ISSN: 2072-7542

BUBT Journal

Bangladesh University of Business & Technology

BUBT
Journal

ISSN: 2072-7542

BUBT

Bangladesh University of Business & Technology
Main Road, Rupnagar
Mirpur-2, Dhaka-1216, Bangladesh

BUBT Journal

Special Issue June, 2019
ISSN: 2072-7542

Publisher
Dr. Md. Harun-or-Rashid
Registrar
Bangladesh University of Business & Technology (BUBT)
Main Road, Rupnagar
Mirpur-2, Dhaka-1216, Bangladesh

Printed By
Natundhara Printing Press
277/3 Elephant Road, Dhaka 1205, Bangladesh
Cell: 01711 019691, 01911 294855
Email: natundhara2014@gmail.com

Cover Design
Wahid Murad Raseel

Price: BDT 200.00
US$ 20.00

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Editorial Board

Editor's Note

BUBT Journal this time is a commemorative issue of the First International Conference on "Sustainable Development through Cross-Border Cooperation" organized by BUBT in cooperation with the Faculty of Business, University of Dhaka. During the two-day conference on October 8 and 9, 2018, about 100 distinguished scholars from home and abroad participated in different sessions to deal with papers on Business, Society and Education, Advancement of Information Technology, Banking and Gender Issues, Textile and Garments, Artificial Intelligence for Social Development, Finance, Stock Market and Governance and General Economics. Primarily 22 papers were selected for publication and after the review 12 papers are finally published in this issue.

The Conference Chair Professor Santi N. Ghosh, Director of Research & IQAC, BUBT stated in his welcome address, "Quality of a university is measured by (i) the performance of the graduates by the university and (ii) the quality and quantity of research articles by the faculty members." BUBT has been trying to put into practice this valuable suggestion of Professor Ghosh through publishing research based articles of the faculty members since its inception. Professor Dr. Shafique Ahmed Siddique, Chairman, BUBT Trust and Professor Md. Abu Saleh, Vice Chancellor, BUBT have played a pioneering role as advisors to the Editorial Board of *BUBT Journal*. This special issue is the latest in this direction.

Contents

Effect of Industrial Disputes on Workers' Job Dissatisfaction in RMG Sector: Bangladesh Perspective

Mir Mokaddesh Ali
Md. Johirul Islam

Abstract

Ready Made Garment (RMG) sector has been playing a vital role in the national economy of Bangladesh for the last few decades. But, the sector is hampered by continuous industrial disputes; and for this reason workers are facing a lot of problems related to their job. The study tries to find out the effect of industrial disputes on workers' job dissatisfaction in the RMG sector of Bangladesh. A total of 120 workers from ten garments factories in Dhaka city are selected through simple random sampling technique. The primary data are collected through the questionnaire survey from the respondents and the secondary data are collected from the literature related to the above stated field such as the articles of different journals, periodicals, annual reports of Bangladesh Garment Manufacturers and Exporters Association (BGMEA), Bangladesh Labor Act (2006), relevant books, different official documents and different websites. Findings of the study suggest that the following causes of industrial disputes: non-implementation of bonus schemes, failure to recognize unions, late payment of wages and non-redressal of grievances have a significant effect on workers' job satisfaction in the RMG sector of Bangladesh. The study will help the employers and government authorities and administrators of the garment factories to be informed about the effect of the factors of industrial disputes on workers' job dissatisfaction. If they consider the causes of job dissatisfaction arising from industrial disputes, good industrial relations will be developed in this sector.

Keywords: Industrial disputes, RMG, Garment factories, Workers, Job dissatisfaction,

1. Introduction

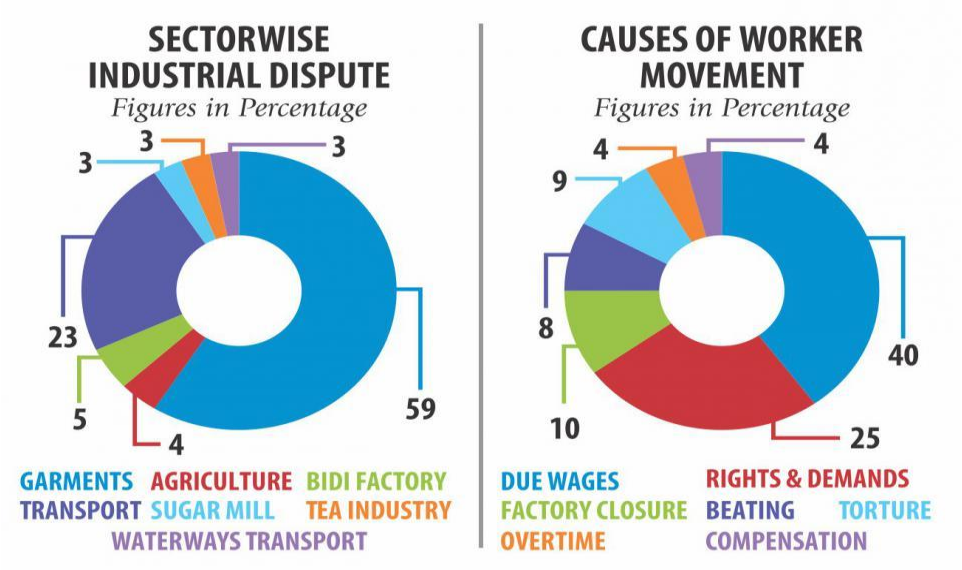
The economy of Bangladesh mainly depends on both agriculture and industry. For the last more than two decades, it has been emphasizing to convert agro based economy into industry based economy. Ready Made

garments (RMG) industry is mostly familiar in this regard. Much of the socio-economic development in the first decade of the twenty-first century in Bangladesh depends on the continuing success of the RMG industry. This sector has emerged as the biggest earner of the foreign currency. Over 80% of the total export of our country comes from this sector (Latifee, Sajib & Hafiz, 2017). This sector contributes not only in collecting foreign currency but also creates a large number of employment opportunities in Bangladesh. There are 4.2 million workers working in this sector where more than 90% workers are female who came from rural areas of Bangladesh (Islam, 2017).

RMG sector in Bangladesh has been facing a lot of problems from its beginning. Industrial dispute is a major problem. Industrial dispute or labor unrest in the RMG sector in our country has become a very common incident between management and workers. In Bangladesh generally there are mainly four parties involved in any industry : government, industrial owners, buyers and workers (Khan, 2011).Among them, workers who make profits and benefits possible for other three parties are to survive a sub-standard or low standard life for years. They are getting very low wages. In most of the cases, their salary, overtime payments, and bonus are not paid in time. 'Hiring and firing' is very common in their recruitment system. Most of the time, they are not given any appointment letters and identity cards of the factory. At any time they can be dismissed by management or owners for any reason. Their job contract is not clear to them. They are maltreated both by owners and mid-level officers. They are being harassed in terms of working under pressure and rough behavior from authority. When they are not getting their expected rights and benefits in usual ways, they go out on streets protect their demands. As a result, they are compelled to create destructive works which hamper the relationship with the owners of the garments and also affect our growing economy. This sector is under the threat of continuous disputes in our country. Industrial disputes create a bad relationship between the workers and the employer. Finally, causes of industrial disputes highly affect the workers' job satisfaction in this sector.

Islam and Ahmad (2010) state that the clashes between garment workers and law enforcers create serious crisis in this industry. It is very essential for a discussion between the management and the workers, mainly in terms of changing working environment. Miller (2012) observes that the inadvertent working environment of garment workers has been emphasized by the incident of Rana Plaza collapse and another terrificfire

incident at Tazreen Fashion in December 2012. These incidents highlight that no development and safety measures are ensured in the workplace which causes a serious violation in terms of building code standards in Bangladesh (Ahmed and Nathan, 2014). The Daily Star (May, 2018) reported that about half of the industrial disputes that took place in 2017 were in the garment sector. A total of 181 industrial disputes took place in 2017, of which 91 were in the garment sector. A total of 68 demonstrations, 21 human chains, 18 strikes, 15 road blocks and 12 gatherings were organised last year. Some 784 workers, including 21 female were killed in different workplace-related accidents last year of which 158 were in the garment sector, which is the highest.



Source: The Daily Star (01 May, 2018)

This paper aims to find out the impact of the factors affecting industrial disputes on workers' job satisfaction in RMG sector of Bangladesh.

2. Significance of the Study

Bangladesh is well known in all over the world for its success in readymade garment industry. The country has been able to create employment opportunities for millions, minimize poverty, accelerate industrialization, attract foreign direct investment, mobilize business and create a positive image of Bangladesh abroad. But these achievements are going to be shattered due to industrial disputes in this sector and the factors of disputes are highly affecting the workers' job dissatisfaction.

The present study aims to find out the influence of industrial disputes on workers' job dissatisfaction in the RMG sector of Bangladesh. The causes of industrial disputes have been analysed. If the causes of job dissatisfaction of the workers are not addressed, garments factories will have to count a heavy loss. As a result productivity will be hampered and the work environment will be degraded. The affected garment factories will be declared closed and the foreign investors will close their business here. The foreign buyers will cancel their order and divert to other countries. Government will lose huge revenue. After all, it will create an adverse impact on the socio-economic condition of the country. By this study, the owners and administrators of the garment factories will be informed about the effect of the factors of industrial disputes on the workers' job satisfaction. If they consider the factors of job dissatisfaction arisen from industrial disputes and try to resolve them, good industrial relations will be developed among them.

3. RMG Sector in Bangladesh

At present, the Ready Made Garments (RMG) sector is the single largest source of earning foreign currency in Bangladesh. This sector initiated its journey in the late 1970s in Bangladesh. Robbani (2000) stated that Bangladesh experienced a real momentum in the RMG sector between the mid-1980s and mid-1990s.The first garments factory in Bangladesh (the then East Pakistan) was established in 1960 in Dhaka (Islam, 1984). Bangladesh started exporting garments in 1976. Desh garment in association with Daewoo, a South Korean company, was the first joint venture garment factory in Bangladesh (Rock, 2001). Bangladesh Garment Manufacturers and Exporters Association (BGMEA) was formed in 1982 to protect the interests of the manufacturers and the exporters of the RMG sector. Uddin (2006) said that imposing of "Quota" restrictions on Bangladeshi products by UK, France, Canada and the USA in 1985 was a critical challenge towards the growth of this sector. Following the General Agreement on Tariff and Trade (GATT) introduction of the Multi-Fibre Arrangement(MFA) permitted the use of quota restriction which facilitated the growth and expansion of garment industry. Over the years, the RMG sector has experienced a remarkable export growth. RMG share is the total export increased from 12.44 percent in 1984-1985 to 60.64 percent in 1992-1993 (Siddiqi, 2005). The RMG sector has faced some challenges such as reducing all internal inefficiencies, managing port effectively, building backward and forward linkages, diversifying product lines and searching for new markets. One of the weaknesses of the RMG

sector in Bangladesh is the heavy dependence on imported raw materials due to inefficient backward linkage. Now-a-days, this sector has been trying to regain its previous position.

4. Literature Review

4.1 Industrial Disputes

Disputes may be defined as a disagreement between two or more persons. An industrial dispute refers to a conflict or disagreement between the management and the workers on the terms of employment. According to the Section 2(62) of The Bangladesh Labor Code, 2006 - "The industrial dispute" means any dispute or difference between employers and employers or between employers and worker or between worker and worker which is connected with the employment or non-employment or the terms of employment or the conditions of work of any person. Disputes may emerge between different organizations or within the organization, or among individuals, employees and employers, organizations and their social and political environments. Industrial crisis includes any form of work discontent which shows up in several ways such as absenteeism, go-slow, loss of man-hour, high labor turnover, work to rule, picketing, strike, sabotage, walk-in and sit–in, over time ban, high rate of sickness, lockout, suspension, and high incidence of query issuance (Yesufu, 1982).

4.2 Job Satisfaction

Many researchers have focused on the intrinsic aspects of the job satisfaction. Job satisfaction is a multidimensional, enduring, important and much researched concept in the field of organizational behavior (Bassett, 1994). The concept is an outgrowth of the human relations movement that began with the classic Hawthorne studies in the late 1920s. There is a lack of consensus as to what job satisfaction is (Hall, 1986), and how the job satisfaction of employees should be assessed. Buss (1988), for example, described job satisfaction as an employee's perception that his or her job allows the fulfillment of important values and needs. Sousa-Poza & Sousa-Poza (2000) described job satisfaction as context comprises of the physical working conditions and the social working conditions**.** On the other hand**,** Job dissatisfaction refers to the negative feelings about the job. Job dissatisfaction is a relative issue. As people's attitude is different from one other, their behavior towards any particular object is different as well. And thus, the satisfaction level of different individual is different from

others. Similarly, the level of job satisfaction determines an employees' behavior towards his/her job. Consequently, the level of job satisfaction determines the level of total satisfaction of the employee's life (Buitendach & Dewitte, 2005).

4.3 Industrial Disputes and Job Dissatisfaction in the RMG Sector

According to the findings of Ali and Khatun (2016), there are many causes of industrial disputes in the RMG sector of Bangladesh. Among those, non-implementation of bonus schemes, failure to recognize unions, late payment of wages, low rate of overtime payment, spreading of rumors, low recognition for work done, and non-redressal of grievances are the most important.

4.4 Non-implementation of Bonus Schemes

Incentive management behavior of authority creates dissatisfaction among the workers. (Islam and Ahmad, 2010). Most of the garments factories do not implement the bonus scheme. Heywood and Green and Artz (2008) presented evidence that the offer of bonuses is likely to have a differential impact on the job satisfaction of union and non-union employees. Pouliakas and Theodossiou (2009) also explored that bonuses and profit-sharing schemes result in higher job satisfaction.

4.5 Failure to Recognize Unions

Failure of garment factories to implement the minimum wage set for the workers and a lack of recognized labor unions were the key reasons for the recent unrest and workers' job dissatisfaction (Bjorn, 2010). Islam and Ahmed (2010) stated that legal and institutional failure to ensure labor rights is one of the reasons for industrial disputes in garments industry. Most of the garment factories in Bangladesh do not follow the labor law and ILO conventions.

4.6 Late Payment of Wages

According to Priyo (2010), late or irregular wages payments are very common in the RMG sectors. The workers in Tuba Garment went on hunger strike for 14 days (July-28—11th Aug, 2015), demanding their unpaid wages (including bonus), which were not paid for 12 months .Generally most of the factories do not deliver any slip of payment and those who provide pay slips have no transparency. The owners claim that more than 90% garment factories pay wages within 1st and 2nd week of the month (Rahman, Bhattacharya & Moazzem, 2008). Another study shows

that unjust payment system is also the major cause of industrial disputes in this sector (Absar, 2001)

4.7 Low Rate of Overtime Payment

Low rate of overtime payment is another cause of industrial disputes in the RMG sector. Sarker (1997) said that overtime allowance is inadequate in the garment sector in Bangladesh. Jakir (2010) said that the demand of basic human needs often force the workers to follow violent behavior. He also states that sometimes the life of a prisoner is better than that of garment workers in Bangladesh. Similar opinion from the study of Bhuiyan (2013), is that it is a basic part for all disputes and job dissatisfaction in the RMG sector in Bangladesh.

4.8 Spreading of Rumors

Daily Star (Mirdha 2012) reported that for the lack of proper counseling and poor relations with the management, the garment workers engage in violent clashes at times on rumors or slightest instigations. Except for the massive industrial disputes for wage hike in 2010, major incidents of disputes in the sector happened either following rumors of death of fellow workers or on instigation. The News Today (August, 2017) reported that the causes for the most of the recent labor disputes were not solely for the demand of salary increments but also a well-coordinated and orchestrated conspiracy created by outsiders. As a result both workers and owners become victimized and dissatisfied.

4.9 Low Recognition for Work Done

Recognition describes how the work of an employee is evaluated and how much the appreciation he or she receives in return from the organization. The reward and recognition programs serve as the most contingent factor in keeping employees' self-esteem high and passionate. Oosthuizen (2001) stated that it is among the function of managers to motivate the employees successfully and influence their behavior to achieve greater organizational efficiency. Flynn (1998) argued that rewards and recognition programs keep high spirits among employees, boosts up their morale, and create a linkage between performance and motivation of the employees. The basic purpose of recognition and reward program is to define a system to pay and communicate it to the employees so that they can link their reward to their performance which ultimately leads to employee's job satisfaction.

4.10 Non-redressal of Grievances

A study by Gathoronjo (2008) shows that poor grievance handling is a major contributory factor to labour disputes. According to Armstrong (2006), it is an interesting fact that when people are asked directly if they are satisfied with their job, most of them (seventy to ninety percent) will say they are. This is regardless of the work being done, and often in spite of strongly held grievance. Chaykowski and Slotsve (1992) stated that constructive grievance handling largely depends on the ability of managers and supervisors to recognize, diagnose, and redress the causes of potential employee dissatisfaction before they become a formal grievance. Daud et al (2011) states that the style of handling grievances affects the employee satisfaction.

Gupta (2004) underscores the importance of grievance handling on job satisfaction. He states that job satisfaction or dissatisfaction arises from the style the management employs to handle their grievances.

5. Objectives of the Study

The main objective of this study is to show the influence of the factors of industrial disputes on workers' job dissatisfaction in the RMG sector of Bangladesh.

6. Methodology

6.1 Sampling Area and Sample Selection

This research is based on a field survey conducted in Dhaka city. Most of the garments factories are located in Mirpur and Savar. For this reason, respondents were selected from these areas to conduct this study. For the convenience of our study, the researchers purposively selected 150 workers from ten leading garments factories located in these areas.

The survey covered 150 workers who realized some industrial disputes in Bangladesh and how it had influences on their job. Purposive sampling was used to choose the respondents. From the distributed questionnaire, 130 responses were received. Among them, 10 unusable responses were found. Eliminating those, 120 respondents were used for this study. The sample size was selected using convenient sampling method.

6.2 Sources of Data

Both the primary and secondary data were used in the present study. Secondary data are collected from the literature related to the above stated

field such as the articles of different journals, periodicals, annual reports of Bangladesh Garment Manufacturers and Exporters Association (BGMEA), Bangladesh Labor Act (2006), relevant books, different official documents and different websites.

The primary data are collected through the questionnaire survey.

6.3 Questionnaire Design and Tools Used

A structured questionnaire with both closed and open ended questions has been used for collecting primary data. For the closed ended questions the researchers used five point Likert scale, where 1= strongly agree, 2 =agree, 3= neutral (neither agree nor disagree), 4= disagree, and 5= strongly disagree. The questionnaire includes 07 variables or factors which affect industrial disputes and job satisfaction in the RMG sector of Bangladesh. Finally, Statistical Package for Social Science (SPSS) was used to analyze and interpret the data.

6.4 Reliability and Validity of Data

The initial reliability of the items has been verified by computing the Cronbach's alpha. The Cronbach's alpha suggests that a minimum alpha of .70 is sufficed for early stage of research. The Cronbach's alpha estimated for all of the variables was .743 (table 1). As the Cronbach's alpha was much higher than .70, the constructs were therefore, deemed to have adequate reliability.

Table 1: Reliability Statistics

Cronbach's Alpha	No. of Items
.743	08

7. Theoretical Framework and Hypothesis

This study identified "job satisfaction" as the dependent variable and industrial disputes affected by the factors like 'non-implementation of bonus scheme', 'failure to recognize unions', 'late payment of wages', 'low rate of overtime payments', 'spreading of rumors', 'low recognition for work done', 'non-redressal of grievances' as independent variables. This study also aims at constructing the regression model using multiple regression analysis to show the relationship between the factors of industrial disputes and workers' job dissatisfaction in the RMG sector of Bangladesh. The model is as follows:

$Y = a + b_1 x_1 + b_2 x_2 + b_3 x_3 +----------+ b_n x_{n.}$

Where,

Y= Job dissatisfaction

$x_{1,}$ $x_{2,}$ $x_{3,}$ and $x_{n\,=}$ Factors affecting industrial disputes

a= constant

$b_{1,}$ $b_{2,}$ $b_{3,}$ and $b_{n\,=}$ The coefficient

7.1 Hypothesis

In order to test the degree of influence of the factors affecting industrial disputes on job satisfaction of garments workers, this study draws the following hypotheses:

H1a: There is a significant influence of non-implementation of bonus scheme on workers' job satisfaction;

H2a: There is a significant influence of failure to recognize the union on workers' job satisfaction;

H3a: There is a significant influence of late payment of wage on workers' job satisfaction;

H4a: There is a significant influence of low rate of overtime payment on workers' job satisfaction;

H5a: There is a significant influence of spreading of rumor on workers' job satisfaction;

H6a: There is a significant influence of low recognition for work done on workers' job satisfaction;

H7a: There is a significant influence of non-redressal of grievance on workers' job satisfaction.

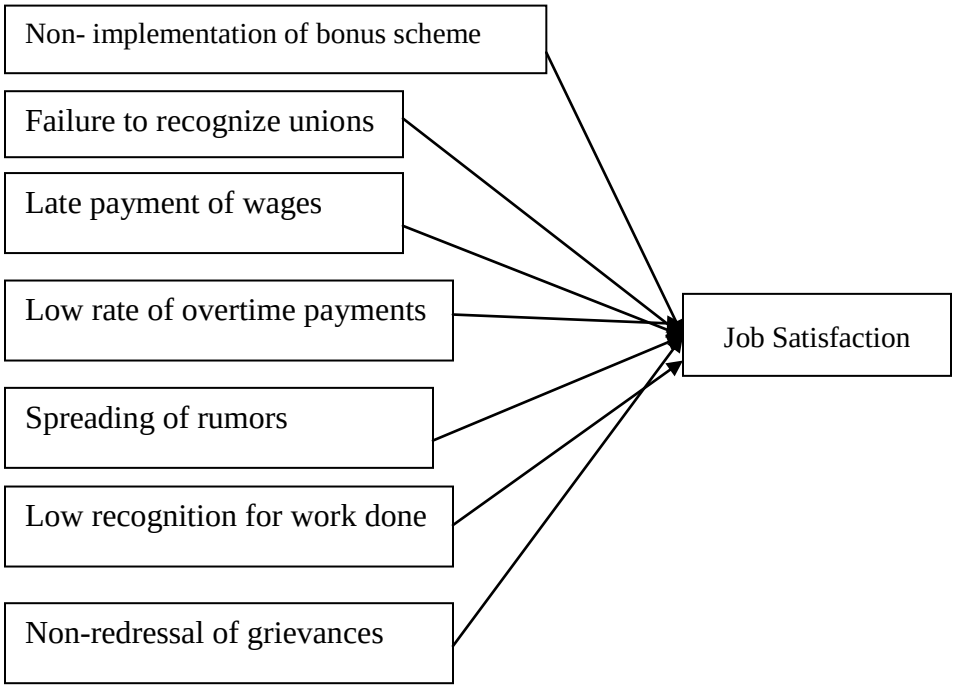


Figure 1: The theoretical framework

X1=non- implementation of bonus scheme

X2= failure to recognize unions

X3= late payment of wages

X4= low rate of overtime payments

X5= spreading of rumors

X6=low recognition for work done

X7= non-redressal of grievances

Dependent Variable: Y= Job Satisfaction

8. Analysis and Findings

The study develops seven groups of variables influencing industrial disputes namely 'non- implementation of bonus schemes', 'failure to recognize unions', 'late payment of wages', 'low rate of overtime payment', 'spreading of rumors', 'low recognition for work done', and non-redressal of grievances and its effects on workers' job satisfaction.

