & Fern posit, "Ombudsman must ensure that their services are free to complainants, accessible and user-friendly, and are adequately publicised by the bodies within their jurisdiction."[22] They also note that Ombudsman not only "have a responsibility to see that *nothing* has gone wrong as much as to see that *something* has gone wrong"

The Bangladesh Scenario

The bureaucracy in this region has had a powerful, coercive force since the colonial era and has continued to do so whether in the form of ICS offices or CSP officers. They established for themselves an impervious clique that was able to carve out a tranquil and prosperous space for itself despite the political upheavals that shook the subcontinent. It was totally resistant to accountability and change and was prone to cronyism and corruption.[23] The failure to establish political control over the bureaucracy from before 1971 and the recognition that this body had to be reformed, led to the authors of the *Constitution of the People's Republic of Bangladesh, 1972* to provide for the Office of Ombudsman in Article 77, so as to ensure accountability and transparency in the bureaucracy in Bangladesh. However, the cataclysmic events and upheavals of the 1970s and 80s meant that such an aim came to nought.

At the same time, the traditional democratic avenues of accountability through MPs and councillors became increasingly insufficient with the growth of state activity in Bangladesh.[24] While certain internal accountability procedures have long existed, such as "time limits for disposal of files, inspection, supervision, Annual Confidential Reports (ACRs), civil service conduct rules etc."[25] They need to be strengthened. This is because

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19 Obaidullah, A.T.M. *Op Cit.*, p. 34

20 Obaidullah, A.T.M. *Op Cit.*, p. 34

21 Ibid

22 Doyle, M and Fenn, P (2003) *Ombudsman*, Arbitration, 69(4), 243-251, p. 246

23 Obaidullah, A.T.M (2001) *Democracy and Good Governance: The Role of Ombudsman*, Bangladesh Institute of Parliamentary Studies: Dhaka, p.45

24 Not only has government bureaucracy expanded, so have the points of contact between citizen and the state.

25 Khan, M. M. (1995) *Governance in Bangladesh*, Journal of Administration and Diplomacy, Vol-3, Nos. 1 & 2

"time limits for disposal of files are not usually complied with. Supervision has been weak in many cases and non-existent in others. Inspections are conducted casually and at irregular intervals…and [t]he ACR is largely subjective and therefore is not of much use."[26] This has meant that in spite of superficial checks and balances, the administration has continued to exert a powerful control over the governance of the country.

One of the best available methods of curbing this, is utilising the till now dormant office of Ombudsman. Article 77 of the Constitution of the People's Republic of Bangladesh provides for such an office:

1. Parliament may, by law, provide for the establishment of as office of Ombudsman.
2. The Ombudsman shall exercise such powers and perform such functions as parliament may by law, determine, including the power to investigate any action taken by the ministry, a public officer or a statutory public authority.
3. The Ombudsman shall prepare an annual report concerning the discharge of function and such report shall be laid before parliament.[27]

In 1980, at the initiative taken by the Government, the National Parliament passed the necessary act (Act No. XV of 1980) providing for the establishment of the office of ombudsman.[28]

Hossain has helpfully summarized the salient provisions of the Ombudsman Act as such:

"(a) There shall be an Ombudsman who shall be appointed by the president on the recommendation of the parliament.

(b) Parliament shall recommend for appointment as Ombudsman a person if known legal or administrative ability and conspicuous integrity.

(c) It shall come into force on such date as the Govt. may, by notification in the official Gazette, appoint.

(d) The Ombudsman shall, subject this section, hold office for a term of three years from the date on which he enters upon his office, and shall be eligible for reappointment for one further term.

(e) The Ombudsman shall not be removed from his office except by an order of the president passed pursuant to a resolution of parliament supported by majority of not less than two thirds of the total numbers of parliament on the ground of proved misconduct or physical incapacity.

(f) The Ombudsman may investigate action taken by a ministry, a statutory public authority, or a public officer in case where a complaint in respect of such action is made to him by a person.

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[26] Hossain, M. A. 2002.*Ombudsman for Bangladesh: Theory and Reality*. Available online at:<http://unpan1.un.org/*intradoc/groups/public/documents/Other/UNPAN014483.pdf* > (accessed November 22, 2012), p.1

[27] GOB. 2011. *The Constitution of the People's Republic of Bangladesh*. Dhaka: Government of Bangladesh.

[28] Ahmed, Ali. 1993. *Ombudsman For Bangladesh*. Dhaka: Academic Publishers.

(g) Ombudsman shall have the power to punish any person who, without lawful excuse obstructs him in the performance of his functions with simple imprisonment, which may extend to three months, or with fine which may extend to two thousand taka, or with both."[29]

Other important provisions of the statute include there being no strict procedure for investigation[30], the body being given all the powers of a civil court to obtain evidence[31] and proceedings before the Ombudsman being considered as 'judicial proceedings'[32].

However, as noted by the Bangladesh Law Commission in its report in 2000, section 6 of the Act only empowers an Ombudsman "to investigate only such action of a Ministry, a public officer or a statutory public authority as (1) has caused injustice to any person or (2) has resulted in undue favour being shown to any person or (3) has resulted in accrual of undue personal benefit or gain to any person."[33] In addition to this, the Law Commission, which had been entrusted with the duty of examining whether the Ombudsman Act was up to date and effective by the Government and had consulted "various Bar Associations of the country, the Ministries of the Government of Bangladesh including the President's Secretariat, the Prime Minister's Secretariat, the Parliament Secretariat, Academics, Law Teachers, Judges, Journalists, Chambers of Commerce etc."[34] to do so, ultimately concluded that numerous reforms needed to be made regarding the jurisdiction, applicability and functions of the Ombudsman. However, a glance at the Ombudsman Act, 1980 reveals that no amendment has been made to effect such necessary changes.

Despite these limitations and defects being advantageous to the administration, the office has not yet been established and the provisions of the Act have grown stale. This is not to say that discussions were not held regarding the establishment of the office. Various steps had been taken over the years to ensure that Bangladesh institutes an Ombudsman but that has borne little fruit: They have researched the legal aspects of appointing an Ombudsman[35], considered the financial prospects and cost of doing so[36] and formed potential organograms of an Ombudsman's office.[37] Regardless of this, little substantive progress was made until 2002.