8.1 Demographic Information About the Respondents

The information in the following table relates to Demographic information about the respondents:

Table 2: Demographic Information About the Respondents

Particulars	Percentage
Gender	
Male	37.5
Female	62.5
Total	100.00
Marital status	
Married	33.33
Unmarried	57.67
Divorced	7.5
Widowed	2.5
Total	100.0
Educational Level	
HSC	12.5
SSC	23.5
Under SSC	64.0
Total	100.0
Age	
Below 20	25.0
20-30	58.33
31-40	12.5
Over 40	4.17
Total	100.0
Experience	
Less than 6 months	16.67
6 months-1 year	25.0
1-3 years	41.66
3-5 years	10.0
More than 5 years	6.67
Total	100.0

From the above table (Table 2) it is apparent that most of the respondents are in the age range of 20-30, 62.5 % are females, 57% respondents are unmarried (highest), and 64% of respondents are under SSC which is the highest, and 41.66% have the highest experience.

8.2 Component for Regression Analysis

8.2.1 Anova

Anova shows the overall effect of the independent variables on the dependent one. The following table shows the results and interpretations:

Table 3: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	20.819	7	2.974	2.329	.030
	Residual	143.047	112	1.277		
	Total	163.867	119			

Predictors: (Constant), Non- redressal of grievances, Low rate of over time payment, Failure to recognize unions, Low recognition for work done, Spreading of rumors, Late payment of wages, Non implementation of bonus schemes

Dependent Variable: Job dissatisfaction

The above table (Table 3) shows that the P value (.030) is lower than the standard value (.05) of the level of significance, which indicates that the overall influence of the factors of industrial disputes on the workers dissatisfaction is significant.

8.2.2 Model Summary

The model summary indicates the percentage of the influence of the independent variable on the dependent one. The indicators in the following table:

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.874	.775	.723	1.13014

a. Predictors: (Constant), Non-redressal of grievances, Low rate of overtime payment, Failure to recognize unions, Low recognition for work done, Spreading of rumors, Late payment of wages, Non-implementation of bonus schemes

From the above table (Table 4) it is found that the value of R is .874, it indicates that the impact of the independent variables on the dependent variable is very strong and enough to represent the model. In accordance with the value of the Adjusted R Square, it indicates that the factors of industrial disputes in the garment sectors have influences at 72.3% on job dissatisfaction of the workers.

Table 5: Coefficient

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Variables (Factors)	B	Std. Error	Beta	T	Sig.	Tolerance	VIF
(Constant)	2.100	.757		2.772	.007		
Non-implementation of bonus schemes	.318	.118	.291	2.696	.008	.668	1.497
Failure to recognize unions	.229	.108	.211	2.126	.036	.790	1.265
Late payment of wages	.029	.115	.027	2..252	.032	.682	1.467
Low rate of overtime payment	.074	.100	.078	.746	.457	.711	1.407
Spreading of rumors	.089	.100	.088	.888	.377	.793	1.261
Low recognition for work done	-.023	.091	-.024	-.248	.804	.855	1.169
Non- redressal of grievances	.232	.105	.200	2.200	.030	.944	1.060
Dependent Variable: Job dissatisfaction							

The above table (Table 5) shows the value of the coefficients of the regression model. Since the beta value of standardized coefficients is 0, unstandardized coefficients column is to explain. In the above table it is seen that the p value of independent variables: ‘non-implementation of bonus schemes’, ‘failure to recognize unions’, ‘late payment of wages’, ‘non-redressal of grievances’ are only significant ($p<.05$); that means they have a significant influence on the dependent variable. So the hypotheses

H1a, H2a, H3a, and H7a are accepted. It is also seen that the p value of the variables: 'low rate of overtime payment', 'spreading of rumors', 'low recognition for work done' are not significant ($p>.05$). This means, these variables do not affect the job satisfaction of garments workers; and hence, the hypotheses H4a, H5a and H6a are rejected. The reason behind this can be, that these factors are not much influential to the respondents than the other stated factors: non-implementation of bonus schemes, failure to recognize unions, late payment of wages, and non-redressal of grievances. The VIF (variance influence factor) indicates that all of the variables do not have the any multicollinearity effects. Multicollinearity/collinearity refers to the correlation among the independent variables.

9. Conclusion

The RMG sector of Bangladesh is a flourishing industry in respect of production, export, earning foreign exchange, contribution to Real GDP, employment, investment, and business mobilization. But this sector is being hampered by the continuous labor unrest. As a result, total economy of the country is affected. The study has found that reasons responsible for industrial disputes like non-implementation of bonus schemes, failure to recognize unions, late payment of wages and non-redressal of grievances have a significant effect on workers' job satisfaction in the RMG sector of Bangladesh. It is very essential to take necessary steps to fulfill workers' demand. The RMG industry involves various stakeholders covering from public, private and international organizations, Ministry of Labor and Employment and its sub-ordinate offices, Ministry of Home Affairs and various law enforcing agencies, political leaders of central and local government, local administration comprising the public side whereas factory owners, managers, officers, garment workers, BGMEA, workers' association, member of civil society organizations, NGO activists fall in the private sector. The employer and the concerned authority should sacrifice their own interests and give attention to the workers' interest as because the organizational productivity is dependent on workers' job satisfaction and commitment. So, industrial disputes in the RMG sector of Bangladesh should be settled as soon as possible for the minimization of the worker's job dissatisfaction.

10. Limitations and Future Research Direction

The limitations of this study are: the narrow research area, the fear of disclosing responses of the respondents whether it goes against their

employers. Some of the respondents also were found unwilling to disclose their personal issues and some of them were unconscious about filling of the questionnaire seeing a lot of questions. This study can serve as a guideline for future research and we believe that future research can be done in this area. Measurements and items adapted from other researches should be adjusted to fit into the research context. Future researches can expand the sample size to represent the population for better and more accurate results. In the further research attempts, the above important limitations may be considered to enrich the study and get much closer to the real findings.

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The Effect of Corporate Governance and Strategic Improvisation on Performance: A Study on Banking Sector of Bangladesh

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Abstract

Corporate governance and strategic improvisation are the key elements in improving the economic efficiency of an organization. There has been an increasing importance of corporate governance and strategic improvisation in organizations in recent years. This study has been conducted to explore the effects of corporate governance and strategic improvisation on the performance of the banks in Bangladesh. The population of the study constituted of 57 banks in Bangladesh. The sample of the study was selected using the convenient sampling technique. Primary data was collected using structured questionnaires from 20 commercial banks out of 57 banks. Data was analyzed through Factor analysis (Kaiser-Meyer –Olkin measure and Bartlett's test of sphericity), Regression analysis. After the analysis of data, this study was found highly significant having a positive impact of strategic improvisation on the performance of banks in Bangladesh. On the other hand, although a moderate correlation between corporate governance and bank performance was found, yet the regression analysis result indicates that corporate governance had a negligible or insignificant positive impact on the performance of banks in Bangladesh.

Keywords: Corporate Governance, Strategic Improvisation, Firm Performance, and Banks in Bangladesh

1. Introduction

The banks play the key role in the financial system of a country. It is widely believed that good corporate governance (CG) and strategic improvisation (SI) are imperative factors in improving the performance of Banks in any country. Corporate governance (CG) is a set of principles, which should be incorporated to ensure accountability and responsibility in every part of the organization. The corporate governance framework always helps to promote transparent and efficient markets, be consistent with the rule of law and clearly state the division of responsibilities.

Likewise, corporate governance, in recent year's improvisational activity has emerged as being significantly important in the business arena. Improvisation always allows managers to constantly learn while working and acting spontaneously and creatively to consistently moving products and services out of the door (Brown and Eisenhardt, 1997). By practicing strategic improvisation, organizations could gain a better understanding of how individual and groups in organizations can cope with and coordinate the conflicting demands of existing time perspective (Crossan, Pina e Cunha,Vera and Cunha, 2005); learn and adapt how to work under time pressure (Vera and Cunha, 2005); and remain flexible under turbulent environments (Cunha, Cunha and Kamoche, 1999).

The financial sector of Bangladesh comprises of commercial banks, non-bank financial institutions, insurance companies etc. There are 57 scheduled banks in Bangladesh now operated under full control and supervision of Bangladesh Bank which is empowered to do so through Bangladesh Bank Order, 1972 and Bank Company Act, 1991. In 2016 out of the 57 banks operating in Bangladesh, 06 belong to the public sector, 02 are specialized banks, 40 are private commercial and 09 are foreign owned banks (Bangladesh Bank, 2018).

Banking sector of Bangladesh witnessed declining profitability, rising non-performing loans, provision and capital shortfalls, eroded credit discipline, rampant corruption patronized by the aid of political quarters, low recovery rate, inferior asset quality, managerial weaknesses, undue interference from government and owners, fragile regulatory and supervisory role etc. (Hassan, 1994; USAID, 1995). The various problems have been attributed to the lack of sound corporate governance and strategic improvisation among the banks. The reviews by Bangladesh Enterprise Institute (BEI) (2003) raise severe concerns on the banking sector and criticize the quality of governance that prevails in the banking sector in Bangladesh.

In this context, the objective of this study is to examine how corporate governance and strategic improvisation can improve the performance of banks.

2. Literature Review

2.1 Firm Performance

In achieving organizational goals, the measuring and analyzing of firms' performance play an important role. The performance is usually assessed

by estimating the values of qualitative and quantitative performance indicators (Maharmand Anderson, 2008). Greater performance generally depends on developing a competitively distinct set of resources and deploying them in a properly-conceived approach (Fahy, 2000). Certainly strategists who embrace the Resource-Based View (RBV) also figure out that a competitive advantage comes from aligning competencies, motives, etc. with organizational systems, structures, and processes that help to accomplish capabilities at the organizational level (Salaman et al., 2005). Kapelko (2006) mentioned that RBV can be used to measure firm's performance. RBV can be classified into financial like accounting-based measures such as cash in hand at bank, profitability, and sales growth, etc. and non-financial like market share, new product introduction, product quality, and marketing effectiveness or manufacturing value-added. One of the most familiar measures of performance of an organization is the profitability and sales growth (Daily & Dalton, 1994).

2.2 Corporate Governance

Corporate governance plays the foremost role in macroeconomic stability; providing the suitable environment for economic growth as well as social welfare. Because of the importance of corporate governance at both the country and the corporate levels, therefore, international institutions give major attentions and concerns to this issue at the level of macro and micro aspects. Chitnomrath et al., (2011) found in Thailand that the key corporate governance mechanisms which are monitoring and incentive mechanisms are significant determinants of a firm's post-bankruptcy performance. The key monitoring mechanism is ownership concentration, measured by shares held by the largest shareholders, while the critical incentive mechanisms are cash compensation and percentage of common shares held by the plan administrator.

2.3 Strategic Improvisation

Many previous researches have paid considerable attention on the centrality of improvisation in individual and group outcomes (Kamoche et al., 2003) to the detriment of focus on organizational outcomes (firm performance). New product development as an improvisational outcome was studied by Moorman and Miner (1998) and Vera and Crossan (2005); Leybourne and Sadler-Smith (2006) explore internal and external project outcomes; Souchon and Hughes (2007) concentrate on export performance as an outcome of export improvisation; while Hmieleski and Corbett (2008) scrutinize venture performance as an outcome of entrepreneurial

improvisational behavior. According to Vera and Crossan, (2005) and Hmieleski and Corbett (2008), this relationship between improvisation and organizational outcomes have appeared to be undecided in extant research and lacks empirical examination.

Many earlier researchers tend to believe that improvisation may lead to superior performance through the secondary benefits of contingent factors such as flexibility (Crossan et al., 2005), self-efficacy (Hmieleski and Corbett, 2008), and management of environmental turbulence. By noting this deficiency in the investigation of strategic improvisation in Banks, this research seeks to provide additional contributions to existing theory and practitioners.

2.4 Corporate Governance (CG) Scenario in the Banking Industry of Bangladesh

A number of studies on the CG in Bangladesh banking industry were undertaken. All these studies determined that CG practices in banking industry were poor and that Bangladesh had lagged behind its neighbors and the global economy in CG (Gillibrand, 2004). In the recent time, Kutubi (2011) has studied the impact of board of directors' size, independence and performance of private commercial banks in Bangladesh. The study has found a statistically significant positive relationship between the proportions of the independent directors and the performance of the banks. Hossain (2011) highlighted the corporate governance practices in Bangladesh in his study and pointed out that good corporate governance has an impact on company behavior towards employees, shareholders, customers. He has suggested that improved corporate governance can provide significant benefits to both companies and countries. A study by Javed Siddiquiin 2010 pointed out the weaknesses in the Bangladeshi corporate governance regime. The author notes that the "the corporate sector in Bangladesh is characterized by high ownership concentration, lack of shareholder involvement and the reluctance of firms to raise capital through the stock markets, and reforms that are still only at initial stages**.** Rashid et al (2010) have observed board composition and firm performance of Bangladesh perspective. The study has also observed the influence of corporate board composition in the form of representation of outside independent directors on firms' economic performance in Bangladesh. The finding of the study has provided an insight to the regulators in this quest for harmonization of internal corporate governance practices.

3. Research Gap and Objectives of the Study

In the context of Bangladesh, a huge body of literature can be found in the field of corporate governance, but specifically the impact of corporate governance and strategic improvisation on the performance of banks had not sufficiently been studied here. This study has found, from the aforementioned review of literature that no study previously had scrutinized impact of both corporate governance and strategic improvisation on the performance of banks in Bangladesh.

Since there is a scope for further exploration, this study had adopted a conclusive design in order to explore the effects of corporate governance and strategic improvisation on the performance of the banks more deeply. Hence to bridge the above gaps in the literature in Bangladesh, this study has specified its objectives to unearth whether

a) There is a significant relationship between corporate governance and Banks' performance.

b) There is a significant relationship between strategic improvisation and Banks' performance.

Hence, the following are the hypotheses:

H_{01}= There is no significant relationship between corporate governance and Banks' performance

H_{02} = There is no significant relationship between strategic improvisation and Banks' performance.

4. Research Methodology

4.1 Nature of the Research

The most appropriate type of research design for this study was causal research design.

4.2 Sources and Collection of Data

For this study purpose, both primary and secondary data have been collected.

Primary data:

This study relied on a field survey on the banks' branches situated in Dhaka city. And for this study data was collected through the mail survey and face to face conversation.

Secondary Data:

Secondary data were collected from the following sources: documents, journals, articles, books and internet. Secondary data for the study were derived from the annual report of public and private commercial banks listed in the Dhaka Stock Exchange (DSE).

4.3 Population of the Study

Population of the study is confined to 57 banks in Bangladesh.

4.4 Sample Selection Technique

The sample of the study was selected using the convenient sampling technique. A total of 20 commercial banks which were situated in Dhaka city have been selected for this study. The list of the sampled banks is given below

1.Al-ArafahIslami Bank Limited	2.Bank Asia Limited	3.City Bank Limited	4.Jamuna Bank Limited
5.Dhaka Bank Limited	6.Dutch-Bangla Bank Limited	7.Eastern Bank Limited	8.IFIC Bank Limited
9.Mercantile Bank Limited	10.Mutual Trust Bank Limited	11.National Bank Limited	12.National Credit & Commerce Bank Limited
10.One Bank Limited	13. Premier Bank Limited	15.Prime Bank Limited	16.Standard Bank Limited
17.Trust Bank Limited	18. United Commercial Bank Ltd	19.Uttara Bank Limited	20.Southeast Bank Limited

The respondents of this study were the top level and mid-level employees of private commercial banks of Bangladesh. The Vice President (VP), Senior Assistant Vice President (SAVP), and Assistant Vice President (AVP) were the top level employees while principal officers, senior officers, and officers were the mid level employees. The convenience sample of this has been surveyed with a total of 70 questions in a questionnaire. After receiving the feedbacks, because of fragmentary responses and centrality bias, 10 questionnaires were rejected and 60 copiously completed questionnaires were finally retained which consequently had engendered 86% response rate for this study.

4.5 Operationalization

4.5.1 Dependent Variables

Firm performance is a relevant construct in strategic management research and used as a dependent variable in this study. This study was adopting the conceptual definition of firm performance as comprises the actual output or results of an organization as measured against its intended outputs (or goals and objectives). In this study, we attempt to measure firm's performance using Resource-Based View (RBV). RBV can be classified into financial (accounting-based measures such as cash in hand at bank, profitability, sales growth, etc.) and non-financial (market share, new product introduction, product quality, marketing effectiveness or manufacturing value-added) (Kapelko, 2006).

Table 1: Factors for Assessing firm Performance

Particulars:
Return on investment
Net profit
Control of operational expenses
Resource utilization

4.5.2 Independent Variables

This study considered corporate governance and strategic improvisation as independent variables. For measuring our variables, we have used the rating scale like Likert scale.

The conceptual and operational definitions of these independent variables are given below:

4.5.2.1 Corporate Governance

Conceptually, corporate governance is the set of processes, customs, policies, laws, and institutions affecting the way a corporation is directed, administered or controlled. Corporate governance also includes the relationships among many stakeholders involved and the goals for which the corporation is governed. In this study, we have shown corporate governance as the relationships among the management, Board of Directors, controlling shareholders, minority shareholders and other

stakeholders. To assess the practices of corporate governance of banks of Bangladesh, we considered the following factors:

Table 2: Factors for Assessing Corporate Governance

Particulars:
Minority Shareholders' rights are protected
All shareholders have the same rights to select/remove members of the board
Rules and procedures for transactions are in place
Commercial laws, stock market listing rules and regulation are in place
Inspectors investigate non-compliance with statutory requirements
Actions are taken against auditors failure to report improper financial records
Preferential treatment is often given to large shareholders
Board of directors reviews and guides corporate strategy

4.5.2.2 Strategic Improvisation

Strategic improvisation is a vital skill of top management as it can contribute to making meaningful decisions, within a limited timescale, without the best information and resources. To assess the circumstance of strategic improvisation of banks of Bangladesh, we have considered the following factors:

Table 3: Factors for Assessing Strategic Improvisation

Particulars:
Top management identifies opportunities for new work process.
Top management explores a wide variety of approaches to a problem.
Top management creates multiple courses of action during planning.
Top management maintains productivity in challenging circumstances.
A top management team adopts the company strategy adequately to changes in the organization's business environment.
Top management believes that their initial impressions of situations are almost always right.

4.6 Questionnaire Design/Formation

A structured questionnaire was developed on the basis of previous literature to collect information which included three sections. The questions are set in first section to collect corporate governance related information of the bank, the second section designed to collect strategic improvisation practices of the bank and the third section designed to collect general and performance related information of the bank. The five point Likert scale ranging from 1 to 5 (1- strongly disagree and 5- strongly agree) is used in this study. Pretesting of the questionnaire was conducted to assure the reliability the research instrument.

4.7 Data Analysis Techniques

This study assessed the effect of corporate governance and strategic improvisation on banks' performance using factor analysis in the SPSS 23. Factor analysis has been used to check construct validity of all of the scales. The results of the factor analysis have been based on two measures. The first is the Kaiser Mayer –Olkin (KMO) measure. The KMO measures the sampling adequacy. The reliability and suitability of the data for factor analysis have been examined. The value of Cronbach's alpha has been found above .90. The KMO test of sampling adequacy of above .8 and Bartlett's test of Sphericity at $p< 0.001$ have been examined. The results of this test have assessed the data factorable, and thus factor analysis has been performed. Regression analysis has been conducted to examine the impact of corporate governance and strategic improvisation on banks performance (dependent and independent variables). Finally, correlation test has been performed to investigate the strength of linear association between the variables.

5. Analysis

5.1 Factor Analysis

The results of the factor analysis have been shown in the tables below.

Table 4: Reliability Analysis (Corporate Governance)

Case Processing Summary			
		N	%
Cases	Valid	60	100.0
	Excluded[a]	0	.0
	Total	60	100.0
a. List wise deletion based on all variables in the procedure.			

Table 5: Scale all Variable

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
.967	.966	8

Table 6: KMO and Bartlett's Test (Corporate Governance)

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.866
Bartlett's Test of Sphericity	Approx. Chi-Square	633.917
	Df	28
	Sig.	.000

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	%of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.489	81.110	81.110	6.489	81.110	81.110
2	.533	6.665	87.775			
3	.401	5.013	92.787			
4	.221	2.763	95.551			
5	.144	1.801	97.351			
6	.119	1.486	98.837			
7	.055	.692	99.529			
8	.038	.471	100.000			
Extraction Method: Principal Component Analysis.						

The varimax rotated principle component factor analysis for the corporate governance scale revealed a one factor structure that explained 81.11 percent of the variance. Only factor loading of at least 0.30 has been included in the factor. Thus no item is detected. All eight items are loaded on the single factor and can be seen in the following table.

Table 7: Factor Analysis for Corporate Governance

Items	Factor Loading
Minority Shareholder's Rights are protected	0.895
All Shareholders have the same rights to select/ remove members of the board	0.744
Rules and Procedures for transaction are in place	0.617
Commercial laws, stock market listing rules and regulations are in place	0.797
Inspectors' investigation of non-compliance with statutory requirements	0.858
Actions are taken against auditors' failure to improper financial records	0.886
Preferential treatment is often given to large shareholders	0.882
Board of directors reviews and guide corporate strategy	0.846
Eigen value: 6.489, Percentage of variance explained: 81.110	

The reliability and suitability of the data for factor analysis for strategic improvisation have been examined. The value of Cronbach's alpha has been found above .90. The KMO test of sampling adequacy of above .8 and Bartlett's test of Sphericity at $p< 0.001$ have been examined. The results of this test have assessed the data factorable, and thus factor analysis has been performed.

Table 8: Reliability Analysis (Strategic Improvisation)

Case Processing Summary			
		N	%
Cases	Valid	60	100.0
	Excluded[a]	0	.0
	Total	60	100.0
List wise deletion based on all variables in the procedure.			

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.929	.933	6

Table 9: KMO and Bartlett's Test (Strategic Improvisation)

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.861
Bartlett's Test of Sphericity	Approx. Chi-Square	289.287
	Df	15
	Sig.	.000

Total Variance Explained						
	Initial Eigen values			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.511	75.184	75.184	4.511	75.184	75.184
2	.502	8.372	83.556			
3	.382	6.365	89.921			
4	.299	4.977	94.898			
5	.185	3.077	97.975			
6	.121	2.025	100.000			
Extraction Method: Principal Component Analysis.						

The varimax rotated principle component factor analysis for the strategic improvisation scale revealed a one factor structure that explained 75.18 percent of the variance. Thus no item is detected. The six items are loaded on the single factor and can be seen in the following table.

Table 10: Factor Analysis for Strategic Improvisation

Items	Factor Loading
Top management identifies opportunities for new work process	0.831
Top management explores a wide variety of approaches to a problem	0.793
Top management creates multiples courses of action during planning	0.646
Top management maintains productivity in challenging circumstances	0.754
A top management team adopts the company strategy adequately to changes in the organization business environment	0.816
Top management believes that their initial impression of situation are almost always right	0.670
Eigen value: 4.511, Percentage of variance explained: 75.184	

The bank performance data have been assessed as factorial via the KMO tests of sampling adequacy with a value of o.825 and Bartlett's test of sphericity with P< 0.001. The results of this test indicate the data factorable and factor analysis has been performed.

Table 11: Reliability Analysis (Bank Performance)

Case Processing Summary			
		N	%
Cases	Valid	60	100.0
	Excluded[a]	0	.0
	Total	60	100.0
. List wise deletion based on all variables in the procedure.			

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.917	.920	4

Table 12: KMO and Bartlett's Test (Bank Performance)

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.825
Bartlett's Test of Sphericity	Approx. Chi-Square	173.522
	Df	6
	Sig.	.000

Total Variance Explained						
	Initial Eigen values			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.224	80.600	80.600	3.224	80.600	80.600
2	.379	9.468	90.068			
3	.227	5.669	95.738			
4	.170	4.262	100.000			
Extraction Method: Principal Component Analysis.						

The varimax rotated principle component factor analysis for the bank performance scale revealed a one factor structure that explained 80.60 percent of the variance. Only factor loading of at least 0.30 has been included in the factor. Thus no item is detected. The four items are all loaded on the single factor and can be seen in the following table.

Table 13: Factor Analysis for Bank Performance

Items	Factor Loading
Net profit	0.779
Control of operational expenses	0.817
Resource utilization	0.770
Return on investment	0.859
Eigen value: 3.224, Percentage of variance explained: 80.600	

5.2.1 The Correlation Matrix of all Items of Corporate Governance

Since corporate governance is the set of processes, customs, policies, laws, and institutions affecting the way a corporation is directed, administered or controlled, the items which assess corporate governance are correlated to each other and the correlation among the items is statistically significant (1-tailed) .

Table 14: Correlation Matrix

	MSR	ASR	RPT	CLSMLR	IINC	AGAF	PTS	BDRCS
MSR	1.00	0.852	0.672	0.814	0.850	0.822	0.846	0.805
ASR	0.854	1.00	0.658	0.715	0.811	0.715	0.715	0.753
RPT	0.627	0.658	1.00	.776	0.625	0.731	0.647	o.603
CLSMLR	0.814	0.715	0.776	1.00	0.799	0.784	0.799	0.749
IINC	0.850	0.811	0.625	0.799	1.00	0.856	0.855	0.851
AGAF	0.822	0.715	0.731	0.784	0.856	1.00	0.945	.908
PTS	0.846	0.715	0.647	.799	0.855	0.945	1.00	0.925
BDRCS	0.805	0.753	0.603	0.749	0.851	0.908	0.925	1.00

Where, MSR = Minority Shareholder's Rights are protected.

ASR = All Shareholders have the same rights to select/ remove members of the board.

RPT = Rules and Procedures for transaction are in place.

CLSMLR = Commercial laws, stock market listing rules and regulations are in place.

IINC = Inspectors' investigation of non-compliance with statutory requirements.

AGAF = Actions are taken against auditors' failure to improper financial records.

PTS = Preferential treatment is often given to large shareholders.

BDRCS = Board of directors reviews and guide corporate strategy.

5.2.2 The Correlation Matrix of all Items of Strategic Improvisation

Strategic improvisation is a vital skill of top management as it can contribute to making meaningful decisions, within a limited timescale, without the best information and resources. In our research we have found that the items assessing strategic improvisation are correlated to each other and the correlation among the items is statistically significant (1-tailed).

Table 15: Correlation Matrix

	TMWP	TMEPP	TMMCA	TMMPC	TMBECS	TMIMS
TMWP	1.00	0.835	0.717	0.721	0.726	0.731
TMEPP	0.835	1.00	0.676	0.711	0.738	0.657
TMMCA	0.717	0.676	1.00	0.618	0.681	0.506
TMMPC	0.721	0.711	0.618	1.00	0.816	0.641
TMBECS	0.726	0.738	0.681	0.816	1.00	0.730
TMIMS	0.731	0.657	0.506	0.641	0.730	1.00

Where, TMWP = Top management identifies opportunities for new work process

TMEPP = Top management explores a wide variety of approaches to a problem

TMMCA = Top management creates multiples courses of action during planning

TMMPC = Top management maintains productivity in challenging circumstances

TMBECS = A top management team adopts the company strategy adequately to changes in the organization business environment.

TMIMS = Top management believes that their initial impression of situation are almost always right.

5.2.3 The Correlation Matrix of all Items of Bank Performance

Bank performance comprises the actual output or results of an organization as measured against its intended outputs. The items assessing bank’s performance such as net profit, return on investment, resource

utilization and control on operational expenses are also positively correlated to each other and the correlation among the items is statistically significant (1-tailed)

Table 16: Correlation Matrix

	NP	CPE	RU	RI
NP	1.00	0.702	0.655	0.813
CPE	0.702	1.00	0.767	0.774
RU	0.655	0.767	1.00	0.734
RI	0.813	0.774	0.734	1.00

Where, NP = Net Profit
CPE = Control of Operational Expenses.
RU = Resource Utilization
RI = Return on Investment

5.2.4 Regression Analysis

[The impact of Corporate Governance (LNCG) and Strategic Improvisation (LNSI) On Bank Performance (LNBP)]

Table 17: Regression Analysis

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.424680	0.072459	-5.860983	0.0000
LNCG	0.117954	0.102217	1.153947	0.2534
LNSI	1.197124	0.082498	14.51100	0.0000
R-squared	0.928760	Mean dependent var		1.122314
Adjusted R-squared	0.926216	S.D. dependent var		0.381434
S.E. of regression	0.103610	Akaike info criterion		-1.646863
Sum squared resid	0.601158	Schwarz criterion		-1.541226
Log likelihood	51.58246	Hannan-Quinn criter.		-1.605627
F-statistic	365.0403	Durbin-Watson stat		2.261172
Prob(F-statistic)	0.000000			

In our research the objective is to find out the impact of corporate governance and strategic improvisation on the performance of banks. The results of OLS regression have been shown in the table. We have found that Strategic Improvisation (LNSI) has a significant positive impact on bank performance (LNBP). If strategic improvisation increases by 1%, bank performance increases by 1.197124% and this relationship is statistically significant at $p<0.001$.On the contrary corporate governance (LNCG) has an insignificant positive impact on bank performance (LNBP) since the coefficient of corporate governance is insignificant at $p=10\%$.

5.2.5 Correlation Analysis

In our analysis we have shown correlations among bank performance, corporate governance and strategic improvisation. The result of the correlation have been shown in the table below

Table 18: Correlation Analysis

	LNBP	LNCG	LNSI
LNBP	1.000000	0.51753	0.962527
LNCG	0.51753	1.000000	0.28352
LNSI	0.962527	0.28352	1.000000

The results of the correlation indicate that there is a significant positive correlation between strategic improvisation (LNSI) and bank performance (LNBP). On the other hand there is moderate positive correlation between corporate governance and bank performance. This correlation analysis gives a clear picture of the association, strength and also the nature of the relationship between the variables.

5.3 Conclusive Analysis

The study has been conducted to examine the influence of corporate governance and strategic improvisation on the performance of banks in Bangladesh. After the analysis of data we have found highly significant positive impact of strategic improvisation on the performance of banks in Bangladesh. On the other hand, although there has been found a moderate correlation between corporate governance and bank performance, the regression result indicates that corporate governance has a negligible or insignificant positive impact on the performance of banks in Bangladesh.

Therefore, our first null hypothesis (H_{01}= There is no significant relationship between corporate governance and Banks' performance) is accepted and the second null hypothesis (H_{02} = There is no significant relationship between strategic improvisation and Banks' performance) is rejected.

6. Conclusion and Directions for Future Research

As the banking sector of Bangladesh is a major team player of economic growth, in recent years the policy makers have become increasingly concerned with the corporate governance and strategic improvisation practices of the banks. Corporate governance aims to increase the company's performance and harmonization of various interest groups. The performance of a company is not only to achieve through corporate governance, but effective strategic improvisation practices are also required. The result of this study reveals that corporate governance has an insignificant positive impact on banks' performance but strategic improvisation has a strong significant impact on banks' performance.

Only 60 respondents were considered for the study, which represented a very small portion of the banking sector in Bangladesh. Study variables were selected on the basis of limited literature review with selected studies related to this field. As there was no up to date study regarding this issue in Bangladesh, lack of appropriate secondary data made the study quite difficult. But this study may be replicated in different industrial setting to generalize these findings.

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Appendices

1. Questionnaire of the survey

Dear Respondents

We would like to draw your kind attention on this fact that, all the information collected in this questionnaire will be used for research purpose and we ensure secrecy of you and your provided feedback. Thank you in advance for considering your valuable time to complete this questionnaire.

Corporate Governance

Corporate governance is the set of processes, customs, policies, laws, and institutions affecting the way a corporation is directed, administered or controlled. In this study, we want to measure corporate governance with below mentioned statements. Your responses will be kept confidential, so please answer as honestly as possible. Read each phrase carefully and circle the appropriate response.

Please indicate the extent to which you agree or disagree with each statement, using the scale below.

1 Strongly Disagree **2 Disagree** **3 Neither Disagree /Agree** **4 Agree** **5 Strongly Agree**

1	Minority Shareholders' rights are protected.	1	2	3	4	5
2	All shareholders have the same rights to select/remove members of the board.	1	2	3	4	5
3	Rules and procedures for transactions are in place.	1	2	3	4	5
4	Commercial laws, stock market listing rules and regulation are in place.	1	2	3	4	5
5	Inspectors investigate non-compliance with statutory requirements.	1	2	3	4	5
6	Actions are taken against auditors' failure to report improper financial records.	1	2	3	4	5
7	Preferential treatment is often given to large shareholders.	1	2	3	4	5

8	Insider trading is effectively prohibited.	1	2	3	4	5
9	All shareholders have equal access to information.	1	2	3	4	5
10	Board of directors' reviews and guides corporate strategy.	1	2	3	4	5
11	Board of directors reviews key executives and board compensation.	1	2	3	4	5
12	Board of directors monitors the effectiveness of the governance practices.	1	2	3	4	5

Strategic Improvisation

Strategic improvisation is a vital skill of top management as it can contribute to making meaningful decisions, within a limited timescale, without the best information and resources. In this study, we want to study the circumstance of strategic improvisation of different banks of Bangladesh. Listed below is a series of statements that may represent how Strategic Improvisation is practicing in an organization. Please indicate the degree of your agreement or disagreement with each statement with respect to the practices of your organization for which you are now working by circling a number from 1 to 5.

Please indicate the extent to which you agree or disagree with each statement, using the scale below.

1 2 3 4 5

Strongly Disagree Neither Agree Agree Strongly

Disagree Disagree /Agree Agree

1.	Top management responds in the moment to unexpected problems.	1	2	3	4	5
2.	Top management identifies opportunities for new work process.	1	2	3	4	5
3	Top management explores a wide variety of approaches to a problem.	1	2	3	4	5
4	Top management creates multiple courses of action during planning.	1	2	3	4	5
5	Top management maintains productivity in challenging circumstances.	1	2	3	4	5

6	A top management team adopts the company strategy adequately to changes in the organization's business environment.	1	2	3	4	5
7	Top management believes that their initial impressions of situations are almost always right.	1	2	3	4	5

Please provide the following information

Name of the organization_____

Return on investment _____Net profit_____

Control of operational expenses_____ Market share_____

Customer service level_____ Resource utilization_____

Product/service cycle time_____

Thank You for your cooperation

Central Bank Influences on the Control of the Deposit in Islamic Banking in Bangladesh

Md. Anwar Hossen

Abstract

Bangladesh is the third largest Muslim country in the world with around 160 million population of which more than 90 percent are Muslims. The Banking system developed here until 1983 was centered to interest rate; but interest is strongly prohibited in Islam. Islamic banking system or interest free banking is a new paradigm which started in Bangladesh in 1983. Why do people deposit their savings in the Islamic Banking system? The purpose of this paper is to find out whether the central bank has any control over the deposit in the system of Islamic banking. The auto-regressive distributed lag (ARDL) approach is employed to check the long run relationship among the variables. The center of attention on the period from 2003-2004: Quarter 1 fiscal year to 2017-2018: Quarter 2 fiscal year is considered in this research paper. The study examined that there is no relationship between the monetary policy variable interest rate and the deposit of Islamic banking system in Bangladesh.

Keywords: Monetary Policy, ARDL, Islamic Banking System, Deposit

1. Introduction

In financial intermediation, Islamic banking system played a very effective, stable and productive role. This type of banking system is now working in different developed as well as developing countries across the world. Islamic banking system is now working as a substitute for conventional or interest based banking system. In Bangladesh, financial sector consists of banks, nonbanking financial institutions, insurance companies etc. But among these institutions, banking sector is playing the key role. For an economy like Bangladesh, a developed and well-organized banking system is very important. Two types of banks are functioning their activities very smoothly; first is the conventional or interest based banking system and the other is Islamic or (PLS) profit-loss sharing banking system. The central bank of Bangladesh named Bangladesh Bank is the monetary authority that has got the power to regulate and to control the financial sector of Bangladesh. After the birth

of Bangladesh in 1971 only conventional or interest based banking system was operating in the country and only this system was continuing until 1983. In addition to this system, interest free banking or Islamic Shariah based banking system as a new pattern started its journey in Bangladesh in 1983. After the introduction of Islamic banking system in the country, 1983, it has remarkably expanded its business activities. Its importance in the financial sector is increasing day by day including financing in the different productive sector of the country by using its deposit liabilities. The first Shariah based or interest free bank established not in Bangladesh, rather in the South Asia is Islami Bank Bangladesh Limited (IBBL). At present there are eight banks which are working as Shariah based Islamic banking system with 1126 branches and they are doing their activities very efficiently all over the country (Developments of Islamic Banking in Bangladesh, July- September, 2017). This system is now adopting many western banks (conventional banks) around the world. Bangladesh is also not an exception because many conventional banks are using the method of Shariah based Islamic banking by opening the Islamic banking booth in addition to conventional banking system. There are 18 (eighteen) Islamic banking branches and 25 (twenty five) Islamic banking windows of conventional banks in Bangladesh (Developments of Islamic Banking in Bangladesh, July- September, 2017). Like conventional banks, Islamic banks also depend on depositors' money as the most important source of funds. Since depositors' money is the most important foundation of funds, it is important for the management of the institution to know the factors that control depositors' choice in depositing their money in this type of financial institutions. So this research paper is just an attempt to investigate the factors responsible for the customers' or depositors' choice to deposit money in the Islamic banking system in Bangladesh.

2. Literature Review

Mushtaq (2017) found out that the interest rate does not significantly affect the deposit of Islamic banking system. Using SVAR (Structural Vector Autoregression) approach, Akhatova et al. (2016) examined that there is a negative relationship between interest rate and Islamic finance in Malaysia. Siaw and Lawer (2015) found out that when money supply increased bank deposit also increased. It means these variables move in the same direction. But bank deposit and inflation rate move in the reverse direction and at the same time deposit interest rate also negatively affects the bank deposit in the long run. Ergeç & Arslan (2013) investigated that the deposit in the system of Islamic banking system is related with the

interest rate in Turkey. Simleit et al. (2011) examined that saving rate is determined by wealth effect, interest rate and the upturn business cycle. In this research they have conducted VECM (vector error-correction Model) approach for cointegration and recommended that fiscal policy is the key to increase the savings. By using OLS (Ordinary Least Square) fixed effect and 2SLS (2 Stage Least Square) Method, Balde and Yero (2011) examined that there is a significant positive relationship between remittance and savings of 37 Sub-Saharan countries for the period from 1980 to 2004. By the help of ARDL (Auto Regressive Distributive Lag model) approach for cointegration, Jongwanich (2010) found out that private savings and domestic savings are positively related with economic growth and inflation rate, but savings rate and credit are in the opposite direction and the findings of the article indicate that national savings can be increased through conducting of fiscal policy. Sukmana and Kassim (2010) established that Islamic bank deposits and interest rate move in the opposite direction. By using ARDL (Auto Regressive Distributed Lag) model, Khan and Hye (2010) investigated that workers' remittance and household savings move in the same direction in the long run as well as short run in Pakistan but Morton *et al.* (2010) found out that remittance and savings move in the opposite direction in 2008 for the top 20 remittance recipient countries. Ang (2009) found that income and inflation leads to raise the household savings but savings and age dependency are negatively related. In addition, savings is promoted if anticipated pension benefit is high in India but in terms of China the result is oppositely directed. Kassim and Majid (2009) investigated that the influence of interest rate on Islamic banks deposits and they have found out that interest rate decrease leads to increase the deposits in the system of islamic banking. Kasri and Kassim (2009) examined the deposit of Islamic banking system and interest rate by using VAR (Vector Autoregressive) approach. The findings of the research reveal that lower interest rate and higher rate of return leads to raise the deposit of Islamic banking system in Indonesia.

By the help of ARDL (Autoregressive Distributive Lag) and VECM (Vector Error Correction Model) approach, Yusof et al. (2009) examined that there is a positive relationship between money supply and deposit in the system of Islamic banking in Malaysia and Bahrain. But Islamic banking deposit and GDP move in the opposite directions and real effective exchange rate also negatively affects the Islamic banking deposit in Malaysia and the interest rate brings also the same result for both the countries. Horioka (2007) examined that there is a relationship among

saving, household's wealth holdings, growth rate and the age. Yusoff and Wilson (2005) examined that there is a strong relationship among the variables of rate of the return of Islamic banking deposit, interest rate of conventional banking, Real GDP (Gross Domestic Product), Islamic banking deposit and conventional banking deposit in Malaysia. Hondroyiannis (2004) conducted cointegration method and found out that savings decision is made by real interest rate and public finance. Mangkuto (2004) found that bank deposits and conventional interest rate move in the opposite direction but there is a significant relationship between interest rate and Islamic banking deposit. There is a negative tradeoff between savings and inflation (Athukorala and Sen 2003). There is a positive relationship between savings, and income level, and also between savings and inflation rate (Ozcan et al. 2003). Savings is highly influenced by the expected future saving prospect and it also is found that precautionary desires and interest rate are important factors for the savings (Qin 2003). Walsh (2003) investigated that the bank deposit is influenced by the interest rate. Savings and income percapita are positively related (Agrawal 2001). Deposit in the system of Islamic banking system and profit rate are significantly related in the same direction but interest rate and Islamic banking are oppositely related in Malaysia (Haron and Ahmad 2000). Loayza and Shankar (2000) tried to find out the relationship among savings, real interest rate, per capita income, financial development, inflation and the dependency ratio, the share of agriculture in GDP etc. They got savings, real interest rate, per capita income, the share of agriculture in GDP move in the same direction but the other variables move in the opposite direction. Adams (1998) found that there is a positive impact on the workers' remittance in the investment in Pakistan. Masson et al. (1998) examined that savings, GDP growth and real interest rate move in the same direction. Edward (1996) examined that there is a strong relationship between remittance and savings. Doshi (1994) established that percapita income and savings are strongly related in Africa. Bernanke and Blinder (1992) examined that central bank has conducted the key role for the bank deposit by the instrument of nominal interest rate. There is a positive relationship between remittance and savings and the standard of living rises as remittance rises (Russel 1986). However, from the review of the different studies monetary policy variables and macroeconomic variables are very important for the bank deposit.

3. Objective of the Study

The main goal of the study is to find out the long run relationship between Islamic banking deposit and monetary policy variables in Bangladesh. As well as the influence of Bangladesh Bank over controlling the deposit of Islamic banking system.

4. Methodology

Considering Ramlogan (2004), there are two unlike assets present in the money channel, one is money and all other assets. A reduction in the level of reserves prompts a fall in the level of deposits. So if money demand and interest rate are interconnected, it will increase open market interest rate to re-establish an equilibrium (Yusof, Wosabi, Majid 2008). On the basis of empirical model given by Yusof, Wosabi, Majid (2009) and the money channel theory of Keynes (1936), a model has been made for this certain research article and it is given below.

4.1 The Model

Empirical model can therefore be represented as follows: the long-run estimates for commercial bank deposit can be represented by the following model which considers no trends and no intercepts term (Nieh, Wang 2005).

$$DIB_t = \phi_1 DIR_t + \varphi_2 ER_t + \gamma_3 M2_t + \mu_4 MC_t + \pi_5 RT_t + \epsilon_t$$

4.2 Variables' Description

There are lots of factors which are influencing Islamic banking deposit in various countries all over the world, for example, interest rate, money supply, religious considerations, inflation rate, remittance and so on. Quarterly data of 2003-2004: Quarter 1 fiscal year to 2017-2018: Quarter 2 fiscal year is utilized to lead this examination. The data of the incorporated variables are taken from the main source: Bangladesh Bank Quarterly of Bangladesh Bank.

Table 1: Variables Description and Sources: Total observations 58.

Variables (Total observations 58 of each variables)	Definition	Source
DIB	Total deposits in the Islamic banking system	Scheduled Bank Statistics, Bangladesh Bank
DIR	Deposit interest rate or interest rate	Bangladesh Bank Querterly
ER	Nominal exchange rate	Bangladesh Bank Querterly
M2	Broad Money supply	Bangladesh Bank Querterly
MC	Market capitalization of Dhaka stock exchange	Bangladesh Bank Querterly
RT	Foreign Remittance	Bangladesh Bank Querterly

4.3 ARDL Model Specification

With a specific end goal to avoid a wrong yield from general cointegration tests when there is of I (1) and I (0) arrangement, Pesaran, Shin and Smith (2001) developed ARDL model and which directed the Bound test in a basic bound to check the cointegration among the factors (Pesaran and Shin 1995a, 1995b; Pesaran, Shin and Smith 1996, 2001). Attributable to its focal points of not just taking care of the issue of arrangement comprising of contrasting requests yet handling little example issue (26 perceptions), ARDL bound testing strategy has been widely connected to various investigations in later past (Abbot, Darnell, and Evans 2001; Bentzen and Engsted 2001; Ghatak and Siddiki 2001). The ARDL display likewise considers the mistake adjustment term in its slacked period. The investigation of mistake revisions and autoregressive slacks completely covers both the long-run and short-run connections of the factors tried. It is an Unrestricted Error Correction Model (UECM).

For the ARDL analysis, we tested for the presence of long-run relationships among the variables, ordinary least squares (OLS) test is conducted for the existence of a long-run relationship among the variables

and by conducting the F-test for the joint significance of the coefficients of the lagged levels of the variables, i.e., against the alternative. Following Pesaran et al. (2001), the ARDL model is as follows:

Dependent variable total deposits in the Islamic Bank system

$$\Delta DIB_t = \sum_{i=1}^{p} \theta_i \Delta DIB_{t-i} + \sum_{i=0}^{p} \varphi_i \Delta DIR_{t-i} + \sum_{i=0}^{p} \phi_i ER_{t-i} + \sum_{i=0}^{p} \gamma_i \Delta M2_{t-i} + \sum_{i=0}^{p} \mu_i \Delta MC_{t-i} + \sum_{i=0}^{p} \pi_i \Delta RT_{t-i}$$

$$+ \lambda_1 DIB_{t-1} + \lambda_2 DIR_{t-1} + \lambda_3 ER_{t-1} + \lambda_4 M2_{t-1} + \lambda_5 MC_{t-1} + \lambda_6 RT_{t-1} + \notin_{1t}$$

Now we use the null hypothesis of the cointegration from the above equation is defined by H_0: $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = 0$ is tested against the alternative of H_0: $\lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq \lambda_5 \neq 0$, by using the recognized F-test. If the calculated F-statistics lies above the upper level of the band, the null hypothesis will not be accepted, indicating cointegration. If the calculated F-statistics falls below the lower level of the band, the null cannot be rejected, supporting lack of cointegration. If, however, it falls within the band, the result is inconclusive. In the final step, we obtain the short-run dynamic parameters by estimating an error-correction model associated with the long-run estimates (Pesaran et al. 2001), i.e., the short-run conditional error-correction model (ECM) of the ARDL model where all variables are as previously defined. All coefficients in the short-run equation relate the dynamics of the model's convergence to equilibrium and λ is the speed of adjustment.

Dependent variable Total deposits in the Islamic bank system

$$\Delta DIB_t = \sum_{i=1}^{p} \theta_i \Delta DIB_{t-i} + \sum_{i=0}^{p} \varphi_i \Delta DIR_{t-i} + \sum_{i=0}^{p} \phi_i ER_{t-i} + \sum_{i=0}^{p} \gamma_i \Delta M2_{t-i} + \sum_{i=0}^{p} \mu_i \Delta MC_{t-i} + \sum_{i=0}^{p} \pi_i \Delta RT_{t-i}$$

$$+ \lambda ECT_{t-1} + \epsilon_t$$

4.4 Model Specification: Johansen Cointegration Test

In order to determine the cointegration relationship for testing the existence of long-term relationship among the variables, Johansen cointegration method is conducted (Johansen, 1988; Johansen and Juselius, 1990; Johansen, 1995). For this purpose trace statistics (trace of matrix eigenvalue) and max statistics (maximum eigenvalue) are conducted in this article. Johansen cointegration test is used to find out whether a group of non-stationary series (such as GDP growth rate, unemployment rate and agriculture growth rate) has a long-run relationship.