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29 Hossain, M. A. 2002.*Ombudsman for Bangladesh: Theory and Reality*. Available online at: <http://unpan1.un.org*/intradoc/groups/public/documents/Other/UNPAN014483.pdf* > (accessed November 22, 2012), p.10

30 Section 7(2), The Ombudsman Act, 1980

31 Section 8(2), The Ombudsman Act, 1980

32 Section 8(3), The Ombudsman Act, 1980

33 Bangladesh Law Commission (2000) *Report on The Ombudsman Act, 1980 (Act XV of 1980)* Available online at: <http://www.lawcommissionbangladesh.org/reports/31.pdf> (accessed November 22, 2012), p.2

34 Bangladesh Law Commission (2000) *Report on The Ombudsman Act, 1980 (Act XV of 1980)* Available online at: <http://www.lawcommissionbangladesh.org/reports/31.pdf> (accessed November 22, 2012), p.31

35 The Independent (4 March 1997) 6

36 Janakantha (3 June 1998) 1

37 The Independent (3 June 1998) 12

On January 6, 2002 the coalition government brought the Act into force through a Gazette Notification.[38] However, the Government decided that the Ombudsman would only be appointed after updating the Act further. Unfortunately, no positive action has been taken since then. In response to the emerging needs and success of other countries, Bangladesh had set up a national, sector-specific Tax Ombudsman office in July 2006 but that too was abolished soon afterwards in 2010, due to it not having "much work to do".[39] With regard to the office of Ombudsman, that has brought us back to square one.

Reasons why a Parliamentary Ombudsman is needed in Bangladesh

> *"…the right to complain, the right to be heard, the right to have corrective action taken if one has suffered harm from government are human rights."*[40]
>
> - Bernard Frank

To address entrenched maladministration and paper over the substantial defects and hindrances in the judicial, legislative and executive complaints processes highlighted above, there is an 'urgent need' to "evolve an adequate and effective mechanism for controlling the administration in exercising its powers, safeguarding individual rights and creating procedures for redress of individual grievances against the administration." Such a mechanism can be manifested by establishing an impartial, independent Ombudsman service. Some of the reasons are outlined below:

Firstly, an effective Ombudsman Service can improve the general climate of public opinion towards Government. Clothier, who was Parliamentary Commissioner for Administration for 6 years, elaborated that many an aggrieved citizen could be easily pacified if laws, regulations and practices were adequately and considerately explained to them.[41] However, if an investigation is needed nonetheless, an Ombudsman's recommendations will compel agencies to explain their actions, thus lifting the veil of administrative secrecy, draped by laws such as the *Officials Secrets Act, 1923* and the *Government Servants (Conduct) Rules, 1979* in Bangladesh. Under the current statute, it is possible for the Ombudsman to investigate complaints sent to him MPs, by an individual or undertaken through their own initiative[42] and this will help citizens to obtain redress for abuse or improper use of powers and will act as a bridge between different tiers of government, as it will expose irregularities in departments or committees that may have been overlooked or unidentified. Additionally, it will also have the effect of making MPs and other officials more circumspect as they will know that their actions are being overseen by a statutory watchdog.[43] Frank opines that ultimately, the "presence of the

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38 Rahman, M. Matiur. 2002. *Ombudsman: An Aid to Transparent and Accountable Government*. Dhaka: Lokprasasana Samayiki.

39 BD News 24, 2010, *Cabinet dissolves Tax Ombudsman Post*, Available online at: <bdnews24.com/mk/kms/adk/bd/1535h> Accessed on 22 November, 2012

40 (Bernard Frank is a Pennsylvanian lawyer who is also Chairman, Ombudsman Committee, International Bar Association.) See Frank, B. (1976) *The Ombudsman and Human Rights Revisited*, 6 Israel Yearbook on Human Rights 122.

41 Clothier, C. (1986) *The Value of an Ombudsman*, Public Law, Summer, 204-211 at p. 206

42 Halim, M.A. (1998) *Constitution, Constitutional Law and Politics: Bangladesh Perspective*, Dhaka

43 Obaidullah, op cit. pp.34-35

Ombudsman has psychological value. The citizens become confident as there is a…deterrent to the bureaucracy."[44]

Secondly, a sound Ombudsman will be able to complement and assist the legislature in its functions. It will help ensure that MPs respond to the entreaties of their constituents by providing reports to the legislature on the actions of MPs, while also being able to call to attention laws producing "unreasonableness, unjust, oppressive or improperly discriminatory results"[45]. Furthermore, as a statutory body acting outside of the Government's control, an Ombudsman can be more objective in assessing complaints regarding maladministration than the internal complaints procedures of public institutions and organs.[46]

Thirdly, A Parliamentary Ombudsman can play a key role in the national integrity system[47], complementing other bodies such as the Anti-corruption Commission (ACC) and can assist and support the effective functioning of other pillars of the State, such as the Judiciary, Parliament, and the Auditor General. An Ombudsman can play a catalytic role in ensuring social accountability of these public institutions and functionaries.

Fourthly, an Ombudsman can play a key role in providing substantial, rather than 'technical' justice.[48] Ombudsman can cut through the delays often faced in the legal system, thus mitigating harm, as they have a relatively less rigid procedure, backlog, etc. This characteristic flexibility also means that they have more avenues of investigation than the courts.

Fifthly, while an Ombudsman does not have the 'teeth' to enforce awards or impose sanctions, it is able to utilise other mechanisms to ensure bodies are compelled to follow their recommendations. Indeed, given that the traditional avenues for redress are sometimes rendered ineffective when confronted with Executive powers, an Ombudsman offers alternate paths and remedies. An Ombudsman can censure those guilty of

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44 Bernard Frank quoted in Jinnah, Mohammad Ali and Mohamad, E. (1999) *Ombudsman in Bangladesh: A Review*, Social Science Review, vol. XVI, No. 1

45 Obaidullah, op. cit. p. 35. Also see Article 19 of the *New Zealand Parliamentary Commissioner (Ombudsman) Act, 1962*.

46 Iftekharuzzaman (2007) *Ombudsman for Good Governance in Bangladesh: Why Now, and How?* (The presented at the Seminar organized jointly by *Manusher Jonno* Foundation and Transparency International Bangladesh, Dhaka, 15 May, 2007), p.4

47 According to Iftekharuzzaman, "NIS is the sum total of the institutions and practices that have key roles in maintaining the honesty and integrity of the government, and thereby promoting good governance. It is through a holistic approach, involving each of the pillars of the NIS that accountable and transparent governance can be established and sustained." Iftekharuzzaman (2007) *Ombudsman for Good Governance in Bangladesh: Why Now, and How?* (The presented at the Seminar organized jointly by *Manusher Jonno* Foundation and Transparency International Bangladesh, Dhaka, 15 May, 2007), p.2. Available online at: <www.tibangladesh.org/Ombudsman150507.pdf> (accessed November 21, 2012) (Note: Though he posits a clear definition of what the NIS is, there is disagreement over what would be considered its constituent pillars. His argument effectively construes civil society, the media, the private sector and international cooperation to be on equal footing with the legislature, executive, judiciary, auditor general, election commission and public watchdogs, however, as a State entity they enjoy a higher status. Instead, the former group of bodies is empowered to help ensure that values of independence, democracy, justice and equality are upheld by the State machinery – within their terms of reference.)