5. Results Analysis

5.1 Stationary Test

To conduct the Johansen cointegration tests, at first we would like to test the stationary of all variables which are considered in this article. Johansen cointegration test needs that all variables are in the same level and none of the variables are in different levels. That is why the order of integration of the variables is the main concern for conducting cointegration. Hence, Augmented Dickey Fuller (ADF, 1981) test is one of the standard methods of stationary tests is applied in this article. Since the ADF test is often arising question by many researchers for low power. Likewise this test, the Phillips-Perron (PP, 1988) test is additionally led. The Schwarz Information Criterion is considered for the slack length in the ADF test. Then again, the data transfer capacity determination depends on Newey-West (1994) in the PP test. In this regard we take natural log of all variables for elasticity of the variables except deposit interest rate because it is already in percentage form. Unit root test demonstrates that all factors are the request of combination I(1) in Table 2. Along these lines the Johansen cointegration testing approach is utilized for finding the long run relationship among the factors.

Table 2: Result of Unit Root Test

Variable	ADF test statistic (with trend and intercept)			P.P test statistic (with trend and intercept)			Result
	Level	First difference		Level	First difference		
Ln DIB	-0.528	-11.794		0.272	-14.530		I(1)
DIR	2.641	-10.794		3.648	-10.319		I(1)
Ln ER	-1.071	-4.120		-1.558	-4.149		I(1)
Ln M2	-0.158	-10.636		0.064	-11.385		I(1)
Ln MC	0.594	-26.700		2.245	-19.422		I(1)
Ln RT	-0.831	-11.210		-0.914	-11.536		I(1)
	1 % level	5 % level	10% Level	1 % level	5 % level	10% Level	
Critical value	-3.566	-2.922	-2.596	-3.566	-2.922	-2.596	

5.2 F-statistics of ARDL Model

The F-test shows that there is a long run relationship. Be that as it may, if the F-measurement falls inside the upper esteem and lower esteem, at that point we cannot achieve any unequivocal conclusions (Pesaran, Shin and Smith, 2001). Basic esteems are taken from Pesaran (2001). So from the F test, the F- statistic value is higher than 1 to 10% significance value and the modulus value of T- statistic is also higher than critical value. So there is a long run relationship among the variables.

Table 3: The Results of F-statistics for Cointegration

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	4.221157	10%	2.26	3.35
k	5	5%	2.62	3.79
		2.5%	2.96	4.18
		1%	3.41	4.68
Actual Sample Size	57		Finite Sample: n=60	
		10%	2.385	3.565
		5%	2.817	4.097
		1%	3.783	5.338
			Finite Sample: n=55	
		10%	2.393	3.583
		5%	2.848	4.16
		1%	3.928	5.408

Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-4.537592	10%	-2.57	-3.86
		5%	-2.86	-4.19
		2.5%	-3.13	-4.46
		1%	-3.43	-4.79

5.3 Serial Correlation Test

In this regard, LM test is conducted for finding out the serial correlation of the different variables. From the analysis found, there is no serial correlation because the null hypothesis is accepted.

Table 4: The Results of LM Test for Serial Correlation

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 1 lag

F-statistic	0.022279	Prob. F(1,48)	0.8820
Obs*R-squared	0.025980	Prob. Chi-Square(1)	0.8719

5.4 Long Run Relationship of ARDL Model

The estimated coefficients of the long-run relationship are reported in Table 5.The results provide evidence that the dependent variable is significantly affected by remittance. And in the Islamic banking deposit is jointly significant (f-statistics) during the period of analysis. So we see monetary policy variable M2 is not significantly affecting deposits of Islamic banking. The results also indicate that the banks' deposits are not susceptible to interest rate changes. This may infer that interest rate changes do not significantly affect deposit in the system of Islamic banking.

Table 5: Estimated Long Run Coefficients using the ARDL Model, Lag Selection is Based on Akaike Information Criterion

ARDL Long Run Form and Bounds Test
Dependent Variable: D(DIB)
Selected Model: ARDL(1, 0, 0, 0, 0, 0)
Case 3: Unrestricted No Constant and No Trend
Date: 08/13/18 Time: 11:11
Sample: 1 58
Included observations: 57

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIB(-1)*	-0.339589	0.095994	-3.537592	0.0009
DIR**	-0.004905	0.005964	-0.822490	0.4147
ER**	0.000740	0.143987	0.005141	0.9959
M2**	0.365552	0.111976	3.264546	0.0820
MC**	0.007838	0.015445	0.507452	0.6141
RT**	0.062198	0.039184	1.587315	0.0087

5.5 Error Correction Model

From Table 6, the short run error correction term is consistent with the long run relationships among the variables because the sign of error correction term is negative. So the error is corrected 26.66% in a quarter because of lag selection criterion. Banerjee et al. (1998) stated that a highly significant error-correction term is another evidence of the existence of established long run relationships.

Table 6: Estimated Short Run Error Correction Model (ECM), Lag Selection is Based on Akaike Information Criterion

Dependent Variable: D(DIB)
Method: Least Squares
Date: 08/13/18 Time: 11:29
Sample (adjusted): 4 58
Included observations: 55 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DIB(-1))	0.217597	0.607163	0.358383	0.7217
D(DIR(-1))	0.012408	0.021337	0.581535	0.5637
D(ER(-1))	0.357572	0.296707	1.205134	0.2342
D(RT(-1))	-0.019401	0.043671	-0.444254	0.6589
D(M2(-1))	0.160586	0.223121	0.719727	0.4753
D(MC(-1))	0.060296	0.041071	1.468114	0.1487
ECM(-1)	-0.266568	0.617529	-0.431670	0.0480

R-squared	0.089739	Mean dependent var	0.052666
Adjusted R-squared	-0.045832	S.D. dependent var	0.031635
S.E. of regression	0.032351	Akaike info criterion	-3.890593
Sum squared resid	0.049191	Schwarz criterion	-3.598617
Log likelihood	114.9913	Hannan-Quinn criter.	-3.777683
F-statistic	0.661936	Durbin-Watson stat	1.863082
Prob(F-statistic)	0.702735		

5.6 Johansen Cointegration Test

The Johansen cointegration test result indicates 3 (three) cointegrating equations regarding Trace statistic test at the 0.05 level of significance of the variables such as DIB, DIR, ER, M2, MC, RT respectively and 1(one) cointegrating equation regarding maximum Eigen statistic test at the 0.05 level of significance of the variables such as DIB, DIR, ER, M2, MC, RT respectively. Thus, the null hypothesis of no cointegration is hereby rejected at the 0.05 per cent level of significance. This test therefore provides an evidence of a long run cointegrating relationship among the variables of the study.

Table 7: Johansen Cointegration Test Result

Date: 08/13/18 Time: 11:06
Sample (adjusted): 3 58
Included observations: 56 after adjustments
Trend assumption: Linear deterministic trend
Series: DIB DIR ER M2 MC RT
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.554857	126.4677	95.75366	0.0001
At most 1 *	0.426277	81.14355	69.81889	0.0048
At most 2 *	0.329731	50.02944	47.85613	0.0308
At most 3	0.224430	27.62519	29.79707	0.0873
At most 4	0.125729	13.39241	15.49471	0.1012
At most 5 *	0.099483	5.868004	3.841466	0.0154

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.554857	45.32415	40.07757	0.0117
At most 1	0.426277	31.11411	33.87687	0.1032
At most 2	0.329731	22.40426	27.58434	0.2004
At most 3	0.224430	14.23278	21.13162	0.3462
At most 4	0.125729	7.524408	14.26460	0.4291
At most 5 *	0.099483	5.868004	3.841466	0.0154

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

5.7 Granger Causality Test

After the establishment of the existence of the long run relationships among the variables, the next step is to examine the direction of causality of the variables. The investigation is directed utilizing the Granger causality test (Granger, C. W. J. 1969), Granger, C. W. J. also, Newbold, P. 1974). Granger causality test demonstrates how change in one variable causes change in another variable. This approach is regularly utilized as a part of econometric inquires about everywhere throughout the world. From the Granger causality test, there is a relationship between remittance

and Islamic banking deposit. That is unidirectional relationship at 5% level of significance.

Table 8: Granger Causality Tests Result

Pairwise Granger Causality Tests
Date: 08/13/18 Time: 11:07
Sample: 1 58
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
DIR does not Granger Cause DIB	56	0.08722	0.9166
DIB does not Granger Cause DIR		0.51011	0.6035
ER does not Granger Cause DIB	56	0.12703	0.8810
DIB does not Granger Cause ER		2.09503	0.1335
M2 does not Granger Cause DIB	56	2.69534	0.0771
DIB does not Granger Cause M2		8.20145	0.0008
MC does not Granger Cause DIB	56	0.65767	0.5224
DIB does not Granger Cause MC		0.60380	0.5506
RT does not Granger Cause DIB	56	0.76124	0.0123
DIB does not Granger Cause RT		2.12686	0.1297
ER does not Granger Cause DIR	56	2.15383	0.1265
DIR does not Granger Cause ER		1.99600	0.1464
M2 does not Granger Cause DIR	56	5.12863	0.0093
DIR does not Granger Cause M2		1.03191	0.3636
MC does not Granger Cause DIR	56	0.01523	0.9849
DIR does not Granger Cause MC		2.33227	0.1073
RT does not Granger Cause DIR	56	0.20500	0.8153
DIR does not Granger Cause RT		0.97479	0.3842
M2 does not Granger Cause ER	56	1.81794	0.1727
ER does not Granger Cause M2		1.16025	0.3215
MC does not Granger Cause ER	56	3.27144	0.0461
ER does not Granger Cause MC		2.28322	0.1123
RT does not Granger Cause ER	56	0.17806	0.8374
ER does not Granger Cause RT		0.77577	0.4657
MC does not Granger Cause M2	56	5.68073	0.0059
M2 does not Granger Cause MC		0.21451	0.8077
RT does not Granger Cause M2	56	6.08132	0.0043
M2 does not Granger Cause RT		0.35425	0.7034
RT does not Granger Cause MC	56	1.82445	0.1717
MC does not Granger Cause RT		2.30275	0.1103

6. Conclusion

The aim of this study is to explore the relationship between monetary policy variables namely interest rate and money supply vis-à-vis deposit of

Islamic banking system in Bangladesh. The study shows that Islamic banking deposit in Bangladesh is not controlled by the monetary policy variable interest rate but there is an impact of broad money supply though it is not significant. To find out the foreign shocks on the Islamic banking deposit, remittance and exchange rate are used. In this article remittance is one of the key factors which strongly affects the deposit of Islamic banking system. Stock market is an attractive financial investment sector in Bangladesh but market capitalization of stock market has no impact on the dependent variable. The article show that estimated deposit equations of commercial bank is useful for monetary policy analysis.

Based on the findings in this study, the following suggestions are recommended: The results suggest that monetary policy variable (interest rate) does not influence the deposit of Islamic bank. The amount of the deposit of Islamic banking system was 4.79% of total deposit in Quarter 2, 1997-1998 fiscal year and it increased to 20.14% of the total deposit of commercial banks in Quarter 2, 2017-2018 fiscal year (Schedule Bank Statistics 1997, 2018). If we see the case of private commercial banking deposit excluding Islamic banking system, it was 22.32% in Q2, 1997-1998 fiscal year, which is now increased to 45.74% in Q2, 2017-2018 fiscal year of the total deposit of commercial banks'(Schedule Bank Statistics 1997, 2018). The deposit of Islamic banking system is increasing day by day. So one of the target variables of monetary authority that is interest rate cannot influence the deposit of Islamic banking system, rather money supply controls the dependent variable.

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The Impact of Inflation and Unemployment Rate on GDP Growth of Bangladesh: A Time Series Analysis

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Abstract

Economic growth is the main driving force of an economy. Economic growth represents the size of the economy and strengthens the health of the economy. Inflation and unemployment as key macroeconomic indicators are considered as vital factors of economic growth and development as they play a significant role in boosting up the economy. Therefore, this study has examined the impact of inflation and unemployment on economic growth in Bangladesh. The study has used data from 1991 to 2016 and econometrics techniques on the time series data. Before analyzing the results, the assumptions of the CLRM have been satisfied and the study found no multicollinearity among the explanatory variables in the model. Stationarity of data has been checked by using Augmented Dickey-Fuller (ADF) test. The result of this study indicates that in the long run all variables are cointegrated and inflation and unemployment are found to be the key determinants of GDP in Bangladesh. In the long run, inflation has a positive and unemployment has a significant negative impact on GDP growth rate in Bangladesh. The result of VECM reveals that growth rate of GDP requires 77% of error correction per year, while unemployment rate requires approximately 28% of error correction and inflation requires approximately 82% of error correction per year to reach the equilibrium. The result of impulse response function indicates that any external shock on particular variables has positive and negative effects on itself and on other variables over the time. In three cases impulse function shows that the external shocks have been neutralized whereas in four cases there have been positive shocks and for remaining two cases the external shocks are fluctuating.

Keywords: GDP growth, Inflation, Unemployment, VECM, Impulse Response

1. Introduction

Achieving sustainable growth rate of GDP is the objective of most of the countries. The prerequisite of achieving a sustainable development is

achieving a high growth rate of GDP. since it has diverse effects on other macroeconomic variables. The rate of inflation and unemployment are the central subject of macroeconomics policy. Losing the purchasing power and increasing the cost of production indicate the high rate of inflation; on the other hand unemployment is a situation when people are without job and they have looked for a job for the past four weeks (ILO). GDP growth primarily depends on these two issues. However there is no a clear cut or straight forward decision about the relationship between the GDP growth, inflation and unemployment. Researchers have investigated about inflation, unemployment and the GDP growth and come up with different views.

Hyperinflation may adversely influence the macroeconomic indicators of a country by creating uncertainty in investments in terms of future profitability, contracting export opportunities through making it more expensive, and hampering the borrowing and lending scenario of a country . On the contrary, low unemployment rate is congenial to the sustainable growth and development of any country. In Bangladesh the inflation rate and unemployment rate are on the fluctuating trend since the independence, but in recent years both of them show downward trends which have a positive impact on the sustainable development of the country (WDI, 2016). According to Bangladesh Economic Review (2016), inflation gradually came down and year to year inflation in 2015-16 slid down to 5.92 percent from 6. 41 percent in 2014-15 while Bangladesh's unemployment rate is updated yearly, available from December 1991 to December 2018, with an average rate of 3.74%. The unemployment rate in Bangladesh reached an all time high of 5% in December 2009 and a record low of 2.20% in December 1991 (World Bank). On the other hand, despite having lots of barriers, Bangladesh has a rising trend of the GDP growth rate over the last couples of years (World Development Indicators, 2016). Bangladesh economy has successfully been able to ward off the risks generating from the sluggish recovery of the global economy and those emerging from the domestic fronts. Over the past 7 years (FY 2009-10 to FY 2015-16), the economy achieved an average of 6.3 percent growth (Bangladesh Economic Review, 2016). According to the final estimates of BBS, the GDP growth rate in the fiscal year 2015-16 stood at 7.11 percent. During this period, the average per capita national income stood at US$1,465 from US$1,316 in 2014-15 (Bangladesh Economic Review, 2016).

Since inflation and unemployment are considered as the vital factors of economic growth and development, the research has the following specific objectives:

i. to investigate whether there exists any long run relationship between the GDP growth rate and Inflation as well as between unemployment and the GDP growth rate and their impact on the growth rate of the GDP,

ii. to explore whether there exists any causal relationship between the examined variables,

iii. to examine the external shocks on the variables.

2. Theoretical Background

There are different types of theories regarding inflation, unemployment and economic growth.

This section mainly discusses three significant theories related to this topic.

2.1 Okun's Theory of Unemployment

Okun's law mainly focuses on the relationship between unemployment and economic growth. The theory argues that unemployment has a negative correlation with the economic growth. It also states that 1 percent decrease in unemployment rate leads to 3 percent increase in economic growth (Okun's 1962). The theory further indicates that when the growth rate of unemployment increased by 1% above the trend rate of growth, it can only result to 3% reduction in growth rate of the GDP (Okun's 1962).

2.2 Monetarists View

The monetarist theory is mainly associated with the work of economist Milton Friedman. According to the theory, change in the money supply is the most significant determinant of economic growth. Monetarists believe that inflation occurs if the money supply increases faster than the national income growth rate. Underlying the monetarist theory is the quantity theory of money and there are two versions of it: The Cash Balance Approach (Cambridge Version) and the Transaction Approach (Fisher's version). The Cash Balance Approach to the Quantity Theory of Money is explained by the following equation:

$$\pi = \delta R/M \text{---------} (1)$$

Where, π is the purchasing power of money, δ is the proportion of income that people like to hold in form of money, R is the volume of real income and M is the stock of money supply.

The equation shows that purchasing power varies directly with δ or R and inversely with M.

The Transaction Approach to the Quantity Theory of Money is described by the following equation :

MV = PT---------- (2)

Where M is the total supply of money, V is the velocity of circulation of money, P is the general price level, and T is the total transaction in physical goods.

According to Fisher's version, prices are directly affected by the increase in money supply. If T increases, P will remain relatively constant. However, there is no corresponding increase in the quantity of goods and services produced. In general, production, employment and price level are affected by the changes in money supply (Sattarove ,2011).

2.3 The Traditional Neoclassical Growth Theory

Neoclassical growth theory is an economic theory that outlines how a steady economic growth rate results from a combination of three driving forces: labor, capital and technology. The traditional neoclassical model is an outgrowth of the Harrod and Domar (1957) and Solow (1956). The model focused on the significance of capital accumulation in an economy. In the model, growth model was expanded through Harrod - Domar postulation by adding labour as a second factor and technology as an additional variable in the growth model. The neoclassical growth model of Solow exhibits diminishing returns to labour and capital separately and constant return to both factors jointly (Michael et.al, 2016).

3. Literature Review

Unemployment and inflation as key macroeconomic indicators affect economic growth significantly. Sergii (2009) estimated threshold level of inflation for CIS countries using nonlinear least square technique over the time 2001 to 2008 and concluded that if inflation rate is more than 8% then it is harmful, otherwise helpful for economy. While Hussain and Malik (2011) from Pakistan estimated 9% threshold level for inflation above which inflation detrimental for economic growth. However Hossain et al. (2012) found no cointegrating relationship between inflation and

GDP growth from 1978 to 2010 and a unidirectional causality from inflation to the GDP growth. Al-Habees (2012) expressed a different opinion and told that the higher growth and the decrease in the unemployment rate do not ensure the existence of strong relationship between growth and unemployment. Though growth rate were positive, it was not possible to decrease unemployment rates significantly in some Arab countries like Algeria. However there is a strong relationship between inflation and economic growth.

Jaradat (2013) used ANOVA and correlation test and mentioned that unemployment negatively affects the GDP growth, and inflation positively affects the GDP growth of Jordan. Approaching with error correction modeling in the relationship between unemployment and growth from time 1986 to 2010, Amassoma and Nwosa (2013) concluded that unemployment rate has an insignificant impact on productivity growth in Nigeria. Surprisingly Mosikari (2013) from South Africa declared no causality between unemployment rate and the GDP growth from Granger causality test. Fatai and Bankole (2013) investigating data from time 1980 to 2008 told that Okun's law were not applicable for Nigeria. Using ARDL, Johansen cointegration and Granger-causality test Attari and Javed (2013) from Pakistan concluded that government expenditure had an impact on economic growth but not inflation as well as unidirectional causality between inflation and economic growth and economic growth and government expenditure.

Sir (2014) wanted to find the impact of inflation and growth on unemployment in Sri Lanka. Results expressed that three variables had long run an equilibrium relationship and both the GDP and inflation had a negative significant impact on unemployment. However from Granger Causality there were bi-directional causality between inflation and unemployment and unidirectional causality between inflation and the GDP in the economy of Sri Lanka. Chowdhury and Hossain (2014) discussed the determinant of unemployment in Bangladesh and indentified that inflation rate positively did impel the unemployment where the GDP growth rate and Exchange rate had negative effect on unemployment. Roșoiu (2014) adopting regression analysis from the period 1977 to 2011 assured the theoretical opinion of Okun's law for the USA. In the same year Akeju and Olanipekun (2014) utilizing cointegration and error correction method disclosed that there were both the short and the long run relationship between unemployment rate and output growth in Nigeria. Abdul-Khaliq et al. (2014) selecting nine Arab countries during 1994 to

2010 and adopting pooled EGLS the study found that if growth increases by 1% the unemployment rate decreases by 0.16%. However in India inflation was identified as harmful for economic growth by Kaur (2014) and that study revealed a long run negative relationship between inflation and economic growth.

Using Johanson cointegration Alhdiy et al. (2015) revealed no cointegration between unemployment and the GDP growth but in short run a direct causality was found from unemployment rate to the GDP growth. Singh and Singh (2015) from Japan investigated the clue between CPI and economic growth and confirmed bidirectional causality between economic growth and CPI. Mahmoud (2015) also evaluated the same CPI and growth relationship and found a positive significant relation between the variables and a unidirectional causality from inflation to growth. Mohseni and Jouzaryan (2016) using ARDL model concluded that there was a negative significant impact of inflation and unemployment on the GDP growth of Iran using data from 1996 to 2012. Jelilov et al. (2016) indicated that inflation and unemployment had a positive influence on economic growth of ten selected members of ECOWAS. Ademola and Badiru (2016) employed OLS technique to reveal that inflation and unemployment were positively related to the growth of Nigeria. Dritsakisand Stamatiou (2016) in Greece showed that there was an unidirectional causality from unemployment to growth and from inflation to growth over the time 1995 to 2015. Irpan et al. (2016) from Malaysia told, the decrease in unemployment rate by 1% increases the GDP by 3.5% during the time 1982 to 2012. Madurapperuma (2016) used Johansen cointegration test and Error Correction model to identify the effect of inflation on the economic growth of Sri Lanka and found negative significant relationship between the variables for the period 1988 to 2015. In the same year from the experience of BRICS, Behera and Kumar (2016) found significantly positive relationship between inflation and growth for China and South Africa in the long run. Study also confirmed unidirectional causality between economic growth and inflation for India while bidirectional causality occurred for and no short run relationship between inflation and economic growth for BRICS countries.

Ajie et al. (2017) noticed that the impact of unemployment on growth was not significant and there was a negative relationship between inflation and growth for the time 1981 to 2015. Mucuk et al. (2017) from Turkey found no causal relationship between the unemployment and the GDP growth but growth shock had a negative impact on the unemployment rate while unemployment shocks had a positive impact on the growth.

Alamoudi (2017) exercising panel data technique in gulf countries detected two important determinant of unemployment such as Government's expenditure (%) of the GDP and the GDP per capita. Anning and Darko (2017) referred that Phillips Curve hypothesis was valid in Iraq.

Examining the existing literature review we have found that although some studies have been conducted in this area, very few studies have been conducted in Bangladesh. After reviewing the available literatures, the study found that very few researches on this topic have been performed in Bangladesh where limited econometric tools had been applied. However this study has applied various types of econometrics tools to analyze the results. Therefore, this study is reliable and adds more information to the existing works.

4. Data and Methodology

4.1 Data

The study particularly relies on secondary data of Bangladesh from 1991 to 2016. Data on the GDP growth rate (represented by GDP_R), Unemployment rate (represented by Un) and Inflation rate are taken from the World Development Indicators database. Econometric results based on the dataset have been obtained by statistical package STATA 12 and Eviews 9.5.