48 Halim, M. A. (2006) *Office of ombudsman: Why the delay?* The Daily Star: Dhaka, 21 January 2006

maladministration and this will have great resonance, given their Constitutional and statutory authority. It is evident that such persuasion has been effective in other jurisdictions as expressed by Clothier, when sharing his personal experience as PCA: "In my six years of office, I was never finally denied the remedy I asked for, although occasionally I had to press a little to get it."[49] Furthermore, under section 9(5) of the Act, if the Ombudsman is not satisfied with the action taken by the accused body upon receiving their report, they can make a special report to the President of the Republic. It is highly likely that such a special report will be damaging to the career of a professional administrator and so fear of such may act as a substantial deterrent.

Some bodies in the private sector such as Transparency International-Bangladesh (TIB) have *de facto* assumed the role of Parliamentary Ombudsman and Anti-Corruption Commission, despite such functions and powers not being within its terms of reference. While advocating a noble cause, their actions are supposed to be circumscribed by the objectives of their Trust Deed and further constrained by the laws of Bangladesh. The Preamble to the Trust Deed of TIB states: "the promotion and development of institutions, laws an [*sic*] rules for the establishment of an efficient system ensuring transparency in governance, politics and business and for combating corruption…in Bangladesh." More specifically, 5(A) of the main text states "The main objects of the Trust shall be to promote and provide for the development of institutions, laws and rules for the establishment of an efficient system for ensuring transparency in governance, politics and business transactions and combating corruption." However, there are restrictions on how this objective can be achieved, given that TIB accepts foreign donation from DFID, DANIDA, NORAD, SIDA, UNDP and the SDC. The Act concerning foreign donations for voluntary activities such as those conducted by TIB, *The Foreign Donations (Voluntary Activities) Regulation Ordinance, 1978* states in 2(d) that a "voluntary activity" means an activity undertaken or carried on by any person or organisation of his or its own free will to render agricultural, relief, missionary, educational, cultural, vocational, social welfare and development services and shall include any such activity as the Government may, from time to time, specify to be a voluntary activity." Within this comprehensive definition, there is no mention that voluntary activities can include rendering 'governance' or 'supervisory' services. To be consonant with the law they need to circumscribe themselves within the activities specified above and cannot adopt a capacity to supervise and criticise Parliament. Other private organisations would face similar constraints. A Parliamentary Ombudsman in contrast would be empowered to investigate issues of maladministration but would be limited largely to cases of corruption, given the terms of The Ombudsman Act, 1980.

Sixthly, the establishment of an Ombudsman by the current Government could be seen to complement their vision of a 'Digital Bangladesh', where governance is modern, accountable and transparent. Even if the Ombudsman publishes a few negative reports, the fact that a body has been established to identify and investigate irregularities would enhance the State's reputation. To foster a transparent image, information on all of the Ombudsman's activities should be available online and in print and regularly updated. The entity should also fully comply with Bangladesh's Freedom of Information legislation.

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[49] Clothier, C. (1986) *The Value of an Ombudsman*, Public Law, Summer, 204-211 at p. 210

Seventhly, abstractly speaking, the establishment of an Ombudsman would help address the inequities in governance and thereby reduce the 'structural violence'[50] inherent in many societies.

Potential Pitfalls

"An Ombudsman cannot be bought off the peg: he must be made to measure"[51]

- Professor de Smith

Even if it is accepted that an Ombudsman is needed in Bangladesh and the Ombudsman Act needs to come into force, issues will arise as the governing statute is in urgent need of reform. Though there is much to be garnered from the experience of other countries in providing Ombudsman services, it is pivotal that any such body is created to fit the current context in Bangladesh.

The biggest pitfall on the road towards establishing a Parliamentary Ombudsman in the country is that only a limited number of public functionaries are held responsible by the Act. They include the: "Chairman, Mayor, Director, Member, Trustee, Officer or other employee of a statutory public authority or any other authority, corporation, body or organization established, managed or controlled by the Government."[52] Crucially, MPs & Ministers do not fall within the purview of the Act. As the Law Commission correctly identifies, this is due to the fact that the law was passed when Bangladesh was ruled by a Presidential form of Government and administrative decisions were not made by Ministers. However, as that has changed and Ministers are "increasingly being associated with decision-making, actions, development work, implementation of various projects, etc."[53] there is a need for them to be exposed to greater scrutiny[54] so as tackle maladministration. There are lessons to be learned in this regard from the experience of establishing Ombudsman in other developing countries. In Tanzania, the first African country to establish the office, the challenges of balancing an 'effective' government with having an 'accountable' government was recognised as early as 1965, but was instituted nonetheless.[55] A wider jurisdiction is also needed for greater public confidence in the Ombudsman as well, so as not to give the impression that it is merely a 'mouthpiece' or a 'hollow organ'.

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50 For more on what constitutes structural violence, see Galtung, J. (1967) *Violence, Peace and Peace Research*, Journal of Peace Research

51 Mauritius Legislative Assembly Sessional Paper No. 2 of 1965, para. 39

52 Section 2(1), *The Ombudsman Act, 1980*

53 Bangladesh Law Commission (2000) *Report on The Ombudsman Act, 1980 (Act XV of 1980)* Available online at: <http://www.lawcommissionbangladesh.org/reports/31.pdf> (accessed November 22, 2012), p.10

54 This has been recommended by the Law Commission, Bangladesh Law Commission (2000) *Report on The Ombudsman Act, 1980 (Act XV of 1980)* Available online at: <http://www.lawcommissionbangladesh.org/reports/31.pdf> (accessed November 22, 2012), pp.13-15

55 The Report of the (Tanzanian) Presidential Commission stated: "…there is already a good deal of public concern about the abuse of power. We have, therefore, given careful thought to the possibility of providing some safeguards for the ordinary citizen which will not have the effect of limiting the actions of Government or Party in a way which could hinder the task of nation building." See Hatchard, J. (1986) *The Institution of the ombudsman in Africa with special reference to Zimbabwe*, International & Comparative Law Quarterly, 35(2), pp. 255-270 at p. 256