4.2 Methodology

This study is concerned with the identification of short run and long run impact of inflation and unemployment on the growth rate of the GDP in Bangladesh. To examine the dynamic linkage among variables the study makes use of Vector Autoregressive (VAR) modeling. The stationarity property of the dataset has been checked by ADF test of unit root.

In time series analysis the second step usually involves identifying if the non-stationary variables under study have a cointegrating relationship among them. This procedure is important to further explore the nature of short term and medium term dynamics. The long run equilibrium relationship is examined using Johansen and Juselius (1998) cointegration test. The study also tried to examine the nature of causality among variables under the study by employing Granger Causality test. Finally, an impact of external shocks to the restricted VAR model has been shown by Impulse Response Function (IRF) analysis.

4.3 The Unit Root Test

Despite the fact that the Ordinary Least Square (OLS) is often applied to estimate the slope coefficient of autoregressive models, the use of OLS requires any stochastic process to be stationary. However, if the stochastic process is non-stationary, the use of OLS can actually produce nonsensical estimates. Granger and Newbold(1974) showed that when applying OLS on some non-stationary stochastic process the estimates of regression results would be spurious. The study takes this matter into account and tests the possibility of unit root in the time series variables by applying the ADF method.

The ADF test estimates the following general regression

$\Delta Y_t = \alpha_1 + \alpha_2 + \beta Y_{t-1} + \Omega_i \sum_{i=1}^{m} \Delta Y_{t-1} + \eta_i$ ..... (i)

Where, $\Delta Yt = Yt - Yt\text{-}1$ and Y is the variable which is in consideration and m represents lag of dependent variable with the Akaike Information Criterion and η_i represents stochastic error term. The ADF technique tests the hypothesis of $\Omega=0$, meaning that the series is a unit root, series is non stationary, If the null hypothesis is rejected at some level of significance

(usually at 5% or 1%) then we can conclude that the series is stationary.

4.4 The Cointegration Test

Engle and Granger (1987) first discussed the idea for cointegration showing that time series data involving I (1) can be meaningful.They showed that if two or more series are individually integrated in some order, but some linear combination of them has an integration, in that case the series are called cointegrated. There are two statistics for cointegration under the Johansen approach, which are formulated as:

$$\lambda_{trace(r)} = -T \sum_{i=r+1}^{h} \ln(1 - \hat{\lambda}_i) \quad \text{..... (ii)}$$

and

$$\lambda_{\max(r,r+1)} = -T \ln(1 - \hat{\lambda}_{r+1}) \quad \text{..... (iii)}$$

Where r is the number of the cointegrating vectors under the null hypothesis and λi is the estimated value for the i^{th} recorded egienvalue from the matrix. Intuitively, the larger is λ_i , the more large and negative will be $\ln(1- \lambda_i)$and hence the larger will be the test statics. There is an association between each eigenvalue with its cointegrating vector called

eigenvectors. A significant non zero eigenvalue indicates a significant cointegrating vectors.

λ_{trace} is a joint test with the null hypothesis that the number of cointegrating vector is less or equal to r against an alternative that there is more than r. It starts with p eigenvalue, and then successfully the largest is removed.

$\lambda_{trace}=0$ when all the $\lambda_i=0$ for i = 1…..h.

λ_{max} conducts separate tests on each eigenvalue, and has as its null hypothesis that the number of cointegrating vector is r against an alternative of r+1.

4.5 Granger Causality Test

The granger causality test for two time series, yi and xi, involves running the following models

$$Y_t = \delta + \sum_{i}^{I+r} \alpha_{1t} y_{t-i} + \sum_{i}^{I+r} \beta_{1t} x_{t-i} + \varepsilon_{1t} \quad \text{.....(iv)}$$

$$X_t = \delta + \sum_{i}^{I+r} \alpha_{2t} x_{t-i} + \sum_{i}^{I+r} \beta_{2t} y_{t-i} + \varepsilon_{2t} \quad \text{.....(v)}$$

Where r represents the order of integration and α and β are the coefficients of the variables and $\varepsilon_{1t}$and $\varepsilon_{2t}$are the white noise error term. The null hypothesis of the test is that the lagged value of one variable does not cause the other against the alternative of causality running from one to another.

4.6 Impulse Response Function

Impulse Response function portrays how changes in one variable resulting from an external shock affect the other variables through time. Taking into account the bivariate framework of the preceding two equations, the IRF equation can be written as

$$\boldsymbol{\Omega} = \boldsymbol{\phi}_i B^{-1} \boldsymbol{\Lambda}^{1/2} \quad \text{.....(vi)}$$

Where B^{-1} is the coefficients matrix of all the variables at time t, $\boldsymbol{\Lambda}^{1/2}$ denotes lower Cholesky decomposition of the covariance matrix of μ_i, and $\boldsymbol{\phi}_i$ represents another matrix that shows the effects of a one unit increase in error term at date t (μ_t) on the value of the other variable at time t+s.

5. Result Discussion

This section outlines the results of different time series models that the study aimed to estimate. It starts with unit root test, then cointegration test, after then VECM and finally impulse response function.

Table 1: Augmented-Dickey-Fuller (ADF) Test Result for Unit Root

Variables	ADF(Intercept)		ADF(Trend and Intercept)		Order of Integration
	Level	1st Diff	Level	1st Diff	
GDP_R	-2.405055	-6.055615***	-3.757237**	-5.928067***	I(1)
Inflation	-3.592078***	-6.647006***	-4.025426**	-6.573776***	I(1)
Un	-5.128507***	-12.55219***	-7.457339***	-4.901183***	I(1)

Notes: ***, ** and * indicate rejection of the null (variables are unit root/ non stationary) at the 1%, 5% and 10% level respectively

Table 1 shows that all the variables are stationary at first difference at 1% level of significance in case both with trend and without trend. Therefore it can be said that the time series under consideration are integrated of order one i.e. I(1).

5.1 Cointegration

Since the variables are integrated of first Difference i.e. I (1), now this paper tests whether these variables are co-integrated or not (Table 2). The Johansen test statistics show rejection for the null hypothesis of no co-integrating vectors under both the trace and maximal Eigen value forms of the test.

Table 2: Unrestricted Co integration Rank Test (Trace)

Maximum rank	Eigen value	Trace statistic	Critical value 0.05
None *	0.581887	40.38188	29.79707
At most 1*	0.461115	19.45377	15.49471
At most 2*	0.174957	4.615688	3.841466

* denotes rejection of the hypothesis at the 0.05 level

If trace statistics value is greater than critical value then null hypothesis is rejected. Here trace test indicates 3 cointegratingeqn(s) at the 0.05 level as the trace statistic value is greater than the critical value for all cases.

Table 3: Unrestricted Co Integration Rank Test (Maximum Eigen Value)

Maximum rank	Eigen value	Max-Eigen statistic	Critical value 0.05
None	0.581887	20.92811	21.13162
At most 1*	0.461115	14.83808	14.26460
At most 2*	0.174957	4.615688	3.841466

* denotes rejection of the hypothesis at the 0.05 level

Also in case of the Maximum Eigen value test, if max statistics value is greater than critical value then null hypothesis is rejected. Therefore the results indicate the existence of at least two cointegrating relationship among the variables in the series.

Long-run impact of inflation and unemployment on the **GDP growth rate in Bangladesh (1991-2017):**

Table 4: Normalized Cointegrating Coefficients

Cointegrating equation(s)	Coint Eq[1]	SE	t statics
GDP_R	1.000000		
Inflation	-0.778838	(0.13464)	5.7845959596**
Un	0.839284	(0.47041)	1.7841542484

The values of the normalized cointegrating coefficient indicate that in the long run unemployment is inversely related to the GDP growth rate and inflation in positively related to the GDP growth rate. In the long run 1% increase in unemployment leads to 0.839284% fall in the GDP growth rate and vice versa. Similarly, in the long run 1% increase in inflation leads to 0.778838% increase in the GDP growth rate and vice versa.

5.2 Vector Error Correction Model (VECM)

From earlier discussion it has been observed that the series are cointegrated, so we may proceed with Vector Error Correction (VECM) model to examine the adjustments among the variables.

Table 5: Vector Error Correction Estimates (Speed of Adjustment)

Cointegrating Equation(s)	Coint Eq1	SE	t statistics
D(GDP_R)	-0.771063	(0.30655)	[-2.51531]
D(Inflation)	-0.822982	(1.37629)	[-0.59797]
D(Un)	-0.279418	(0.28074)	[-0.99528]
C	0.137707		

The estimated error correction coefficient indicates that about 77% deviation of the GDP from its long run equilibrium level is corrected each year. About 82% and 28% deviation of inflation and unemployment respectively from its long run equilibrium level is corrected each year.

Table 6: Granger Causality Test (Lags 2)

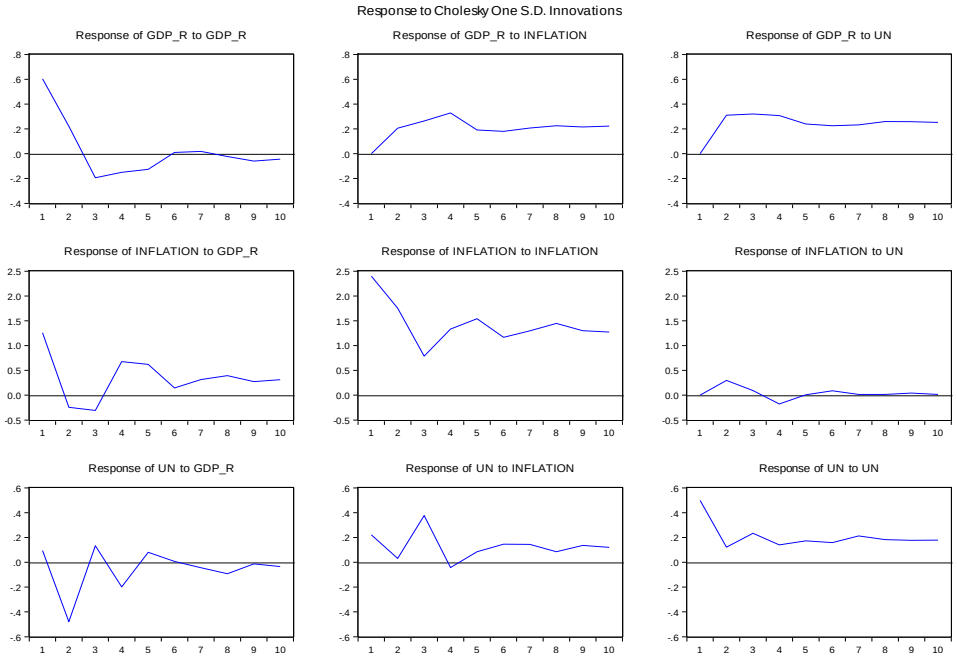
Null Hypothesis	Obs	F-statistic	Prob.
UN does not Granger Cause GDP_R	24	9.16286	0.0016
GDP_R does not Granger Cause UN	24	2.80893	0.0854
INFLATION does not Granger Cause GDP_R	24	0.65169	0.5324
GDP_R does not Granger Cause INFLATION	24	1.51206	0.2458
INFLATION does not Granger Cause UN	24	1.03137	0.3756
UN does not Granger Cause INFLATION	24	1.33301	0.2872

Granger Causality suggests that if p-value is greater than 0.05 critical value then we cannot reject null hypothesis rather we accept null hypothesis.

From Table 6 it is clear that there is bi-directional causality running from unemployment to the GDP growth and from the GDP growth to unemployment. There is no causal relationship between the variables in the other cases.

5.3 Impulse Response Function

Impulse Response function shows the impact on a particular variable due to the external shocks on itself or on other variables.



We consider ten years forward following a shock in VAR model is shown by the horizontal axis of the figure. The vertical axis shows estimated values of a response variable following an external shock. The upper part of the figure shows how economic growth is responding from one standard deviation shock from the GDP growth, inflation and unemployment. The middle part presents how inflation is reacting to its own shock as well as shock from the GDP growth and unemployment. Lower part shows how unemployment is reacting to a shock on the GDP growth, inflation as well as to its own shock. Overall we find that shock on GDP growth causes the GDP growth to be neutralized after 5 years, shock on unemployment causes inflation to be neutralized after 6 years while shock on the GDP growth leads unemployment to neutralized after 8 years.

6. Conclusion and Recommendations

This paper explores the association between three important components of the economy termed as the GDP growth rate, Inflation and Unemployment with a cointregration approach. The results of unit root test shows that all the data series of the variables are stationary at first difference values and integrated of order one (1). The result of Johansen cointregration shows that inflation is positively c integrated to the GDP

growth rate which is statistically significant and unemployment is negatively related with the GDP growth rate which is statistically insignificant. These findings support most of literature under consideration. In the long run 1 percent increase in inflation leads to a 0.78% increases in the GDP growth rate and 1 percent increase in unemployment leads to a 0.84% decrease in the GDP growth rate. Finally, the result of Impulse response function shows that, an external shock on our examined variable has effects (positive or negative) on other variables. Although unemployment and inflation as key macroeconomic indicators have a significant impact on economic growth, growth is also affected by other factors like trade, FDI, productivity, money supply and so on. So further study can be performed with this variation, moreover variables with time frame as well as techniques. This study suggests the effectiveness of fiscal and monetary policy to reduce the strength of unemployment and inflation of Bangladesh. Policy makers should detect the potential sectors of the economy to create more job opportunities and how govt. spending can be more favorable to create job, political stability, labor intensive technology, encouragement of self-employment etc. and can be effective in reducing unemployment problem. However, higher inflation creates harmful effects for any economy by creating its vicious cycle, so policy makers should check it again and again.

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Factors Influencing Students' Enrolment in Private Universities in Bangladesh: A Study on Bangladesh University of Business and Technology (BUBT)

Md. Johirul Islam

Abstract

Nowadays, higher learning institutions have emerged significantly throughout the world. From the very beginning of the private university history in Bangladesh, higher educational institutions (HEIs) have been playing a vital role in the development of human resources as well as the whole nation. So, the choice of HEIs for the post-secondary students is very important for their future life. But the decision making process in HEIs is not so easy, rather it is a very complex one. The purpose of this study is to find out the factors that influence the students' choice of enrolment in private universities. The study is conducted on BUBT. In order to have a better understanding of the factors influencing enrolment at BUBT, a 35-item self-developed comprehensive questionnaire was surveyed among 180 students. The survey result shows that the most influencing factors for students' enrolment at BUBT are better opportunities provided by the institution and its stakeholders, reputation of the university, good affiliation with outsiders, quality of teaching, job market related courses, convenient location, low tuition fees, easy admission process, and a pool of available options. After getting the result of the survey analysis, it may be suggested for the organization that it may give significant concentration on these factors for increasing as well as retaining students' enrolment.

Keywords: Private University, Students' Enrolment, Choice Factors, Higher Education Institutions.

1. Introduction

The university plays a very significant role in the lives of students. The knowledge that students earn from their universities has a great influence on their decision making process both in personal lives and in organizational lives. University also shapes one's perception, norms, values, and judgment. The image of the university and student's academic performance have an impact of getting better jobs in national and international level. After the completion of secondary education, students

run in a competition for university admission. Among a large number of universities, both public and private, the selection of a right one is a difficult task. The number of universities is continuously increasing in Bangladesh and students are now presented with a number of choices and programs at different public and private universities. A great number of them are offering similar programs and there is a strong competition among them. In this situation, it is also very important for a student to choose the right one. Before choosing a university, a student has to consider some factors. A study conducted by Yvonne J. Moogan (2001) identified some factors that influence students' enrolment in the university. These factors are: the desire to be awarded a degree, the possibility to enhance the chances to obtain a decent job, the desire to have a higher income in the future and the location of the university which acquires a great importance in the decision making process. The present study is related to the factors that influence the students for choosing their university and the study is conducted especially on Bangladesh University of Business and Technology (BUBT).

2. Significance of the Study

The institutions that provide higher education are called higher educational institutions (HEIs). These institutions play a very important role for the development of human resources and the nation. After completion of the secondary education, students choose different HEIs for their higher study by considering several factors. Very few researches have been conducted on the issue of students' influencing factors for the enrolment in higher educational institutions in Bangladesh. But no research has been conducted yet on the above issue especially on Bangladesh University of Business and Technology (BUBT). This study aims to find out the most significant factors that influence the students for the enrolment at BUBT. The study can help BUBT in its decision making process related to students' enrolment.

3. Literature Review

The factors that influence the students' enrolment in private universities differ from one to another but there are several factors common. Some factors are very important to influence the students' decision to enroll at a certain university. The factors are academic reputation, variety of study programs, quality of education, campus location, costs, as well as the opinion of other persons (Tekle et al., 2006). The study conducted by

Router, Ropper, and Lettice (2015) also demonstrated that a strong social media presence can have a positive effect on the university student recruitment, especially when university interacts with students via their social media accounts and can promptly respond to questions and comments. Beneke and Human (2010) also have identified numerous factors such as the geographic location, the reputation of the higher education institution, the level of the tuition fees, the development of various social programs, the possibility to obtain a certain scholarships and the recommendations from family or friends who have a great influence on students' enrolment in a university. Based on a research by Wagner & Fard (2009), there are several factors which affect the students' attention for choosing a certain higher educational institution and these are: the cost of education, the content and structure of the study programs, the facilities offered by the university, the value of education and the influence exerted by family and friends.

A study conducted by Cynthia and Olawale (2012) showed a series of factors that influence the process of choosing a university. They are as follows: scholarships, the academic reputation, the level of tuition fees, the facility to access information and technology, the importance of the higher education institution, cultural diversity, the recommendations from family and acquaintances, the image of the university, the quality of the offered facilities, the social life within the campus, the employment opportunities, the international partnerships, the admission requirements, the friendly attitude of the academic staff, the campus attractiveness, the location of the university, the facilities regarding sports activities, the quality of the teaching process and the existence of some flexible study modalities. Yvonne (2011) has discovered some other issues that also play a vital role in the decision making process in a higher education institution. These issues are as follows: the reputation of the degree, the chances of getting a better job, the desire to have a high income in the future and the location of the university. Students' choice of a university is a basic and integral part of theory and research on higher education. For the students of elementary, primary and secondary schools, the options for choosing the institutions are very small. But for the post-secondary students, there exists a lot of freedom to choose (John, 1990). The choice of college process has been defined as the process through which students decide whether and where to go to college (Bergerson, 2009). The choice process models help the students in choosing the best one when a person is confronted with multiple alternatives (Rose and Scarpa, 2008). According to Hossler and Stage (1992) there are several factors that act as the choice

factors for the students before selecting a university or college. These factors include the socio-economic status, students' academic achievement, parents' educational levels, ethnicity, gender, encouragement from high school counselors and teachers, support from peers, and parental expectations and encouragement.

Another study by Kim (2004) suggested that the demographic information can have a strong influence on students' college decision making process. While demographic information is an important factor, it cannot be influenced by a higher education institution.The relationship between students' preferences and institutional characteristics is a significant determinant of where students ultimately decide to attend a college (Weiler, 1994; Hossler 1998). Strayhorn, Blakewood, and Devita (2008) found that there are three sets of factors that influence the students to enroll in university: academic, financial, and individual experiences. (Ismail, 2008, Canale, et al., 1996) have referred to lecturers' quality, availability of desired programs, international recognition, other facilities (library services, computing facilities and recreational facilities). Class size and subject difficulty and availability of financial support play the major role for the enrolment in any higher education institution. According to Domino et at. (2006) and Yamamoto (2006) parents have a great influence on their sons' enrolment at university. SiaKee (2010) has identified that institutional nature is the most influencing factor for choosing the higher education institution for the students. He also identified some independent variables that also influence the students' enrolment in their desired institution and those factors are like-the location of the university, the study programs, the reputation of the higher education institution, the existence of different educational facilities, the level of the tuition fees, the employment opportunities, the employed promotion, the promotion by university representatives, the possibility to visit the campus, the possibility to obtain scholarships etc.

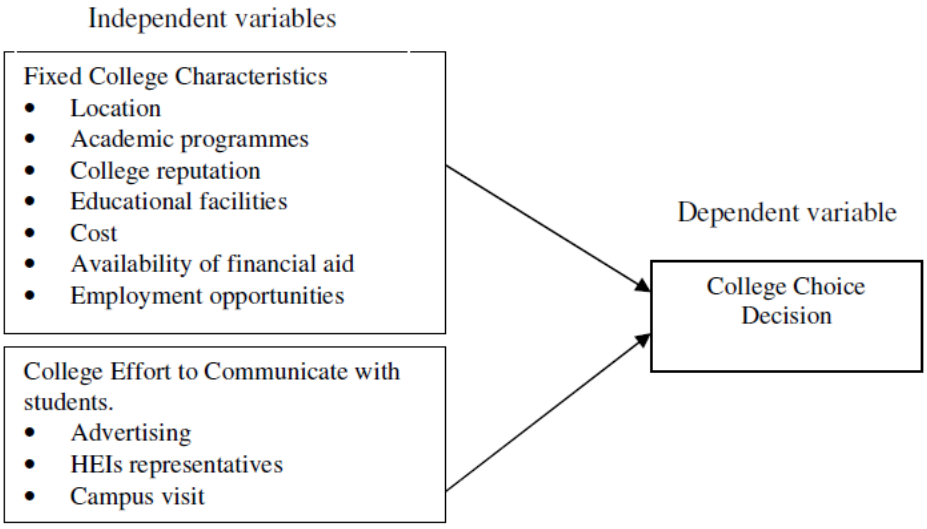

Figure 1: Student choice influencing factors

According to Gregory (2014), online presence of the university is very essential as students now conduct digital research on a university rather than physical. Students want clear and concise information of what the university stands for and what it has to offer through an easily accessible online presence. The study conducted by Router, Ropper, and Lettice (2015) also stated that a strong social media presence can play a vital role for students' recruitment, especially when university interacts with students via their social media accounts and can promptly respond to questions and comments. Another research by Keling (2007) concluded that students critically evaluate the reputation of the institution before selecting their college of choice. Other researches by Ancheh et al., (2007), O'brien et al., (2007) and Sia (2010) concluded too the importance of institutional reputation as the main driving factor for students in choosing the relevant place to study. Cost is one of the very important factors for choosing the university and based on that issue a research conducted by Ancheh et al. (2007) and Fernandez (2010) mentioned that students are very much cost-conscious. They prefer to apply in those institutions for higher education that offer them quality courses at affordable low costs. Research studies by Joseph & Joseph (2000), concluded that cost-related issues seem to have more importance as years go by. Tuition cost remains on top of the list of the international student's consideration before enrolling into a university (Dahari & Abduh, 2011). Some researches recommended a high degree of correlation between

students' enrolment in higher education and parents' influence. O'brien (2007), Ivy (2010) and Johnston (2010) in their researches stated that there is a positive relationship between family/peers influence and intention to study at graduate schools. But Koe & Saring (2012) proved in their study that there is a negative relationship between family/peers influence and intention to study at graduate schools. The easy entry to private universities and colleges provides students with an alternative choice to access and participate in higher education, which was not traditionally provided by public universities (Shah and Nair, 2013). The environment of the university also plays an important role in students' decision making process about their choice of the institution. A study by Maringe (2006) found that the scenario of higher education is becoming very competitive day by day and institutions have to compete with each other to attract more students for enrolment.

4. Objectives of the Study

The main objective of this study is to identify the major factors that influence the students' enrolment in BUBT as their higher education institution. To satisfy this objective, the study also tries to satisfy the following objectives:

1. To provide the academic information of the students;
2. To provide an overall picture of private universities in Bangladesh at present;
3. To provide further research direction on this issue.

5. Research Materials and Methods

5.1 Participants

The participants of this study are the students of BUBT who are studying in the undergraduate program. This study covers the students of BBA program only. The participants comprise of 111 males (61.7%) and 69 (38.3%) (Table 1) females and they are from the very 1st year to the final year students.

5.2 Sample Area and Sample Selection

This research is based on a field work conducted at BUBT. For the convenience of the study the researcher purposively selected 190 students who are studying BBA at BUBT. A structured questionnaire both open ended and close ended was used for collecting the data. A total of 190

questionnaires were provided but 10 questionnaires (5.26%) show the unusual response and that is why this study is completed based on the response of 180 students by eliminating 10 questionnaires. The sample size was selected using a convenience sampling method.

5.3 Sources of Data

For this study both primary and secondary data have been used. For collecting the primary data the only source is the responses of the students that are collected through the questionnaire. And secondary data have been collected from different journals, periodicals, different websites etc.

5.4 Instrument

This study employs a self-developed 35-item questionnaire. The questionnaire includes the items like university image, campus outlook, tuition fee, scholarship facility etc. to find out the opinion of the students for being enrolled at BUBT. For the close ended questions five point Likert Scale was used where 5= strongly agree, 4= agree, 3= neutral, 2= disagree, and 1= strongly disagree. Finally, Statistical Package for Social Science (SPSS), Microsoft Excel is used to analyze the data. For collecting the data the research has been conducted at the class room.

6. Result and Discussion

6.1 Demographic Figure of Students' Enrolment

After analyzing the surveyed questionnaire the ratio of male and female students who have participated in the survey was found out. It is seen that 61.7% of the participants are male and 38.3% participants are female.

6.2 Reliability and Validity of Data

The reliability of data is being verified by computing the Cronbach's alpha. The Cronbach's alpha suggests that a minimum alpha of .70 is sufficient for the early stage of research. In this study the Cronbach's alpha for all variables is 0.921 (Table 2). As the alpha is much higher than .70, the collected data have the adequate reliability.

6.3 Descriptive Statistics

Table 3 shows the mean, standard deviation, and number of respondents who participated in the questionnaire survey. By analyzing the mean it can be concluded that low tuition fee, convenient location, near to students' living place, good teaching quality, good behavior of the faculty, minimum entry requirement etc. are the most important factors that

influence the students to choose BUBT as their institution for higher education. The mean values of these variables are 4.22, 4.17, 3.94, 3.82, 3.77, and 3.58 respectively.

6.4 Kaiser-Meyer-Olkin (KMO) and Bartlett's Test

Measuring the sample adequacy is very necessary. The KMO test measures the adequacy of the sample and if the value is greater than 0.5 then it means the sample size is good and the research may be preceded. Looking at the table 4, the KMO measures is 0.873. The value 0.5 for KMO test is minimum and barely accepted, values between 0.7-0.8 are acceptable, and values above 0.9 are superb. Bartlett's test is another indication of the strength of the relationship among variables. It tests the null hypothesis that the correlation matrix is an identity matrix. It is seen from Table 4 that Bartlett's test of sphericity is significant as its associated probability is less than 0.05. In this study it is 0.000, i.e. the significance level is small enough to reject the null hypothesis.

6.5 Communalities

The table of communalities (Table 5) shows how much of the variance in the variables has been accounted for by the extracted factors. In Table 5 it is seen that over 75% of the variance in better job opportunity, over74% of the variance in convenient location is accounted for while 46% of the variance in better facilities is accounted for.

6.6 Total Variance Explained

Table 6 shows the factors extractable from the analysis along with their Eigen Values, the percent of variance attributable to each factor, and the cumulative variance of the factor and the previous factors. It is noted that the first factor accounts for 28.26% of the variance, the second 6.02%, the third 5.06%, the fourth 4.19%, the fifth 4.03%, the sixth 3.62%, the seventh 3.52%, the eighth 3.28%, and the ninth 3.09%. All other remaining factors are not significant.

6.7 Scree Plot

The scree plot shows the eigenvalues against all factors. The Eigen Value refers to the standardized variance associated with a particular factor. Figure 2 shows how many factors to be retained. The point of interest is where the curve starts to flatten. It can be seen that the curve begins to flatten between factors 4 and 5. From Table 6 it can be seen that factors 1 to 9 possess the Eigen Values more than 1 and the remaining factors

(factors 10 to 35) have the Eigen Values of less than 1. So, only nine factors have been retained.

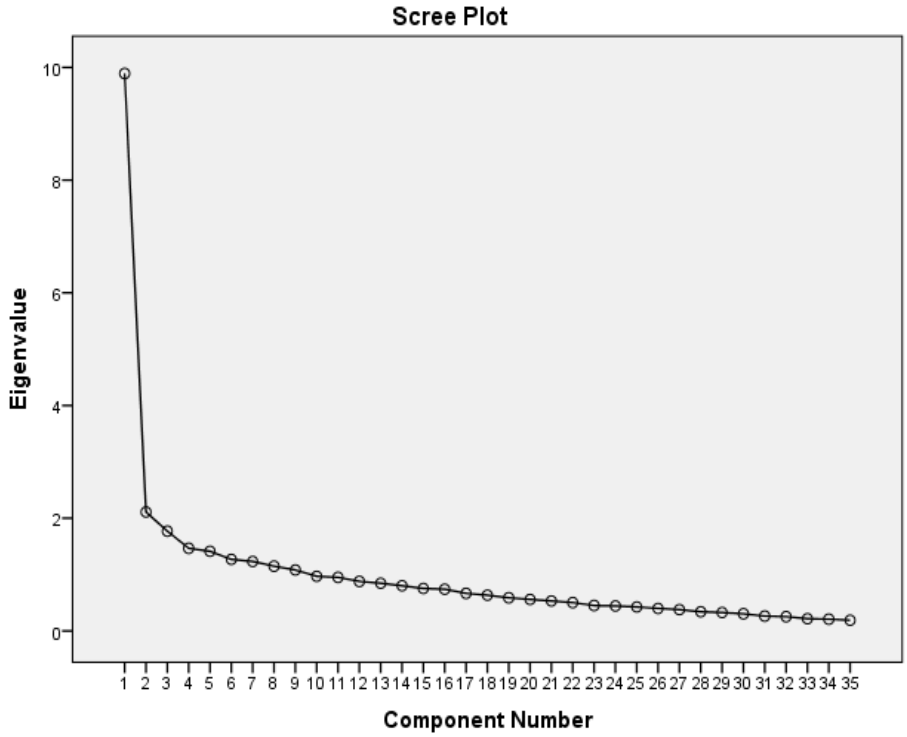

Figure 2: The Scree Plot

6.8 Component (Factor) Matrix

The Table 7 shows the loadings of the 35 variables on the 9 factors extracted. The higher the absolute value of the loading, the more the factor contributes to the variable. The gap on the table represents loadings that contribute less to the variable. The values less than 0.5 are suppressed from the table.

6.9 Rotated Components (Factor) Matrix

The aim of the rotation is to reduce the number of factors on which the variables under investigation have high loadings. This attempt does not change anything but makes the interpretation of the analysis easier. It can be seen from Table 8 that no better option is substantially loaded on factor (component) 9, open credit facility and easy admission process are substantially loaded on factor 8, low tuition fee and influence of parents or

friends are substantially loaded on factor 7, convenient location and near to students' living place are substantially loaded on factor 6, better facilities, safe campus and relevant course to job market are substantially loaded on factor 5, good administrative services, good teaching quality and behavior of the faculty are substantially loaded on factor 4, availability of courses, alliances with overseas institutions, minimum entry requirement and affiliation with international bodies are substantially loaded on factor 3, attractive campus atmosphere, well-known reputation, worldwide recognition and scholarship facilities are substantially loaded on factor 2, and all the remaining variables are substantially loaded on factor 1.

6.10 Composition of Factors

Table 09 shows the factors composed with the variables used in this study as the causes of students' enrolment at BUBT. Factor 1 is named as better opportunities provided by the institution and its stakeholders which is composed with the variables of link with industries, alumni help in job placement, internship facility, good marketing strategy, better job opportunity, and employment opportunity in the university; similarly factor 2 named reputation of the university is composed with the variables of attractive campus atmosphere, well-known reputation, worldwide recognition, and scholarship facility and other factors are shown in Table 09.

7. Conclusion

The result of this study indicates that there are numerous factors that have the influencing capacity for students' enrolment at BUBT, but among those factors some factors influence students very significantly. These factors are better opportunities provided by the institution and its stakeholders, reputation of the university, good affiliation with outsiders, quality of teaching, job market related courses, convenient location, tuition fee, easy entry process and, pool of available options. This paper can provide valuable information for the institution on different criteria to attract students. As those factors have a significant importance in students' enrolment, the institution may pay more attention to these factors.

8. Future Research Direction

The focus point of this study is to identify the factors that influence the students enrollment at BUBT. But this study focuses only on BUBT.

Future researches may be conducted on all private universities as well as public universities. A comparison between private universities and public universities may also be conducted. Comparison among public universities or private universities may also be done. Again this study focuses on only the perception of the students of BBA program. Future research may be done considering the opinion of other programs like CSE, EEE, Architecture, English, Law etc.

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Appendix-I: The Questionnaire

Dear Student,

This is to inform you that I, Md. Johirul Islam, Assistant Professor, Department of Management, Bangladesh University of Business and Technology (BUBT), am going to survey a questionnaire related to **the factors influencing students' enrolment in the private universities in Bangladesh: A study on BUBT**. You as a graduating student is requested to give your sincere comment against each of the statement by putting a tick mark. Your sincere evaluation will be helpful for the correct assessment of the issue so that next improvement plan may be undertaken. I am declaring that all information will be kept confidential and used only for research purpose.

Part-A: Studying Program: Please put the tick mark.

I	BBA	
II	MBA	
III	Others	

Gender: i) Male ii) Female

Part-B: Influencing factors for students' enrolment in BUBT.

On a scale of 1-5 (1 being Strongly Disagree and 5 being Strongly Agree), please rate your opinion on the following statements:

S.N	Factors	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	I have chosen this university because it offers low tuition fee.					
2	I have chosen this university because its location is very convenience.					
3	I have chosen this university because it offers the course that I am interested in.					
4	I have chosen this university because it is near to my living place.					
5	I have chosen this university because it offers the course that I am interested.					

S.N	Factors	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
6	I have chosen this university because its teaching quality of the faculty is very good.					
7	I have chosen this university because its atmosphere is so much attractive and friendly.					
8	I have chosen this university because the behavior of the faculty is very satisfactory.					
9	I have chosen this university because it provides better facilities like internet facility, library facility, common room facility, canteen facility etc.					
10	I have chosen this university because my parents/relatives/friends influence me.					
11	I have chosen this university because I have no better option surrounding my dormitory.					
12	I have chosen this university because its reputation for quality is well known.					
13	I have chosen this university because the recognition of the program is worldwide.					
14	I have chosen this university because of easy credit transfer facility to various international university.					
15	I have chosen this university because it offers better scholarship facility for the poor and meritorious student.					
16	I have chosen this university because it provides open credit facility.					

S.N	Factors	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
17	I have chosen this university because of the availability of different courses.					
18	I have chosen this university because it has a strong strategic alliance with well-known overseas institutions.					
19	I have chosen this university because of minimum and flexible entry requirement.					
20	I have chosen this university because it has a close link with different renowned industry in Bangladesh.					
21	I have chosen this university because the institution's recognition of prior students' quality.					
22	I have chosen this university because the institution or alumni association helps the graduates with job placement.					
23	I have chosen this university because it provides internship facility to every student.					
24	I have chosen this university because the institution has good affiliation with national and international professional bodies.					
25	I have chosen this university because there are lots of extracurricular facilities.					
26	I have chosen this university because the campus outlook is very much attractive.					
27	I have chosen this university because of the ease of application and admission					

S.N	Factors	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
	procedure.					
28	I have chosen this university because the marketing strategy of the university is very good.					
29	I have chosen this university because graduates can get better job after the completion of their studies.					
30	I have chosen this university because the university provides high employment opportunities for its graduates.					
31	I have chosen this university because it is one of the top ranking private universities in Bangladesh which is recognized by University Grants Commission.					
32	I have chosen this university because of the huge physical size of the institution.					
33	I have chosen this university because the campus is safe for the students.					
34	I have chosen this university because the courses offered in this university are relevant to the work market.					
35	I have chosen this university because of the efficient transportation facility.					

Thank you for your kind cooperation.

Appendix II: Tables

Table 1: Frequency Table

Gender	Frequency	Percent	Cumulative Percent
Male	111	61.7	61.7
Female	69	38.3	100.0
Total	180	100.0	

Table 2: Reliability Statistics

Cronbach's Alpha	No. of Items
.912	35

Table 3: Descriptive Statistics

Influencing Factors	N	Mean	Std. Deviation
Low tuition fee	180	4.2222	.88788
Convenient location	180	4.1722	1.06666
Interesting courses	180	3.3778	1.10436
Near to my living place	180	3.9444	1.24498
Good administrative services	180	3.4500	1.03716
Good teaching quality	180	3.8222	.96968
Attractive campus atmosphere	180	2.6556	1.12027
Behavior of the faculty	180	3.7722	.90208
Better facilities	180	2.8111	1.35279
Influence of parents or friends	180	3.4889	1.19818
No better option	180	3.0667	1.21720
Well-known reputation	180	3.2778	1.05203
Worldwide recognition	180	2.8444	1.03472
Credit transfer facility	180	2.8000	1.14042
Scholarship facility	180	3.3111	1.21577
Open credit facility	180	2.0111	1.14330

Availability of courses	180	3.2056	1.12213
Alliances with overseas institutions	180	2.9167	.99650
Minimum entry requirement	180	3.5889	.92627
Link with industries	180	2.6889	1.00440
Recognition of prior student's quality	180	3.0833	.89614
Alumni helps in job placement	180	2.8667	1.17896
Internship facility	180	3.1722	1.20442
Affiliation with international bodies	180	2.7556	1.00625
Extracurricular activities	180	2.7889	1.13840
Campus outlook	180	2.0278	1.01624
Easy admission process	180	3.3556	.88199
Good marketing strategy	180	2.6722	1.13271
Better job opportunity	180	2.8278	.95619
Employment opportunity in university	180	2.6556	1.05873
Top ranking university	180	2.9000	1.19168
Huge physical size	180	2.4556	.93547
Safe campus	180	3.4667	1.18369
Relevant course to work market	180	3.2778	.96332
Transportation facility	180	2.1444	1.28647

Table 4: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.873
Bartlett's Test of Sphericity	Approx. Chi-Square	2448.089
	df	595
	Sig.	.000

Table 5: Communalities

	Initial	Extraction
Low tuition fee	1.000	.550
Convenient location	1.000	.744
Interesting courses	1.000	.501
Near to my living place	1.000	.736
Good administrative services	1.000	.568
Good teaching quality	1.000	.679
Attractive campus atmosphere	1.000	.565
Behavior of the faculty	1.000	.728
Better facilities	1.000	.467
Influence of parents or friends	1.000	.633
No better option	1.000	.684
Well-known reputation	1.000	.715
Worldwide recognition	1.000	.557
Credit transfer facility	1.000	.508
Scholarship facility	1.000	.521
Open credit facility	1.000	.613
Availability of courses	1.000	.595
Alliances with overseas institutions	1.000	.554
Minimum entry requirement	1.000	.631
Link with industries	1.000	.632
Recognition of prior student's quality	1.000	.611
Alumni helps in job placement	1.000	.696
Internship facility	1.000	.584
Affiliation with international bodies	1.000	.587
Extracurricular activities	1.000	.477
Campus outlook	1.000	.663
Easy admission process	1.000	.626

Good marketing strategy	1.000	.576
Better job opportunity	1.000	.755
Employment opportunity in university	1.000	.683
Top ranking university	1.000	.528
Huge physical size	1.000	.622
Safe campus	1.000	.652
Relevant course to work market	1.000	.558
Transportation facility	1.000	.587

Extraction Method: Principal Component Analysis.

Table 6: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.892	28.263	28.263	9.892	28.263	28.263
2	2.110	6.028	34.291	2.110	6.028	34.291
3	1.771	5.060	39.352	1.771	5.060	39.352
4	1.466	4.190	43.542	1.466	4.190	43.542
5	1.414	4.039	47.580	1.414	4.039	47.580
6	1.269	3.625	51.206	1.269	3.625	51.206
7	1.232	3.521	54.726	1.232	3.521	54.726
8	1.149	3.283	58.009	1.149	3.283	58.009
9	1.081	3.090	61.099	1.081	3.090	61.099
10	.969	2.770	63.868			
11	.951	2.716	66.585			
12	.879	2.511	69.096			
13	.846	2.416	71.512			
14	.802	2.291	73.803			
15	.753	2.152	75.955			
16	.740	2.114	78.068			
17	.666	1.903	79.972			
18	.635	1.813	81.785			

19	.588	1.680	83.466			
20	.558	1.595	85.061			
21	.532	1.520	86.580			
22	.503	1.437	88.017			
23	.451	1.289	89.306			
24	.442	1.262	90.569			
25	.425	1.215	91.784			
26	.399	1.141	92.924			
27	.377	1.077	94.002			
28	.340	.972	94.973			
29	.326	.932	95.906			
30	.304	.868	96.773			
31	.263	.752	97.526			
32	.253	.722	98.248			
33	.216	.617	98.865			
34	.208	.596	99.461			
35	.189	.539	100.000			

Extraction Method: Principal Component Analysis.

Table 7: Component Matrix[a]

	Components								
	1	2	3	4	5	6	7	8	9
Low tuition fee		.593							
Convenient location		.630	.530						
Interesting courses	.548								
Near to my living place		.573	.539						
Good administrative services	.603								
Good teaching quality	.624								
Attractive campus atmosphere	.541								
Behavior of the faculty	.581								
Better facilities	.569								
Influence of parents or friends									.535

No better option								.598	
Well-known reputation	.678								
Worldwide recognition	.566								
Credit transfer facility	.664								
Scholarship facility	.540								
Open credit facility									
Availability of courses	.573								
Alliances with overseas institutions	.501								
Minimum entry requirement									
Link with industries	.693								
Recognition of prior student's quality	.613								
Alumni helps in job placement	.685								
Internship facility	.543								
Affiliation with international bodies	.640								
Extracurricular activities	.602								
Campus outlook	.656								
Easy admission process					.571				
Good marketing strategy	.549								
Better job opportunity	.721								
Employment opportunity in university	.550								
Top ranking university	.592								
Huge physical size	.583								
Safe campus	.579								
Relevant course to work market									
Transportation facility									

Extraction Method: Principal Component Analysis.
a. 9 components extracted.

Table 8: Rotated Component Matrix[a]

	Components								
	1	2	3	4	5	6	7	8	9
Low tuition fee							.560		
Convenient location						.839			
Interesting courses									
Near to my living place						.841			
Good administrative services				.583					
Good teaching quality				.725					
Attractive campus atmosphere		.505							
Behavior of the faculty				.779					
Better facilities					.509				
Influence of parents or friends							.768		
No better option									.811
Well-known reputation		.744							
Worldwide recognition		.509							
Credit transfer facility									
Scholarship facility		.550							
Open credit facility								.557	
Availability of courses			.569						
Alliances with overseas institution			.634						
Minimum entry requirement			.585						
Link with industries	.566								

Recognition of prior student's quality									
Alumni helps in job placement	.737								
Internship facility	.641								
Affiliation with international bodies			.589						
Extracurricular activities									
Campus outlook									
Easy admission process								-.646	
Good marketing strategy	.636								
Better job opportunity	.661								
Employment opportunity in university	.701								
Top ranking university									
Huge physical size									
Safe campus					.676				
Relevant course to work market					.720				
Transportation facility									

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 11 iterations.

Table 9: Composition of Factors

Factors	Factor's Name	Loaded Variables
Factor 1	Better opportunities provided by the institution and its stakeholders	Link with industries Alumni helps in job placement Internship facility Good marketing strategy Better job opportunity Employment opportunity in university
Factor 2	Reputation of the university	Attractive campus atmosphere Well-known reputation Worldwide recognition Scholarship facility
Factor 3	Good affiliation with outsiders	Availability of courses Alliances with overseas institution Minimum entry requirement Affiliation with international bodies
Factor 4	Quality of teaching	Good administrative services Good teaching quality Behavior of the faculty
Factor 5	Job market related courses	Better facilities Safe campus Relevant course to work market
Factor 6	Convenient location	Convenient location Near to my living place
Factor 7	Tuition fee	Low tuition fee Influence of parents or friends
Factor 8	Easy entry process	Open credit facility Easy admission process
Factor 9	Lake of available options	No better option

Appendix-IV: Teachers' Qualifications

U.G.C Guidelines regarding Qualifications and Experience of the University Teachers:

Professor

A. (i) An eminent scholar with Ph.D. qualification(s) in the concerned / allied / relevant discipline and published work of high quality, actively engaged in research with evidence of published work with a minimum of 10 publications as books and / or research / policy papers.

(ii) A minimum of ten years of teaching experience in University / college, and / or experience in research at the University / National level institutions / industries, including experience of guiding candidates for research at doctoral level. (iii) Contribution to educational innovation, design of new curricula and courses, and technology – mediated teaching learning process.

(iv) A minimum score as stipulated in the Academic Performance Indicator (API) based; Performance Based Appraisal System (PBAS), set out in the UGC Regulation, 2010 and subsequent amendments thereof.

Or,

B. An outstanding professional, with established reputation in the relevant field, who has made significant contributions to the knowledge in the concerned / allied / relevant discipline, to be substantiated by credentials.

Associate Professor

Candidates should have a **Ph. D** degree in relevant discipline from a reputed and recognized university or institute and at least **eight years of postdoctoral research/ teaching experience** with high quality publications in high impact journals. Candidates should have demonstrated a record of having successfully led independent research programs and have scholarly achievement in the respective field of research. Candidates should have interest and ability to teach courses in M.A. /M. Sc. programme and in the PhD programme. It is expected that candidates applying for this position should have experience of guiding several PhD and undergraduate students and minimum API Score as per UGC norms

Assistant Professor

(i) Good academic record at the Master's Degree level in a relevant subject from a reputed University/Institute.

(ii) Besides fulfilling the above qualifications, the candidate must have cleared the National Eligibility Test (NET) conducted by the UGC, CSIR or similar test/obtained as per Ph.D or equivalent degree as per U.G.C norms.

The Impact of RMG Sector on Women Development in Bangladesh

Mst. Amina Khatun
Tareq Imam Zahid

Abstract

The objective of this paper is to investigate the effect of Ready-Made Garments (RMG) sector on women development for the period of 2000 to 2015 in the context of Bangladesh. Gender Development Index (GDI) is the ratio of female and male Human Development Index (HDI) values where each gender's HDI value is measured by life expectancy index, education index, and GNI index. Still, the increase in female development is lower than male development. As there is an existence of women deprivation in Bangladesh for many years, there is a necessity of accelerating the speed of female development to cope up with the development enjoyed by men. In fiscal year 2016-17 the total export of RMG sector is 81.23% (BGMEA) and 80% of garment workers are women (World Bank, 2017). So, the question of 'does the RMG sector in Bangladesh really lead to women development?' is generally sought to be answered. Moreover, in the context of Bangladesh, there are very few rigorous studies that focus the influence of RMG sector on GDI. Therefore, the present study has been conducted. The Breusch-Pagan test ensures the existence of homoscedasticity and the Breusch-Godfrey test indicates a zero existence of autocorrelation. The Jarque-Bera test confirms the existence of normal distribution. The ordinary least square (OLS) test reveals that if total apparel export from Bangladesh increases (or decreases) by 1 percent, the GDI increases (or decreases) significantly by about 0.06 percent, which means that in this case female becomes 0.06 percent more (or less) developed than males. A set of policies should be initiated to enhance the RMG sector in Bangladesh exponentially with well and secured job environment in order to achieve women development.