Since the passage of the Ombudsman Act in 1980 and the Law Commission Report in 2000, the Anti-Corruption Commission (ACC) has come into force through the *Anti-Corruption Commission Act, 2004* which serves many of the same functions as outlined in the Ombudsman Act. Therefore, if a Parliamentary Ombudsman is created as per the current statute, then not only would it be faced by a strictly curtailed terms of reference but also by conflicting jurisdictions. To maintain the credibility and effective functioning of both entities, it will be necessary for the Ombudsman Act to be amended and schedules drafted to exhaustively list the agencies and departments the Ombudsman will oversee. One option that can be considered is that the Parliamentary Ombudsman will be responsible for maladministration in the form of inefficient, delay, etc. while the ACC will have consider all issues tied to nepotism, fraud, etc. If there are complaints that touch upon both maladministration and corruption, as they will in many cases, then an inter-body committee can be set up to investigate. Ensuring that such terms of reference are made clear to the general public will help prevent them from lodging complaints beyond the Ombudsman's jurisdiction and causing consequent delays.

From the English experience, it is clear that Ombudsman may build a considerable backlog of casework which in turn may lead to delays in processing and investigating complaints. However, this has often been due to a lack or resources and manpower. These budget, staffing and transport problems are particularly acute in developing countries as has been evidenced in Zimbabwe, Ghana, Nigeria, Tanzania etc.[56]

To ensure that such an issue does not arise in the Bangladesh context it will be necessary to ensure than any Ombudsman is adequately equipped and its efficiency, annually reviewed. At the same time it is necessary to avert the risk of creating a 'mini-bureaucracy' in the guise of an Ombudsman as it will create the very encumbrances it is intended to alleviate. There is a real possibility of this occurring as Bangladesh is a densely populated country of approximately 160 million people but the size of the office must be contained within reasonable limits, perhaps along the lines recommended by the Public Administration Reform Commission (PARC).[57]

They also "cannot accept complaints that are...too old"[58]. This again raises the accessibility issue: if an Ombudsman is truly accessible, then this problem would not arise in the first place as the process of lodging a complaint would be straight-forward and clear and it would not take an undue amount of time to do so.

Another criticism that has been posited in other countries about ombudsman is that it anaemic to forthright criticism, sustains government actions[59] and "potentially serves to limit public protest and outrage by maintaining the status quo, and inherent inequities, by

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56 Hatchard, J. (1986) *The Institution of the ombudsman in Africa with special reference to Zimbabwe*, International & Comparative Law Quarterly, 35(2), pp. 255-270 at p. 260

57 *Public Administration for the 21st Century,* Report of the Public Administration Reform Commission (PARC) vol-2, June 2000. The report contained an organogram which provided for an Ombudsman office containing 35 personnel.

58 Doyle, M and Fenn, P (2003) *Ombudsman*, Arbitration, 69(4), 243-251, p. 247

59 For instance, Hossain, M. A. 2002.*Ombudsman for Bangladesh: Theory and Reality*. Available online at: <http://unpan1.un.org/*intradoc/groups/public/documents/Other/UNPAN014483.pdf* > (accessed November 22, 2012), p.9

merely tweaking the edges rather than overhauling an entire system"[60]. However, as correctly identified by Doyle & Fenn, an effective Ombudsman service can help effect substantial changes in long-term and broad policies and practices, which courts would not be able to ordinarily do as they have to treat each case individually.

Finally, the independence of the Ombudsman is also an issue that will inevitably rise. At present, the role of the opposition in appointing an Ombudsman is unclear. As Parliament has to advise the President on such an appointment, it would be beneficial to the independent image of the post, if the entire Parliament, including the MPs of the opposition parties, were consulted. A general consensus in the parliament regarding the appointment of Ombudsman candidate can greatly contribute towards establishing a credible and acceptable institution.[61] When coming to a decision, the Parliament could also consider consulting the Chief Justice, senior civil servants, the Chairman of the Anti-Corruption Commission, eminent citizens, etc. The Act is also not specific regarding the qualifications required to be an office holder and importantly, does not specify that the office holder should not be holding any other lucrative post or posts of the Republic.[62] Additionally, it has been opined by many commentators that tenure of three years is too short for the post of Ombudsman and should be extended.[63] A seven year tenure, like the one the Parliamentary Commissioner for Administration in the UK[64] enjoys may be more suitable as it would help distance the State entity from the Government. Such provisions are imperative for the independent functioning of the Office.

Conclusion

Over the course of this paper, it has been established how, to establish democracy and good governance, it is necessary for the administration to be accountable. It has been mentioned how, in Bangladesh in particular, the bureaucracy has long played a powerful role with little in the way of checks and balances. At the same time, it has been observed that the traditional avenues of redress for maladministration have not always been successful. It is in such a milieu that the need for an Ombudsman arises.

If the Ombudsman is established with a truly independent, impartial nature and vested with appropriate powers and jurisdiction, then it is hoped that it will be a strong voice against administrative malpractice and will be able to provide innovative recommendations to combat such. Simultaneously, the provision of adequate and appropriate resources and concrete steps towards ensuring the independence of the body

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60 Doyle, M and Fenn, P (2003) *Ombudsman*, Arbitration, 69(4), 243-251, p. 251

61 Kamal, Touhid Md. Faisal. 2007. *We Want Ombudsman For Bangladesh.* Available online at: <*http://www.americanchronicle.com/articles/ view*/25109.> (accessed November 20, 2012).

62 See Bangladesh Law Commission (2000) *Report on The Ombudsman Act, 1980 (Act XV of 1980)* Available online at: <http://www.lawcommissionbangladesh.org/reports/31.pdf> (accessed November 22, 2012), p.15

63 For instance, Hossain, M. A. 2002.*Ombudsman for Bangladesh: Theory and Reality*. Available online at: <http://unpan1.un.org*/intradoc/groups/public/documents/Other/UNPAN014483.pdf* > (accessed November 22, 2012), p.12; the short duration of the tenure of Ombudsman has also been commented upon in other jurisdictions such as in Zimbabwe. See Hatchard, J. (1986) *The Institution of the ombudsman in Africa with special reference to Zimbabwe*, International & Comparative Law Quarterly, 35(2), pp. 255-270 at pp.268-269

64 Section 1, *Parliamentary Commissioner Act 1967* c. 13

may assist in reducing entrenched practices of obtaining illegal gratification, deliberately misplacing records, removing and destroying documents, etc. To achieve these objectives and to avoid the pitfalls indicated above, it is necessary to reform the Ombudsman Act, 1980 through a suitable Parliamentary Amendment.

However, it is likely, that just as in many other developing countries, a Parliamentary Ombudsman in Bangladesh will face endemic shortages of staffing and finances, especially as Bangladesh is a densely populated country. They will also have to cope with the daunting challenges incumbent in developing such a service in a country where many citizens are illiterate and/or highly suspicious of authority. Unfortunately, as Clothier posits, "the best administration in a complex society is too costly: and the depressing conclusion therefore is that it will always be so and there will always be a steady volume of complaints about maladministration. And of course an Ombudsman will be needed to hear and determine them"[65] But as Hossain comments, such an initiative can only be beneficial in the long term as it "will undoubtedly go a long way in helping to establish a real democratic social order and polity based on parliamentary system of government for the well-being of the people at large."[66]

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65 Clothier, C. (1986) *The Value of an Ombudsman*, Public Law, Summer, 204-211 at p. 208

66 Hossain, M. A. 2002.*Ombudsman for Bangladesh: Theory and Reality*. Available online at: <http://unpan1.un.org*/intradoc/groups/public/documents/Other/UNPAN014483.pdf* > (accessed November 22, 2012), p.18

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Development of Legislative Bodies in British-India: A Historical Overview

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Abstract: Democracy is the most popular form of government where parliament plays an important role to articulate and to aggregate the demand of the people. Parliament is a primordial institution of the modern age through which the democratic ethos of a state is manifested. Over the years, it has evolved with its multi-dimensional roles across the world according to the aspirations of the people. The legislative body of former British-India inherits the trend of the Westminster system as a part of its colonial legacy. The Parliamentary traditions and norms have gradually developed for nearly two centuries with several constitutional measures during the British rule in India. This paper aims to explore the historical development of the parliament since its inception from the British Parliament. It includes the Constitutional Development in India during British colonial rule and the development of legislative bodies. This article is primarily qualitative. It is a combination of both Historical and Analytical Approaches. With a Historical approach, the historical origin and development of legislative bodies in former British-India has been analyzed in this study. The relevant data were gathered from Secondary sources. Secondary sources of data include documents on the legal framework concerning the parliament, various Charters/Acts initiated by the British colonial ruler in India, published reports, press reports, related books, journals and monographs.

Keywords: Legislative Bodies, Democracy, Colonial Rule, Constitutional Development, Westminster System

1. Introduction

Democracy is the most popular form of government where parliament plays an important role to articulate and to aggregate the demand of the people. Parliament is an ancient institution of the modern age through which the democratic ethos of a state is manifested. Over the years, it has evolved with its multi-dimensional roles across the world combined with the aspirations of the people. The origin and the development of parliament have a long history. The parliament in India has also a glorious historical background in regards to its growth and development. However, in the past, it was not known as the parliament. In ancient India, the *Vedic* and *Puranic* literature has several references to similar political institutions. The existence of popular Assemblies namely *Sabhas* and *Samitis* were examples of such political institutions. These institutions had their generic practice, procedure, norms and values like the Parliament of the modern age. The Parliament of former India inherits the trend of the Westminster system as a part of its colonial legacy. The Parliamentary traditions and norms have gradually developed for nearly two centuries with several constitutional measures during the British rule in India.This paper aims to explore how the legislative bodies in former British India have evolved as an institution

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since its inception from the British Parliament. It includes the Constitutional Development in India during British colonial rule and the development of legislative bodies.

2. Legislative Bodies in British-India: A Colonial Legacy

The Parliamentary institution in British-India has been developed gradually for near about two centuries. The Royal Charters, Acts of British Parliament and reforms in administration brought about by the colonial rule from time to time had decisively shaped the design of parliamentary institutions in India. Initially, the East India Company used to run its administration based on various Charters issued to this effect until the coming up of the Regulating Act of 1773 through which the authority of the British Parliament imposed on the company."The historic but failed Indian revolt in 1857, downgraded by the British Raj as little more than the *Sepoy* (solder) Mutiny save for the Indians who cherished the episode as the 'first war of independence' signified the change in the British Colonial imagination: for effective governance and harmony in India, the imperial government realized that the massive disparity between the ruler and the mass in India needed to be overcome." (Rashiduzzaman, 1965). Several British leaders also realized that an institutionalized process of involving the Indians in the country's law-making process was necessary for the peace and stability of India. Among them, the comments of Sir Bartle Frere, a member of the executive council seems very significant. He mentioned in 1860, 'The perspective of the Indian people has become vital, in my opinion, because we have fewer options to understand what Indians think of our initiatives and how they will be benefited from such initiatives (Rashiduzzaman, 1965).

Subsequently, the British Parliament passed several Acts to maintain the peace and stability in India and introduce the representation of Indians in the law-making process as well as administration. Thus, the representative bodies gradually shaped as a legislative body in India. The provisions of Several Acts through which the legislative bodies were formed in India are analyzed below.

2.1 The Regulating Act of 1773: To Enforce Parliamentary Control over Company

It was an Act to set up certain regulations for the enhanced administration dealings with the East India Company as well in India. This was also the beginning of the process of administrative centralization under which the three presidencies of Bombay, Madras and Calcutta were administratively brought under the central control. Under this Act, the Governor of Bengal was made Governor-General with a Council of four members and they will be nominated by the Board of Directors of the Company. The council was to decide by the majority and the Governor-General had a 'Casting Vote'. The Legislation by the Executive was under the independent check of the Supreme Court which had a 'Veto' Power and was set up under the Act itself (Tripathi, 2002).One significant point that needs to be noted here is that despite the beginning of parliamentary control the major power remained with the Directors of the company.

2.2 Charter Act of 1833: The Beginning of the Central Legislature in India

A major development in the direction of legislative power comes with the passage of the Charter Act of 1833. This Act formally ended the rule of the Company. Now the Governor-General and his councillors were styled as 'Governor-General in Council', and a fourth Member, known as 'Law Member' was added (Shimla,2015).The law member

according to the Act could sit in the meeting of the Council only when it met for legislative purposes. The adding of the fourth ordinary member in the Council was working as an expert in lawmaking as it was a rudimentary Legislature in India. It was the first faint beginning of the Central Legislature in India (Tripathi, 2002). It is maintained that this had some inherent limitations. One major problem with this arrangement at that time was that it was difficult for the Governor-General in Council sitting in Calcutta to know 'local' problems in other 'Presidencies'.