Keywords: RMG sector, Apparel export, GDI, HDI, Women empowerment.

1. Introduction

Women empowerment has been regarded as major issues in changing the world scenario over the decades. Traditionally, in a male dominant society

women are deprived a lot in various ways. But, the scenario has been changing. Women are more empowered than before. One of the major reasons behind that is the economic empowerment of women around the globe. It is beyond question that women development is very necessary. Women hold almost half portion of the society. Without their development, the overall development of the country will lag behind. In Bangladesh there has been a significant involvement of women in various sectors in the last several years. Through the involvement of women in various economic activities, the women empowerment is being increased. A significant number of women who were idle earlier have got themselves involved in RMG sector, earning for themselves and their families, gaining empowerment, and hence contributing to social development.

The gender development index (GDI) deals with gender gaps with respect to the human development achievements by calculating differences between women and men on the basis of three major aspects of human development. These three major dimensions are health, knowledge, and standard of living. The GDI is the ratio of HDI (Human Development Index) values measured individually for females and males. In Bangladesh, the female HDI value is lower than male HDI value by 0.05 during the time span of 2000 to 2015. From 2000 to 2010 the female HDI value increases by about 10.6% whereas the male HDI value increases by about 6.2%. Over the period of 2010 to 2015 the female HDI value increased by 1.5% on an average whereas the male HDI value increased by about 1% (UNDP). It is seen that although the level of women development is lower than men development, the increase in women development is notably faster than men development.

The share of export of goods and services to GDP in Bangladesh is about 16% over the period of 2000 to 2015 (WDI). From 2000-2001 to 2015-2016 the share of RMG export to total export is about 77.4% (BGMEA). The RMG sector is a great contributor to our country's total export which itself is a great contributor to GDP and thus the RMG sector is a big sector. As 80% of garment workers are women (World Bank, 2017), a large number of women within the overall economy are employed in RMG sector. Therefore the expansion of RMG export should also imply the expansion of women employment in the RMG sector as well as in the economy. As it is seen that there remains a greater acceleration in the speed of increase in women HDI value than the acceleration in the speed of increase in men HDI value, it is logical to find out whether the RMG sector in Bangladesh is playing a significant role for accelerating the speed of women HDI value or not.

2. Objective of the Study

The objective of the study is to determine the effect of ready-made garments (RMG) sector on women development for the period of 2000 to 2015 in the context of Bangladesh.

3. Literature Review

There are several studies found with relation to women empowerment and RMG sector as well as trade. Some of them are mentioned below:

Kibria (1995) has examined the income-related experiences of female garments workers in Bangladesh. The analysis of the study is based on in-depth interviews of 34 female garment workers who are stitching machine operators in five factories. In spite of the usually low economic autonomy of Bangladeshi women, the women's ability to control their income was varied, and in fact, a substantial number of the female workers exercised complete control over their wages. Socio-economic background is also affected by women's income. With the omission of some young unmarried workers, women's employment in the garment industries did not pose an important challenge to patriarchal household relations. Sathar and Kazi (1997) found that the 'access to resources' which indicates whether women take part in household expenditure, decisions and whether women can freely purchase their daily necessities and take the 'control over resources' which is measured by knowing who kept household income and who has the right in household expenditure can play a major role to the women empowerment. Ozler (2000) showed that the activity of export in a developing country leads to an advanced part of female employment. He has conducted the study with the help of plant level data from Turkey from 1983 to 1985.The study has also found that the trade liberalization of Turkish economy has led to employment advantages for women comparative to men in industrial sector. Seguino (2000) empirically showed the determining factors of economic growth for semi-industrialized countries on the basis of export-oriented economies where women afford the greater part of labor in the export sector. Absar (2001) showed that female workers have inadequate purchasing authority and poor controls over commodities. He has also described and figured out their rights of entry to accommodation, healthiness and hygiene and transportation amenities.

Mahmud (2003) showed that the enhancement of women labor supply co-operated by invention of demand for women labor force has a great impact

to form new productions consequences of feminization of labor force in Bangladesh. Inflexible gender separation of labor in the domestic affairs and reproductive economies transmits negative implications for not only the wellbeing of women but also the members of their households depending upon women's labor. Ahmed (2004) showed that women empowerment is focused by raising voices for the rights of woman. Female garments workers have inadequate voice not only in the household because of male control but also at the work place.

Hossain (2011) argued that the Ready Made Garments (RMG) employment has transformed the status and the lives of women workforces that definitely enhance women empowerment of Bangladesh. The study was conducted on the secondary data sources and the main objective of the study is to justify the effects on female Ready Made Garments workers to their employment in Bangladesh. The finding of the study also shows that women's employment in the RMG sectors have larger potentials to contribute not only to the women's empowerment but also to the gender equity in Bangladesh. Habib (2014) argued that though women are receiving facilities from the garment sectors in terms of their earnings, the negative sides overshadow the positive sides of women workers' attachment in the garment sectors. As a result, it hinders the change of structural violent behavior in the society and that's why, socio- economic empowerment of women through their involvement in the garment industry of Bangladesh is contradictory.

Rahman and Siddiqui (2015) showed that there is no way to deny the point that without women empowerment the objectives of development of Bangladesh are always difficult to get. In this regard they have argued that participation of women in the Ready Made Garments industries playing a significant role to the economic growth of Bangladesh. The study was an exploratory research that designed on the basis of qualitative and quantitative analysis. Both primary and secondary sources of data were used to conduct the study over the period of 1983 to 2015. The main objective of the study is to focus on the RMG sector as a promoter of women development in Bangladesh. The findings of the study have showed that the labor cost of Bangladesh is very low specially the female workers. In this regard Bangladesh has already got the attention of foreign countries, international buyers and international companies. As a result, the foreign direct investments have increased day by day in this sector and Bangladesh has tried the best to support the apparel industry with various measures. The suggestions part of this study shows that female garments

workers are playing the most significant role to enhance the sector globally so that some necessary steps should be taken to improve the status of female workers and build a more gender equal society as the female are treated equally by the officials and society also.

Billah and Manik (2017) illustrates that the participation of women in the various workforces especially RMG sector has increased day by day and the result of this participation has been changing the society's old conception that women are the burden of the family. In this regard they have argued that working of women in the Ready Made Garments industries generates various opportunities to aware of their rights and cope with the society especially women's economic involvement to family, women's entrance to assets, women's involvement in domestic decision making and their awareness of coping capacity with risks that enhances their empowerment. The main determination of the study is to observe the connection of Ready Made Garments sector's support to women empowerment in Bangladesh. This research study has conducted on both quantitative and quantitative methods. Both primary and secondary sources of data were used to conduct the study and the study has developed the OLS regression model to assess the women empowerment of Bangladesh. The findings of the study have showed that the most significant indicator of women's empowerment is the financial contribution to the family and due to these financial solvency women can participate household decision making, can access to resources and so on. The recommendations part of this study shows that the owners and management sectors of garments industries should ensure such a friendly working environment by providing appropriate human resource management, establish various facilities including the child care center and should ensure equal employment opportunity where zero tolerance of sexual harassment and build a victim support center to increase women empowerment.

In the context of Bangladesh, there are no serious studies found in the literature that focus on GDI being influenced by of RMG sector. Therefore, the present study has been conducted.

4. Methodology

The model for the study is:

$$\ln GDI_t = \beta_1 + \beta_2 \ln RMGX_t + u_t \quad \ldots\ldots\ldots 1$$

This is a linear model, where $\ln GDI$ and $\ln RMGX$ are gender

development index and value of total apparel export of Bangladesh in the forms of logarithm respectively. β_1 is the intercept term, β_2 is the slope coefficient which says how much of the value of GDI changes as a result of 1% change in the value of total apparel export. u is the disturbance term that includes all the variables other than RMG export that affect the GDI.

4.1 Breusch-Pagan Test

The residual followed by the regression model (in 1) can be written as:

$$\hat{u}_t^2 = \delta_1 + \delta_2 \ln RMGX_t \quad \ldots\ldots\ldots 2$$

Followed by Chi-Square distribution with the degrees of freedom of 1, the set of hypotheses (from 2) are constructed: $H_0 : \delta_t = 0$ and $H_1 : \delta_t \neq 0$. If the null hypothesis is not rejected, then δ is homoscedastic or in other words, u (in 1) is homoscedastic. If the null hypothesis is rejected, then u (in 1) is heteroscedastic.

4.2 Breusch-Godfrey Test

The auto regressive model of order 1, AR(1)on the basis of u (in 1) is:

$$u_t = \rho_1 u_{t-1} + v_t \quad \ldots\ldots\ldots 3$$

In terms of estimation it can be rewritten as:

$$\hat{u}_t = \lambda_0 + \lambda_1 \hat{u}_{t-1} \quad \ldots\ldots\ldots 4$$

According to Breusch and Godfrey, the following auxiliary regression model is constructed:

$$\hat{u}_t = \lambda_0 + \gamma_2 \ln RMGX_t + \lambda_1 \hat{u}_{t-1} \quad \ldots\ldots\ldots 5$$

Followed by Chi-Square distribution with the degrees of freedom of 1 the set of hypotheses (from 3 followed by 5) are constructed: $H_0 : \rho_1 = 0$ and $H_1 : \rho_t \neq 0$. If the null hypothesis is not rejected, then there is no serial correlation between u_t and u_{t-1} or in other words, u s (in 1) do not show any serial correlation. If the null hypothesis is rejected, then there exists serial correlation among u s (in 1).

4.3 Jarque-Bera Test

The Jarque-Bera test statistic for residual followed by the regression model (in 1) is:

$$JB(\hat{u}_t) = \frac{n}{6}[s^2 + \frac{1}{4}(k-3)^2] \ \ldots\ldots\ldots 6$$

Where n is the sample size, s is the skewedness, and k is kurtosis. In this case Chi-Square distribution is followed with degrees of freedom of 2 and thus a set of null hypotheses (on the basis of 6): $H_0 : s = 0, k = 3$ and $H_1 : s \neq 0, k \neq 3$. If the null hypothesis is not rejected, then the residual follow the normal distribution or in other words, u (in 1) follow the normal distribution. If the null hypothesis is rejected, u (in 1) do not show normal distribution.

4.4 Ordinary Least Square Estimation

If the assumptions of classical normal linear regression model are satisfied, then OLS (ordinary least square) can be initiated. The sample regression function formulated from 1 can be written as:

$$\ln GDI_t = \ln \hat{GDI}_t + \hat{u}_t$$

By taking sum of square it can be stated that:

$$\sum \hat{u}_t^2 = \sum (\ln GDI_t - \ln \hat{GDI}_t)^2$$

Or, $\sum \hat{u}_t^2 = \sum (\ln GDI_t - \hat{\beta}_1 - \hat{\beta}_2 \ln RMGX_t)^2 \ \ldots\ldots\ldots 7$

By minimizing the $\sum \hat{u}_t^2$ (in 7) and satisfying the first order necessary conditions for the minimization, the estimated parameters: $\hat{\beta}_1$ and $\hat{\beta}_2$ are achieved by the formulas:

$$\hat{\beta}_2 = \frac{\sum \ln RMGX_t \ln GDI_t}{\sum \ln RMGX_t^2} \ \ldots\ldots\ldots 8$$

And, $\hat{\beta}_1 = \overline{\ln GDI} - \hat{\beta}_2 \overline{\ln RMGX} \ \ldots\ldots\ldots 9$

If $\hat{\beta}_1$ and $\hat{\beta}_2$ are statistically significant, then the sample regression function actually infer about the behavior of population regression function (in 1). The $\hat{\beta}_2$ is expected to be positive.

4.5 Data Source

The present study is based on the secondary data. The data of GDI in Bangladesh is collected from the Human Development Data published by

the United Nations Development Programme (UNDP). GDI is the ratio of the HDI value of females to the HDI value of males, where HDI ranges from 0 to 1. The value of GDI below 1 represents that males are more developed than females, the value above 1 represents that female being is more developed than male, and the value exactly 1 represents that both females and males have equality in terms of development. Total apparel export from Bangladesh is collected from Bangladesh Garment Manufacturers and Exporters Association (BGMEA). The value of total apparel export is accounted in millions in US dollar. The time period of all of these variables is 2000 to 2015. The following data are used for the analysis in the present study.

Table 1: Value of Total Apparel Export and GDI in Bangladesh

Year	Value of Total Apparel Export[1] (in Million US$)	GDI[2]	Female HDI[2]	Male HDI[2]
2000	4824.71	0.835	0.422	0.505
2005	6900.08	0.868	0.465	0.536
2010	14854.6	0.904	0.516	0.57
2011	19214.47	0.916	0.53	0.579
2012	19788.14	0.924	0.541	0.585
2013	23500.98	0.925	0.546	0.59
2014	24583.96	0.926	0.551	0.595
2015	26602.7	0.927	0.556	0.599

Data Source: [1]BGMEA (http://begmea.com.bd) and [2]UNDP (http://hdr.undp.org)

4.6 The Reason of Choosing the Regression Analysis

The data of GDI in Bangladesh is actually a time series data of 8 observations consisting of year 2000, 2005, 2010, 2011, 2012, 2013, 2014, and 2015. The available time series data are not continuous and the number of observation is low. This is why the simple regression analysis is undertaken into consideration.

5. Empirical Result

5.1 Breusch-Pagan Test

On the basis of 2, the Breusch-Pagan test shows the following result:

Table 2: The Result of Breusch-Pagan Test

Degrees of Freedom	Chi-Square	Probability
1	1.53	0.2164

It is seen that the null hypothesis of homoscedasticity is not rejected. Therefore, u (in 1) is homoscedastic.

5.2 Breusch-Godfrey Test

From 3 followed by 5, the Breusch-Godfrey test shows that:

Table 3: The Result of 3.2 Breusch-Godfrey Test

Lags	Degrees of Freedom	Chi-Square	Probability
1	1	0.204	0.6513

It is seen that the null hypothesis of no serial correlation among u s is rejected. Therefore, u s (in 1) do not show any serial correlation.

5.3 Jarque-Bera Test

On the basis of 6, the Jarque-Bera Test brings the result of:

Table 4: The Result of Jarque-Bera Test

Degrees of Freedom	Chi-Square	Probability
2	0.489	0.7831

It is seen that the null hypothesis of normality is not rejected. Therefore, u (in 1) is normally distributed.

5.4 Ordinary Least Square Estimation

On the basis of 8 and 9 followed by 7, the following result of OLS estimation is found:

Table 5: The Result of OLS Estimation

Dependent Variable: *lnGDI*	**Coefficient**	**Standard Error**	**t-Value**	**p-Value**
Independent Variable: *lnRMGX* (β_2)	0.0599023***	0.0040634	14.74	0.000
***Constant* (β_1)**	-0.6794379***	0.0392081	-17.33	0.000
R^2	**Adjusted R^2**	**F-Value**	**Probability>F-Value**	**Degrees of Freedom**
0.9731	0.9687	217.32	0.000	7

Note: *** represents 1% level of significance.

The 0.599 says that if the apparel export from Bangladesh increases (or decreases) by 1%, then the value of GDI significantly (at 1% level of significance) increases (or decreases) by 0.599% or 0.6%. In other words, it can be said that if the export by RMG sector from Bangladesh expands by 1%, then females' development goes ahead of about 0.6% than males' development even though females' development is lower than males' development. The coefficient value -0.679 says that if the apparel export from Bangladesh remains unchanged, then the GDI value significantly (at 1% level of significance) decreases by about 0.7. Or, in other words, the unchanged RMG export leads to a massive inequality in terms of development between women and men.

6. Conclusion

The data used in the present study are homoscedastic, normally distributed, and show zero autocorrelation according to Breusch-Pagan, Jarque-Bera, and Breusch-Godfrey tests respectively. On the basis of OLS estimation, the study finds that the RMG sector in Bangladesh is accelerating the women development by 0.06% more than men development. The present study finds that the RMG sector in Bangladesh is accelerating the speed of women development than the speed of men development.

The RMG female workers in Bangladesh are being empowered significantly through financial contribution to family, access to resources,

owning of assets, participating in household decision making, insight of gender awareness, and adaptability to cope with household shocks (Billah and Manik, 2017). Likewise, the findings of the present study represent that the contribution of RMG sector is significant in women empowerment in Bangladesh. So, it is recommended to keep the RMG sector growing. The Article 28 in the constitution of Bangladesh upholds equal rights for men and women. Bangladesh Labour Act, 2006 provides the laws with relation to the employment of labor and The Prevention of Oppression Against Women and Children Act, 2000 provides the laws regarding the repression against women. The order of these existing laws should be established perfectly for every woman. Steps should be taken to assure more involvement of women in RMG sector so that this process of women development continues. When there will be a number of sectors where women can get economically involved, that will boost women development and the overall social development of the country.

The study has applied the OLS estimation on time series data. This is a major limitation of the study. One can use a different methodology dedicatedly designed for time series analysis. One can focus on other sectors of the economy that affect the magnitude of GDI. One can also use other than GDI variable by which women development or women empowerment can be measured.

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Biogas Adoption: A Profitable Venture and the Key Factors Influencing Profit

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Abstract

Energy is one of the most important factors of industrialization and development. Biogas has a bright future as a green source of energy. It can be utilized to improve the life style of the people of different categories in the community. The aim of the study is to establish that the adoption of biogas is a profitable venture and determine the factors that influence the profit of biogas adoption. Four-stage cluster sampling design was used to select 360 biogas users and 500 households who did not use biogas (biogas non-users) were randomly selected from the neighboring biogas users. A questionnaire based survey method was applied for data collection and data were gathered directly from the field from door to door interview. This paper deals with the effects of biogas on economic, health and environmental conditions of the users. It was showed that about 80.5 percent owner used bio-slurry as fertilizer on their own land which reduce the cost of using chemical fertilizer on land. The impact of biogas on household sanitation was determined and found that mosquito breeding, flies and rodents, foul odor and smoke was decreased after the biogas plant installation. A higher number of user thought that various diseases decreased after the installation of biogas plant and results showed that there was a statistically significant association between biogas adoption and occurence of diseases. The findings indicate that the profit of biogas was mainly influenced by the factor conventional fuel source, availability of feeding material of the plant, maintenance of biogas plant and financial benefits. The present results clearly showed that the effects of biogas on economic, health and environment of rural households to a large extent established the biogas technology adoption as a profitable venture.

Keywords: Biogas, Profitable Venture, Factor analysis.

1. Introduction

Though Bangladesh is a least developed country, it has possibility to progress towards increasing the demand of energy. In FY 2013-14, about

68 percent of the total population of the country has the access to electricity (including renewable energy) and per capita electricity generation is 348 KWh, (Bangladesh Economic Review, 2014) which is still low compared with other developing countries. Other natural resources like oil, gas etc. are limited and will be exhausted in course of time. That is why, we should consider our natural resources very precious and we have to be cautious about extracting those. With the present rate of consumption, natural energy resources like gas will be exhausted shortly and this is high time to take policy and practice for exploration and use of alternative renewable sources if we do not want to meet energy crisis in the near future. Biogas has been found to be a proven renewable energy option. Biogas can be used as fuel for cooking, lighting, running vehicles and generators, etc.

A large proportion of rural and urban poor people depend on fire wood, vegetation, animal excreta and agricultural residues for domestic cooking. These methods proved to be unsustainable as fire woods contributed to higher levels of deforestation. Population explosion and the related energy demands make deforestation level higher than forestation efforts which cause environmental degradation. Uses of fire wood increases at the rate of 2 % annually. The high cost of petroleum products, low coverage of the electricity grid, gasification and increasing scarcity of traditional fuel woods due to deforestation created an energy deficit situation in rural Bangladesh. The demand for petroleum products, gas and other energy products are also increasing day by day. Achieving the avowed goal of transforming Bangladesh into a middle income country according to Vision 2021 as declared by the Government, is closely linked to meeting the escalating demands for power and energy. In spite of being insignificant in volume, the availability of biogas to a very large number of rural people and to very remote areas makes the technology very suitable and effective. Commercially produced pipeline natural gas plays and will continue to play a vital role in the industrialization and urbanization of the country, but this gas will not reach the remote village households any time soon. In that respect there is no alternative to biogas for the millions of villagers. Raw materials for biogas are easily and cheaply available everywhere. All the hazardous materials that pollute the environment spread bad smell and diseases are raw materials for a biogas plant. Biogas is produced through fermentation of organic matter in an anaerobic condition. So, the process does not only produce gas, but also kills all harmful bacteria. It is decentralized and appropriate for the rural areas, where neither piped gas supply nor grid electricity supply is

possible. Biogas has multiple advantages. It can meet the need for both gas and electricity. At the same time, it gives valuable organic fertilizer.

2. Rationale of the Study

The total installed capacity of Bangladesh's energy generation systems is 11,532 MW in 2015 while the daily generation is around 6000–8000 MW (BPDB 2015). Its fuel mix includes: natural gas 63%, furnace oil 20%, diesel 8%, coal 2% and hydro 2% (plus power imports of around 5%) (BPDB, 2015). With the prospect of the available domestic gas reserves being exhausted in the next 10 years (Rahman 2013) and no new fields discovered, the country would have to rely on imports. This is economically unviable and with only a small current share of renewable energy, Bangladesh energy sector is contributing to environmental pollution and greenhouse gas emissions (Khan, Hossain & Marinova, 2016).

In Bangladesh majority of rural residents live rear the cattle (22 million cows and buffaloes), and hence huge quantities of dung (0.22 million tons) are produced which emit massive fugitive methane gas into the atmosphere, increasing global warming and climate change (*energypedia*). As an effort to counteract these environmental, public health and social problems arising from wood fuel combustion and use, and dung production, numerous efforts made by several development organizations in Bangladesh, and the national government of Bangladesh (GoB) through the Local Government Engineering Department (LGED) and National Domestic Biogas and Manure Program (NDBMP), to introduce biogas technology in the area, to provide affordable, clean and sustainable domestic energy to the residents were not successful (GoB, 2011). However despite the efforts by the Bangladesh Government and NGOs to promote biogas technology in various parts of the country, adoption among households in Bangladesh has remained as low as 0.1%. Majority of households (more than 86%) have persistently continued to cook with inefficient traditional wood fuel systems with consequent detrimental environmental effects. The potential of this technology has thus remained untapped, and its socio-economic and environmental benefits have largely remained elusive. The reasons for this scenario remain unexplored. Yet in Bangladesh since 1972, there exists Biogas technology which is appropriate and economically feasible since it combines solid waste and wastewater treatment, which can simultaneously protect the surrounding water resources and enhance access to affordable energy. With all its

values, benefits and other sources of energy, it is interesting that most rural households have not embraced this technology despite government support. Despite its necessity and profit, the issue of profit and factors of profit is not over-researched in Bangladesh. It is in relation to the foregoing background that this study aimed at establishing the fact that the adoption of biogas is a profitable venture and also found out the factors that affects the profit of biogas adoption.

3. Literature Review

Bangladesh has a wonderful climate for biogas production. The ideal temperature for biogas is around 35°C. The temperature in Bangladesh usually varies from 6°C to 40°C. But the inside temperature of a biogas digester remains at 22°C-30°C, which is very near the optimum requirement. In Bangladesh, animal dung, poultry waste, and agricultural residues have long been used to produce biogas in the plant. The highly production rate of animal dung has given it more attraction to be used as the chief biomass element.