2.3 The Act of 1853: The Separation between the Executive and Legislative Council

Hence when the Act of 1853 was passed after the expiry of 20 years of the earlier Act, it initiated an attempt to make a separation between the Executive and Legislative Council and provided for the enlargement of the Governor General-in-Council. According to this Act, the composition of the Legislative council was made with twelve members which include; six legislative members, Chief Justice and one Judge from Calcutta High Court and four members as representatives of the Provincial Governments comprised with for legislation. Six members of the legislative body were designated as Legislative Councilors and were prevented from sitting and voting in the Council except at meetings to enact legislation and rules. Legislative meetings were chaired by the Governor-General and in his absence by the Vice-President and in his absence by any senior ordinary member present. The chairperson may exercise his 'Casting Vote' if there raised any situation like equality of Votes. The rules of procedures followed by the Council were indistinguishable from those of the British Parliament. Discussions were oral and the Bills were passed through three stages and were referred to the Select Committees of the Council for scrutiny before final consideration in the House (Kashyap, 1994; Tripathi, 2002).The Council have the jurisdiction to condemn the failure of the executive and to investigate it. But there was very little scope for the Governor-General to be informed about the opinions of Indian people regarding legislative actions except through indirect sources because there was no Indian representative in the Council (Rashiduzzaman, 1967). Therefore, it may mention that it was nothing but an extended hand of the Governor General's Council.

2.4 Government of India Act 1858: Control of British Parliament over the Secretary of State for India

After the Revolt of 1857, the Company rule was ended by the passage of the Government of India Act 1858 which vested all territories of India under the control of Company in her Majesty and thereafter it ruled by and in the name of the Crown acting through the Secretary of state. This act brought the system of Dual Government in India to an end (Shimla, 2015). This Act provides for a Council of India, consisting of fifteen members presided by the Secretary of the State who had overriding powers over the decisions of the Council. Though the number of representatives was increased, its powers were curtailed (Tripathi, 2002). The Revolt of 1857 made the colonial ruler realize that one of the main reasons for the widespread outburst of discontent in India was the absence of a relationship between the 'ruling elites and the people' with no Indian member in the Governor-General's Council (Nag, 1978). On the other hand, the Government of Bombay and Madras were also unhappy at the centralization of legislative machinery and loss of their authority. From this backdrop, the British ruler passed the Indian Council Act 1861(Kashyap, 1994).

2.5 The Indian Council Act of 1861: The Devolution of Powers of the Legislative Council

The Indian Council Act of 1861 was very significant in the constitutional development of India as it commenced vitaltrans format the central and provincial legislature in regards to the legislative process. It initiated a system of legislative devolution in India (Kashyap, 1989). It extended the composition of the central legislature and the number of members increased from 12 to lower limit15and upper limit21.It is composed of different categories of members: five ordinary members, an extraordinary member and six to twelve additional member. Five members (ordinary) were designated from the Executive Council of Governor-General, the Commander-in-chief was chosen as an extraordinary member and the remaining members were chosen equally from both official and non-official Indian categories. This political incorporation of Indians, reflected in British policy through this Act, made it more rational to appoint Indians to administrative positions as well. (Dutta, 1980).

Though the devolution of powers and the associations of additional members was a positive step from the point of growth of legislature, the Act went backwards in curtailing and restricting the legislative powers of the Council in comparison to the council of Governor-General under the Act of 1853 (Shimla, 2015). The Act ensured that the Council did not assume the role of miniature Parliament. It was not established like a responsible government with a representative character as prevailed in England. The council was forbidden to transit any business other than the bills introduced which required earlier endorsement of the Governor-General. The Council could not ask a question or ask for information nor could it move resolution and discuss the budget. There was no provision to enquire into grievances and examine the conduct of the executive. Moreover, the Governor-General was given the authority to work without consulting his Council in an urgent situation and issue an ordinance that would have the same legal force as a statute for six months (Tripathi, 2002;Kashyap, 1994). This Act was passed to enhance the power of the Government (Berriedale, 1922). As a result, this Act failed to full fill the desire of the Indian people. However, it is needless to mention that the Act established the constitutional framework, which lasted until the passing of the Indian Council Act in 1892.

The Indian Council Act of 1861 made the provision to set up Bengal Legislative Assembly in the Bengal province in 1862 and at that time there were a few instances to set up representative institutions except Europe and North America (Ahmed, 2001).Among the five provincial legislatures in India, the Bengal legislature was very significant to understand the background of the growth of Parliament in Bangladesh. There are some certain factors behind this: Firstly, the penetration of the British colonial ruler started from the Bengal subsequently they set their control all over the Indian sub-continent and the colonial rule was circulated based on Bengal province, Secondly, Bengal was considered as the nucleus of the nationalist movements in India because of the vital role of Bengali leader. Thirdly, Today's Bangladesh was an integral part of Bengal which was known then as East Bengal and the parliament of Bangladesh received the norms and practices from the Bengal Legislature as a part of its colonial legacy (Mohiuddin, 2009).

The Bengal Legislature was a three-year term Legislative Council for Bengal was established with the Lieutenant Governor as its head. It consisted of twelve members nominated by the Governor. The entire members of the assembly were non-Indian as there were no certain rules for the inclusion of Indians. The functional power and jurisdiction of the provisional assembly were limited. It may not amend the Act made by the central legislature and every bill required prior approval of the Governor to turn it into an Act. Moreover, it may not enjoy the voting power on the budget also. So, it was a kind of lame and tame legislature under the Act of 1861.

2.6 Indian Council Act1892: The Enlargement of the Council with More Rights

Under the Indian Council Act 1892, the composition and workings of Imperial and Provincial Legislatures have been changed. The numbers of additional members of native Indians were enlarged by this Act but it did not secure the official majority in the house. The number of additional members was increased from below 6 to 10 in the lower level and below 12 to 16 at the upper level in the Central Legislative Council (Tripathi, 2002). The Act also introduced a system of indirect elections for some additional members by different classes among local bodies, the institution of higher education and trade and commerce associations etc. The council was authorized to discuss the annual budget but it was not empowered to pass a resolution or divide the house. Members have enjoyed the opportunities to ask questions with certain limitations for the first time on executive policies but they were not allowed to ask auxiliary questions or to move resolutions (Tripathi, 2002).Although the changes were introduced in the Act of 1892, the representative character of the council remained restricted. ‘The Viceroy's executive authority over the Assembly remained unchanged, and the Council essentially served as a Viceroy's Durbar’ (Sikri, 1964). Therefore, the demand of the Congress for the expansion of the Council remained continued and the Indian people were dissatisfied, frustrated and became agitated against the colonial ruler.

In this regard, LordCurzon, the then Governor-General of India initiated some reform policy to make the British sun radiant in the Indian sky and to make the British position impregnable on the Indian soil as he remarked that he wanted to build the edifice of British rule on ‘the rock of granite’(Patnaik, 1973). As a part of his reform policy, LordCurzon partitioned the Bengal for ensuring effective and efficient administration in 1905.Curzon said at a farewell function in Simla in September 1905, “If I had to sum up my work in a single word, I would say ‘efficiency’. That has been our motto and the guiding principle of our administration” (Patnaik, 1973).Through this partition, the agitation spread out across Bengal which made bound the government to with draw such a decision in the next 6 years (Chatterji, 1996) and the partition of Bengal was annulled in 1911.The annulments made a no-confidence among Muslims in the colonial ruler and exaggerated the hostility among Hindu-Muslim. In regards to such circum stances, mass excitement becomes more aggravated for the demand for more representation of native Indians in the Provincial Assembly. Meanwhile, the government in England has been changed and liberals formed the government. The newly formed government took the demand of Indians into their cognizance (Sikri, 1964) and following government directions, John Morley, Secretary of State for India, and Lord Minto, Viceroy of India, began reform initiatives and constituted a committee led by Sir Arundle. The Indian Council Act was passed by the House of Lords in British Parliament in February 1909, based on the committee's recommendations.

2.7 This Indian Council's Act 1909: The Changes to the Power, Composition, and Functions of both the Central and Provincial Legislative Councils

The Indian Councils Act of1909, also known as the Morley-Minto reforms, made significant modifications to the power, composition, and functions of both the Imperial and Provincial Legislative Councils. The composition of the council enlarged from 16 to 60 excluding the executive councillors who were ex-officio members (ex-officio-7, nominated officials-28, nominated non-official-5 and elected 27) and the number of members in Provincial Council was also made double. Members were elected by several electorates such as Muslims, Landlords, Muslim Landlords, Chambers of Commerce, or the business elite, and therefore the provision for indirect election remained unaltered. Though the Governor-General as the President of the Council had the power to disallow any resolution in the public interest, the right to ask supplementary questions and moving of resolution and recording of Votes thereon was also provided for the first time. Besides, the rules of the Council enlarged the scope of discussion on the budget. The heads of expenditure, as well as revenue, has the right to exercise voting. However, some heads of expenditure were treated as non-vote able. The Legislative Council had been working as per its own rules to conduct its business more or less modelled on the British Parliamentary norms and procedure (Kashyap, 1989).It seems that the Act of 1909 brought constitutional changes only in form and not in substance. It has given the right to the representatives to raise additional questions and to forward for motion, yet, it remained inferior to the executive as before (Husain, 1991). The introduction of the indirect method of election was another major backdrop of this Act

2.8 The Government of India Act 1919:The Introduction of Bicameral Legislative Council and the Diarchy in the Provinces

Further changes were brought about by the Government of India Act 1919.The central legislature was reorganized under this new Act and included the Governor-General and two chambers: the Council of State (Upper House) and the Legislative Assembly (Lower House), each with a fixed tenure of five years and three years. The introduction of bicameralism could be considered as one of the most important developments in the history of the growth of parliamentary institutions in India. The central legislature was made representative. It had the power to make legislation for the whole of British India. Though the Act of 1919 was an advancement over the previous constitutional reforms, it did not change the power of the British parliament or the supremacy of the Governor-General or his council. The central legislature remained merely an advisory body or at best a non-sovereign law-making body (Kashyap, 1989).

One of the important changes brought about by the Act of 1919 was the introduction of the Diarchy in eight provinces. The subject of administration was classified into 'Central' and 'Provincial' under 'Devolution Rules. The provinces were given the responsibilities of carrying out the administration of the specified subjects. Giving the nature of reforms and limited power to the legislature under the Act of 1919, the nationalist leaders and the Indian National Congress were not satisfied. The demand for more reform continued. As a response to the demand for reforms the developments that followed after the Act of 1919, further reforms were proposed through the Government of India Act 1935.

2.9 The Government of India Act 1935:The Legislature was Made Representative in Nature, but the Executive was not Made Responsible for It

The Government of India Act, 1935 was a significant proposal of constitutional reform that had a visible impact on the constitutional scheme of India. The Federal legislature was composed of two legislative bodies; the Council of States (upper chamber) and the House of Assembly (lower chamber). The Council of States was composed of 260 members. The break-up was like this: 156 representatives from British India were to be elected by direct election, 6 members were to be nominated by the Governor-General and 104 representatives of Indian states were to be nominated by their rulers. The rest of the 10 seats were reserved for different minorities like Anglo Indians and Indian Christians. Previously, the duration of the Council of States was a fixed term of five years. Butunder this Act, the Council of States becomes an indissoluble body with the provision of a portion of its members (one third) retiring in each tertiary year.

The Federal Assembly, or lower house, had a total of 375 members, 250 of whom were obliquely elected as delegates of Colonial India by the Provincial Legislative Assemblies, while the remaining 125 members were chosen by the rulers of the respective Indian States. The duration of the Federal Assembly was extended from three years to five years. The Governor-General was empowered to dissolve it sooner under his discretion and also may extend the term of the Assembly (Kashyap, 1989).

According to the India Act of 1935, the Governor-General has the authority to ‘summon’ and 'prorogue' the legislature, as well as 'dismiss' the assembly at his 'discretion'. If he does not sign the bill, it will not become law. In addition to that, he could remit a bill to the houses for reconsideration. In case of disagreement, he could call the joint meeting of the two Chambers. Besides, he had some special powers to legislate; he could proclaimrule during the vacation of the parliament to meet the immediate requirements even during the session period he could proclaim ordinance to satisfactory discharge the functions which fell under his discretion and personal judgment. He could even enact statutes called the Governor-General‘s Act for the discharge of his functions required to exercise in his discretion. Moreover, he was also empowered to assume by proclamation all or any power rooted in or exercisable by any institution or authority except the Federal Judiciary (Kashyap, 1989).

Though the Act proposed to introduce many changes, there was hardly anything very substantial to offer to the leaders of the national movement to meet their expectations and demand. One of the bones of contentions has been the enormous power and unaccountable supremacy of the Governor-General. It was hardly curtailed despite the continued demands of the Indian leaders. As such, the Federal Legislature continued to remain under the dominant power of the Governor-General. Both Federal and Provincial legislatures also remained subordinate to the overriding authority of the British Parliament. The Legislative Assembly and the Council of States set up under the Government of India Act 1919 functioned from 1921-1947. The Legislature was to some extent made representative, but the executive was not made responsible for it. The members have the right to ask the question, to criticize and to pass legislation but the administration remained under the Governor-General and through him, it was responsible only to the Secretary of State in England (Kashyap, 1989).

The Provincial Assembly elections in India were scheduled in April 1937 as per the mandate of the Government of India Act 1935.Among eleven provinces, the Congress won with a majority in eight provinces including Bengal. In Bengal province, a coalition government was taking oath led by A.K Fazlul Huq which has not emerged as a stable one. Subsequently, the legislature was not functioning effectively because of an unusual situation for the Second World War. After the War, the elections of Provincial Legislature were conducted in 1946 through which the Muslim League secured the majority of the seats in Muslim majority constituencies and the Indian National congress secured maximum seats of non-Muslims constituencies (Kashyap, 1989).

The Nationalist Movement was never satisfied with the reforms carried out under the Act of 1919 and that of 1935. There was a constant demand for setting up a Constituent Assembly elected by the people of India to frame their constitution. British Government for the first time considered these demands in what is known as the August offer of 1940. The proposal was not accepted by the Indian leaders.

Finally, Cabinet Mission presented a scheme laying down the principles and procedures for framing the future constitution of India on 16th May 1946. They proposed to consider Provincial Legislative Assemblies as constitution-making body as it was elected before this scheme. The composition of the constituent assembly was385 members among them 292 members were nominated from eleven Provinces of Governor-General and 93 representatives were from Indian states. One representative from each of the four Commissioners' provinces was to be added.

After the election in August 1946, the constituent Assembly opened on December 9, 1946, in the Central Hall of the Parliament. But later on, other developments took place. When the Indian Independence Act 1947 was passed in the British Parliament, it divided India into two independent dominions known as India and Pakistan respectively. Under the Indian Independence Act, 1947, the legislatures of each of the new dominions were authorized to make their respective laws and constitutions (Khan, 2005).

It is revealed from the political and constitutional development in British India that the legislatures both in Central and Provincial were in an inferior position and dominated by the executive.

As a Head of the executive, Governor-General has jurisdiction to call and to dismiss the assembly at his discretion. The Bill may not turn into law unless it was assented by him and even he could forward a bill to the houses for reconsideration. Besides, he had some special powers to legislate; he could proclaim rule during the vacation of the parliament to meet the immediate requirements even during the session period he could proclaim ordinance to satisfactory discharge the functions which fell under his discretion and personal judgment. He could even enact statutes called the Governor-General's Act for the discharge of his functions required to exercise in his discretion. Moreover, he was also empowered to assume by proclamation all or any power rooted in or exercisable by any institution or authority except the Federal Judiciary.

Even the legislature was unable to make debate and to conduct voting on several significant issues like the budget. Some significant changes happened in the structure of legislature through some Acts but the overriding power of the Governor-General made it an impotent institution.

2.10 Bengal Legislature in British India

The Indian Council Act of 1861 established the Bengal Legislative Council in the then Bengal province, which was more than a century after British colonial dominance in India. The Bengal Legislature was the ultimate effect of the sequence of constitutional developments from the Indian Council Act, 1861 to the Government of India Act, 1935 through which the Indian states were bestowed with constitutional assemblies. Bengal Legislature was composed with the provision of Government of India Act 1935as bicameral with two legislative bodies: Bengal Legislative Council (upper house) and Bengal Legislative Assembly (Lower House). The first Bengal Legislature election was held in 1937 through which it achieved full representative character by the mandate of the people of Bengal.

3. Role of Legislative Bodies in British-India

3.1 Representation: The representation of Indians was considered as a significant factor to the colonial ruler to maintain stability and control over the colony as the nationalist movement and anti-colonial reaction were growing among the natives. So, there was very little scope for the Indians to play a meaningful representative role in the legislation. The representatives were not directly elected by the people but were nominated according to the whims and regulations of the Acts. However, the native lawmakers were demanding self-government in the legislative bodies enduring all the barrier of the colonial ruler and it was strengthened the national movement of India

3.2 Committee system: The origin of the committee system in India is generally traced back to the Montague-Chelmsford Reforms. The Standing Order of the Central Legislative Assembly provided for three committees; Committees on Petitions in relations to Bills, Committees on Amendments of Sanding Orders and Select Committee on Bill. The committees at that time ‘were not free from the governmental control and interference. They had no power and privileges’(Kaul and Sakdher, 2001). However, the PAC was also set up in India in 1921 in context of the Montague-Chelmsford Reforms. The nature and competence of the committees were not the same as it was found in the British Parliament though the Committee System was replicated from the British Parliament.

3.3 Accountability: The legislative bodies have merely a democratic norm and character as it was exercised in the British Parliament. The meaning of democracy and colonial rule is not compatible with each other rather its look like a mockery of democracy. The cardinal feature of the colonial rule is to suppress and exploit the people of the colony.

4. Conclusion

This paper focused on the historical development of legislative bodies in British India. The inception of legislative bodies in former India started along with the Royal Charters, Acts of British Parliament and reforms in administration brought about by the colonial rule from time to time had decisively shaped the design of parliamentary institutions. There was very little scope for the Indians to play a meaningful representative role in the legislation as the representatives were not directly elected by the people. There was a very little effective legislative mechanism to ensure the accountability and transparency

of the executive. The legislative bodies have merely a democratic norm and character as it was exercised in the British Parliament. So, the development and workings of the legislative bodies needed to evaluate only within the colonial framework in India. Besides, its workings and disappointments hardly may compare with the British Parliament and any other sovereign parliament where the executive generally remained accountable to the elected representatives. How ever, the Indian representatives were demanding autonomy in the legislative bodies having all the limitations and barriers of the colonial ruler. Despite having all the limitations mentioned above, the legislative bodies in British-India especially Central legislature in India (1921-1947) and Bengal Legislature were introduced some legislative tools and mechanism among them committee systems is very significant. Such legislative mechanisms were replicated in the sovereign parliaments of both India, Pakistan and later in the parliament of independent Bangladesh. Last but not the least; it may mention here that the legislative bodies in British India paved the way to install the Westminster type of democracy in India as well as in Bangladesh.

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