Recently, there has been an increasing interest in this technology, especially in the developing world. The governments of some Asian countries such as China, India, Nepal, and Thailand have paid varying degree of attentions to biogas technology. More than 90 per cent of presently existing biogas plants are of family size and the rest are at the farm and industrial scale. The potential of biogas technology for the replacement of traditional energy sources is the highest in China (about 80 per cent) and that of India, Nepal and Thailand is about 10 per cent (Tentscher, 1986). Rahman et al. (1996) mentioned that the relevance of biogas technology in Bangladesh lies in the fact that it makes the best possible utilization of various organic wastes (which have no or little economic value at the present moment) as a renewable source of clean energy in the rural and semi-urban areas. Salma A. Iqbal (2014) reported that Bangladesh as an agricultural country has embedded with plenty of biomass which has been used for extracting energy by burning directly or making biogas. Biogas mainly from animal and municipal wastes may be one of the promising renewable energy resources.

Gofran (2004) stated that biogas is used as cooking fuel, in petrol engine, diesel engine, in generator, in automobile, in lightening hazak etc and biogas slurry is used as fertilizer in crop field and in fish culture. Tarek M. Tarbaghia (1993) explained that Biogas technology can not only provide fuel, but is also important for the comprehensive utilization of biomass

resources and enhancing the development of agriculture, forestry, animal husbandry, fishery, evaluating the agricultural economy, protecting the ecologic environment, realizing agricultural recycling, as well as improving the sanitary conditions in rural areas. Biswas (2002) reported that biogas technology can be an alternative option to combat soil degradation as it converts organic wastes into bio-energy and digested slurry into organic fertilizer. Bhuiyan (2000) attempted to evaluate that biogas generation could solve the problem of fuel demand, as well as produce organic fertilizer, improve the sanitation system and assure to hygienic management of solid and liquid wastes. Das (1999) stated that biogas plant development will continue in the future as environmental aspects, increasing price level of conventional power, fuel conserving initiative and the efforts to reduce in development of energy saving technology. Biogas plants are extremely cost effective. Islam et al. (1999) reported that utilization of biogas is essential to solve the energy crisis and fertilizer problem and also to prevent deforestation. Biogas technology provides fuel for cooking and lighting and supply natural fertilizer for increasing food production.

Paul et al. (1999) stated that biogas acts as a promising alternative or renewable energy and it is the indigenous source of energy for cooking and lighting. The gas generated from biogas plant can meet the fuel requirement of cooking without causing any serious health or environmental pollution. Aktaruzzaman (2003) showed that in Bangladesh, there are about 2 million of cattle which excrete 0.22 million tons of dung per day. Theoretically this can produce an average $2.7x\ 10^9x\ m^3$ of biogas per year. Beside this a considerable amount of gas and organic fertilizer can be obtained from poultry droppings, human excreta, garbage, and water hyacinth etc. Kabir et al., (2013) revealed that education is a determinant in adoption of biogas as those who have more education want clean energy and they also recognize the importance of such energy to environmental conservation. He further asserts that the government or organizational subsidies or loans make it easier for households to adopt biogas since the initial cost becomes affordable and the people are given training and follow ups by the government.

4. Research Gap

While biogas energy has a huge potential, monitoring its performance has remained a significant setback in policy decisions. Currently advocacy is hugely based on outdated data and anecdotal evidence. There is very little

statistical based information on biogas technology in Bangladesh. Rigorous statistical analytical studies on the profit assessment, profit determinants and on livelihood impacts on the wide range of biogas and deployment in the field are rare. While studies have been carried out to ascertain biogas production using organic wastes in countries like India, Kenya and Nepal, only minimal studies on biogas production and use at the household level in Bangladesh have been done. But the context of those countries where researches were done differ from that of Bangladesh. Literature indicates that no study has been conducted in the area to determine the factors that affect the profit of biogas adoption. Furthermore no statistical analytical studies have been done to identify the factors that affect the profit of biogas adoption. Additionally no substantive data are available on profit assessment of biogas, when wood fuel is substituted with biogas fuel in rural households.

5. Objective of the Study

1. To investigate whether biogas adoption is a profitable venture or not on different aspects such as economic, environment, health etc.
2. To investigate the factors that influence the profit of biogas adoption.

6. Research Questions

The following questions were postulated to guide this study:

(i) How economically, environmentally and healthily viable is biogas technology as an alternative source of energy?

(ii) What are the factors influencing the profit of adoption of biogas technology?

7. Research Hypotheses

(i) Adoption and use of biogas technology leads to significant improvement in household health, income and environment.

(ii) Production and utilization of biogas energy in Bangladesh is a profitable venture.

8. Methodology

8.1 Sample Size Determination

To determine the sample size we consider the two categories of respondent which are Biogas user and Biogas non user. We use the

following formula to determine sample size:

$$n = \frac{z^2\ pq}{d^2}$$

Where, n = the desired sample size, z = the standard normal deviation, 1.96 which corresponds to the 95% confidence level; p = the proportion in the target population estimated to have biogas plant; q = 1-p; d = degree of accuracy desired (Precision level of the estimate)

p for different characteristics which are different - ranging from 0 to 1. The necessary sample size of Biogas user is 360 and for non user 500.

8.2 Sampling Design and Data Collection

Four-stage cluster sampling design was used to select the sampling elements. At the first stage 20 districts were selected randomly. In the second stage, 40 upazillas were selected randomly, two from each selected district. In the third stage two unions from each selected upazilla were selected again on randomly, yielding a total of 80 unions. As there is no sampling frame of the biogas plant users, all the biogas users of the selected unions were detected by using snowball sampling technique with a total of 360 biogas users .To identify the need and profit of biogas, 500 households who did not use biogas were randomly selected from the neighboring biogas users.

A questionnaire based survey method was applied for data collection. Primary data were gathered directly from the field by applying door to door interview. Interview session was placed from April to August, 2016. Relevant organizations were also visited to get data regarding alternative energy use, cost of energy, use of cooking technology etc.

8.3 Data Analysis

In order to analyze the data, Microsoft Excel, SPSS 22 have been used. Data were analyzed by using statistical techniques (descriptive statistic, cross tabulation, frequency Tables, means t-test and Factor analysis) with SPSS. Detailed statistical analysis was carried out to establish relationships between variables and draw conclusions.

Tests of significance, specifically t-tests and Chi-Square ($\chi 2$) were used. p-values were set at $p<0.05$, $p< 0.01$ and $p<0.10$. The degree of correlation (r) or association between continuous independent variables and dependent variables was measured by use of Karl Pearsons' coefficient,

while spearman correlation was used between discrete variables. Also was used Fisher's exact test to determine the association between nominal type variables.

Here partial correlation is also used to determine the degree of relation between dependent variables of whether biogas has become profitable or not and biogas related different independent variables.

Factor analysis was used to predict the factors that influenced the profit of biogas adoption. The intrinsic interest of factor analysis is in the "underlying factors". Linear combinations are formed to derive the factors. The factor analysis model can be expressed in matrix notation:

$$x = \mu + \Lambda f + U \quad \ldots\ldots \quad \ldots\ldots\ldots \quad \ldots\ldots\ldots\ldots \quad \ldots\ldots \quad (*)$$

Where

x: whether the uses of biogas become profitable

Λ: $\{\lambda ij\}$ is a $p \times k$ matrix of constants, called the matrix of factor loadings.

f : random vector representing the k common factors.

U: random vector representing *p* unique factors associated with the original variables. It

represents that part of profits that cannot be explained by the common factors.

Equation $(*)$ can be used to find linear combinations of variables to explain set of observations of many variables used in the study. This equation extracts influential common activities (i.e. factors) on profit.

The common factors $F_1, F_2, \ldots\ldots\ldots\ldots F_k$ are common to all *X* variables and are assumed to have zero mean and unit variance. The unique factors are unique to X_i. The unique factors are also assumed to have zero mean and are uncorrelated to the common factors. (We did not use an oblique rotation, which permits correlation among the factors).

9. Results and Discussion

The main challenge of present world is to harness the energy source which is environment friendly and ecologically balanced. This need has forced to search for other alternate source of energy. To explore the necessity and profit of biogas we analyzed the impact of biogas on economic, health and environment by respondent's opinion.

9.1 Necessity of Biogas Plant

Adoption of any technology largely depends on the realization of the necessity of that technology by the target group of people.

9.1.1 Respondents Opinion About the Necessity of Biogas Plant

The necessity of biogas is indispensible. From the study it was found that almost all users about 98.6 percent gave positive answers about the necessity of biogas and majority of the nonusers (about 83.1 percent) mentioned that they would use biogas if it is supplied to their home.

9.1.2 Reasons for the Need of Biogas

From Table 1 it is noted that about 69.2 percent of the biogas users and about 50.6 percent of the biogas nonusers mentioned the necessity of biogas due to the fact that collection of fuel wood is very time consuming and cumbersome. About 56.3 percent users and 50.3 percent of the biogas nonusers mentioned the necessity because they had no supply of gas. About 67.8 percent users and 32.2 percent of the biogas nonusers felt the necessity of biogas because bio-slurry was very essential for the reduction of the uses of chemical fertilizer on land and so on.

9.2 Impact of Biogas on Economy

To justify the economical viability of biogas we analyzed the fuel consumption type and expenses of fuel in the context of biogas users and non-users opinion.

9.2.1 Information on Fuel Consumption Type and Expenses

Table 2 represents the percentage distribution of respondents according to their type of fuels used for cooking purpose. It is evident from Table 2 that about 100 percent of the biogas users used only biogas for their cooking purpose and they need no other types of fuel for cooking purpose. The biogas nonusers used multiple things for cooking purpose. Among the non-users most of the respondents about 80.4 percent used fuel wood, about 32.3 percent used agricultural residue, about 32.9 percent used dry dung and 25.7 percent used gas cylinder for cooking purpose and so on.

9.2.2 Total Fuel Cost

The biogas technology required only one-time investment during the installation phase and very minimal maintenance costs through post-installation. Use of fuel can significantly be reduced if biogas technology is adapted. Table 3 represents the percentage distribution of respondents

according to the monthly cost of fuel. It is evident from the table that most of the users about 81.9 percent mentioned that they have no cost of fuel and very few about 10.9 percent mentioned that their total monthly fuel cost is above Tk. 900 due to the maintenance cost of large size biogas plant.

Household monthly fuel cost was found to be closely associated with biogas technology adoption. Tests of association showed a significant relationship between adoption and fuel cost (χ^2 =299.70, p=0.000). There is a significant relation between biogas adoption and total fuel cost.

It is showed in Table 4 that the average cost of fuel for biogas non user is Tk. 1059.79 which is comparatively very high than biogas user which is only Tk. 168.64 and there is a statistically significant difference in total cost of fuel between user and non-user households, (z = - 14.443, p = 0.000). The Levene's test for equality of variance also revealed a statistically reliable difference in total monthly fuel cost between users and non-users (p = 0.000).

9.2.3 Income Earned by Selling Biogas

Income from biogas was obtained when excess gas was produced or there was no need for personal cooking or lightening. It is noted from Table 7 that most of the users (about 65.0 percent) provided biogas in their own home. About 13.3 percent users earned within (300-600) Tk./month and also noted from the table that about 6.7 percent users earned more than 2000 Tk. /month by selling biogas. The average monthly income by selling biogas is Tk. 1343.89.

9.2.4 Uses of Bio Slurry of Biogas Plant

Biogas slurry when composed, stored and applied properly is considered to be of high nutrient valued natural fertilizer. The economic benefit of biogas technology is greatly increased if the slurry bi-product is used effectively on cultivable land. It was showed in Table 5 that about 80.5 percent users used bio-slurry as fertilizer on their own land; about 26.7 percent used as fish feed and about 29.5 percent sold bio-slurry to others. It was also observed that about 26.7 percent users earned cash money by selling bio-slurry. It was found from Table 7 that the approximated yearly income from bio-slurry was Tk. 3255.47.

9.3 Impact of Biogas on Environment

The impact of biogas on environment was determined and the change in household sanitation after the installment of biogas plant was analyzed. The impact of biogas on household sanitation was determined through five questions. Percentage distribution of the change in household sanitation after installment of biogas plant was presented in Figure 1. It was evident from the Figure 1 that 28.6 percent users thought that mosquito breeding was decreased and 28.6 percent users thought that there was no change on mosquito breeding after biogas plant-installation. It was noted that 41.1 percent users thought that flies and rodents decreased after the installation of biogas plant. It was also evident from Figure 1 that a higher percentage of users from 65.6 percent 85.0 percent mentioned that foul odor and smoke decreased after biogas plant- installation.

9.4 Impact of Biogas on Health

A higher number of users thought that various diseases were reduced after the installation of biogas plant. It was noted in Table 6 that about 22.8% users thought respiratory diseases reduced the most while about 50% users thought eye infections reduced the most. It is noted that about 42.8 percent users mentioned that the main benefit of biogas plant was the liberation from smoke borne diseases. A large portion of the respondents i.e. about 89.7 percent users mentioned that the main benefit of biogas plant was the absence of black soot in the kitchen.

It was evident from Table 6 that adoption and use of biogas technology leads to significant improvement in household health. Fisher's exact test showed that there was a statistically significant association between biogas adoption and occurance of diseases. All the value of Goodman-Kruskal index or lambda indicated that the adoption of biogas perfectly predict the incidence of diseases.

9.5 Factors Influence the Profit of Biogas Adoption in Bangladesh

9.5.1 Descriptive Statistics

Table 7 showed the descriptive statistics of the variables that affect the profit of biogas adoption in Bangladesh. It was noted from Table 7 that among the 360 plants, about 43.3 percent plants were of the capacity of less than 3 cu.m gas productions per day, followed by about 49.7 percent plants of 3-6 cu.m. The average size of biogas plants under study is 3.4 cu.m gas production per day. It is seen from the study that most of the users (73%) installed only one stove for their personal cooking purpose

and about 19 percent users installed 2 to 4 stoves. Most of the users (57%) constructed their biogas plant between the years 2010 to 2015. The average years of used biogas was 5.53.The primary input for biogas digesters in Bangladesh was cattle dung and poultry dropping. Majority of the users (about 90.8 percent) used cow dung and rest of them used poultry droppings as raw materials of their biogas plant. The source of raw materials is a major factor for biogas plant. It is showed that about 92.5 percent users collected raw materials from their own farm. It is seen from the study that about 25 percent users have 1 to 3 cattle and about 40.3 percent users have 4 to 6 cattle. The average number of cattle is 5.45. It is also revealed that about 3.1 percent users have 550 to 1050 poultry birds and 3.9 percent users have more than 1050 poultry birds. The operation and maintenance cost of a plant per year is very little without any parts of the plant having failed. About 81.4 percent users mentioned that they needed no types of repairing of the plants i.e. there was absolutely zero operational and maintenance cost. It is observed from the study that majority of the biogas plant (about 85.3%) reached at profitable condition and rest of the plant (about 14.7%) could not reach the profitable condition because these were newly installed or functioning for less than one year.

It is noted that most of the users which are about 65 percent, provided biogas in their own home. About 17.5 percent of the biogas plant users provided biogas only in one household. Income from biogas was obtained when excess gas was produced or there was no need for personal cooking or lightening. It is noted that about 35 percent users earned from Tk. 300 to Tk. 3000 per month by selling biogas.

From Table 7 it is found that all the values of Skewness and Kurtosis of variables were positive and indicated the tendency for right tail of the distribution to be heavier than the left tail and the distribution is more peaked than a normal distribution.

9.5.2 Factor Analysis

Factor analysis was used to establish the correlation between variables of whether biogas become profitable or not and biogas related different variables. FA was applied to 12 variables: plant size, total investment cost, total maintenance cost, number of years of biogas use, number of stoves installed, raw materials of biogas plant, source of raw materials, number of cattle, number of poultry, number of household provided biogas, total monthly income by selling biogas and approximated yearly income from bio-slurry (tk.).

The matrix of intercorrelation among twelve variables assumed to influence the profit was obtained shown in Table 8. Inspection of the correlation matrix shows that the correlations are substantial, indicating the presence of substantial general factors. Thus, factor analysis may give better results in this case.

Table 9 presents the results of factor analysis. One part of the output from a factor analysis is a matrix of factor loadings. Factor loading is the degree to which every variable correlates with a factor. Factor loadings are the basis for imputing a label to different factors. The meanings of the rotated factors are inferred from the variables significantly loaded on their factors. A decision needs to be made regarding what constitutes a significant loading. A rule of thumb frequently used is that the absolute value of a factor loading greater than 0.3 is considered significant, greater than 0.4 is more important and greater than 0.5 is very important (Lawley and Maxwell, 1971).

The number of factor components (FCs) extracted was based on criterion by Kaiser (1960) where the FC(s) with Eigen values greater than 1 were considered. The FCs was used to identify the most important variables affecting the profit of biogas plant. FA results were presented as component scores and loadings. A varimax rotation was applied to the FCs to minimize the contribution of variables with low loadings and maximize the contribution of variables with high loadings. Profit of biogas (indicated by yes or no) was plotted against each variable for the plant identification, information on livestock, installation and functioning of biogas plant, savings of conventional fuel sources, and the use of slurry. Whether biogas becomes at profitable concern or not was indicated by the answer “yes” or “no”. This was done by comparing the contribution referred to as loading in FA on the items (variables) within each factor component (FC). The variables produced unrelated components with eigen values greater than 1, all cumulatively accounting for 72% of the variance of the data set (Table: 9).

Factor analysis was done to extract and club the items for profit of biogas. Principal component analysis was the method of extraction. Varimax was the rotation method. Factors and factor loading of each item are given below in Table 9. The Table is followed by the explanation of all these 12 dimensions.

Loading on factors can be positive or negative. A negative loading indicates that this variable has an inverse relationship with the rest of the factors. The higher the loading the more important is the factor (Rao &

Sharma). However, Comrey (1973) suggested that anything above 0.44 could be considered salient, with increased loading becoming more vital in determining the factor. Four factors were recovered from the analysis with Eigen value greater than 1.

For the profit of biogas , the subsets highly significantly loaded on the first factor are plant size, number of stoves installed, number of cattle, number of household provide biogas and total monthly income by selling biogas. The subsets loaded on the first factor are related to the biogas plant information in the form of plant size, savings of conventional fuel sources. Therefore, this factor may be named **"Conventional Fuel Source".** The first factor shows high loading. The first factor explained up to 37.09% of the variance of the analyzed data set (variables). Number of households user provide biogas (0.969) and no. of stoves installed (0.958) was found as the most important variable while total investment cost (0.355) is the least important variable on the analysis of whether biogas become profitable or not. In this study, FA indicates that the profit of biogas increased with the increase of the size of plant, number of stoves installed, number of cattle , number of households user provide biogas which is associated with total monthly income by selling biogas and monthly profit.

The second factor is identified by the following subsets: Raw Materials of Biogas Plant and number of Poultry. The second factor (F2) that accounted for 14.61 % of the variance explained, cumulatively 51.69% of the variance and was characterized by high factor loadings for variables raw materials of biogas of the biogas plant. The second factor called "**Availability of Feeding Material of the plant"**, which is considered the second most important factor contains two variables ranked based their communalities.

The third factor (F3) that accounted for 11.642% of the variance explained, cumulatively 63.34% of the variance and was characterized by high factor loadings for variables maintenance of the biogas plant. The third factor called "**Maintenance of biogas plant"** of the user, which is considered the third most important factor contains three variables ranked, based their communalities. This factor includes total investment (TIC), total maintenance cost (TMC) and source of raw materials SR. Total maintenance cost (0.771) was the most important variable; source of raw materials (0.742) is the second most important variables and total investment cost (0.407) was the least important variable in this factor.

The subsets number of years used biogas (NY) and approximated yearly income from bio-slurry (AYIB) are significantly loaded on fourth factor. These subsets measure how the yearly income from selling biogas influences the profit of biogas. Thus the fourth factor may be termed as "**Financial benefits**".

The profit on biogas adoption, the four extracted factors explained about 72% of total variation. The communality measures the percent of variance in a given variable explained by all the factors jointly and may be interpreted as the reliability of the indicator. A communality of 0.75 is here considered high while that of 0.25 or less is low. The values of the communalities indicate that all the indicator variables explained the factors well. A Bartlett's Test of Sphericity (approximate χ^2) indicates that we can comfortably proceed with the factor analysis for determining the factors that influenced the profit of biogas adoption.

10. Conclusion

The main goal of this research is to provide a brief but good picture of the factors that affect the profit of biogas adoption together with the necessity of biogas energy in Bangladesh. The study has identified that the adverse effects of traditional cooking by biomass greatly decreased after biogas plant installation. The use of fuel can significantly be reduced if biogas technology is adapted. The primary input for biogas digesters in Bangladesh was cattle dung and poultry dropping. Majority of the users (about 90.8 percent) used cow dung as raw materials of their biogas plant. Source of raw materials is a major factor for biogas plant. It is showed that about 92.5 percent users collected raw materials from their own farm. So it is noted that biogas technology required only a one-time investment during the installation phase and very minimal maintenance costs through post-installation. It is showed from the study that the average cost of fuel for biogas non user is Tk. 1059.79 which is comparatively very high than biogas user which is only Tk. 168.64. Income from biogas was obtained when excess gas was produced or there was no need for personal cooking or lightening. It is noted that the average monthly income by selling biogas is Tk. 1343.89. The impact of biogas on environment was determined and the change in household sanitation after installment of biogas plant was analyzed. It was evident from the study that a higher percentage of users which are about 65.6 percent and 85.0 percent mentioned that foul odor and smoke respectively decreased after biogas plant- installation. Most of the biogas users thought biogas could have

decreased various pollutants that may have adverse effect on environment. It is evident from the study that adoption and use of biogas technology leads to a significant improvement in household health, economic condition and environment. Factor analysis was used to identify the factors which mainly effect the profit of biogas adoption. There are four factors addressed as Conventional Fuel Source, Availability of Feeding Material of the plant, Maintenance of biogas plant and Financial benefits. These significant factors affect the profit of biogas adoption. Since the technology has greater benefits, enthusiasm should be to improve more households to adopt the technology. Full potential can only be realized if the population of biogas plants is brought to scale. Public support is very important in the promotion of biogas. If the rural communities do not have confidence in investing in biogas they will continue to use fuel wood that is unhygienic and increase environmental degradation. Spreading information about biogas and its positive effects should be promoted. In Bangladesh, biogas energy has mainly been promoted by NGOs that target rural areas, where they think this technology could have the greatest impact by using cow-dung and poultry dropping. However, the huge amount of municipal waste that is produced on the daily basis in urban areas can also be used to generate biogas and these should be used to build commercial size biogas plant so that we can generate electricity. Municipal waste has been used to generate biogas in other parts of the world. A study should be carried out to determine the possibility of this within the urban area of Bangladesh.

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APPENDICES

ALL TABLES AND DIAGRAMS

Table 1: Percent distribution of the respondents according to their necessity of biogas (Multiple responses)

Necessity of biogas	Users	Non users
Not have enough supply of electricity	64(17.9)	92 (26.9)
Not have supply of gas	201(56.3)	172 (50.3)
Gas cylinder was not available for cooking	139(38.9)	97 (28.4)
Collection of fuel wood was very time consuming and cumbersome	247(69.2)	173 (50.6)
Fuel wood's price was comparatively high	149(41.7)	121 (35.4)
Utilization of bio-slurry for the reduction of uses chemical fertilize	242(67.8)	110 (32.2)
To protect the tree destruction	122(34.2)	42 (12.3)
To remove pressure on natural gas	106(29.7)	35 (10.2)
n	1270	842

(Note: Percentage was given in parenthesis)

Table 2: Percent Distribution of respondents according to their type of fuels used for cooking purpose (Multiple responses)

Fuel Type	Owner	Non user
Biogas	360 (100.0)	-
Fuel wood	-	381 (80.4)
Agriculture Residue	-	153 (32.3)
Kerosene	-	37 (7.8)
Gas Cylinder	-	122 (25.7)
Dry Dung	-	156 (32.9)
Electricity	-	21(4.4)
n	360	500

Table 3: Association between total monthly fuel cost of the respondents and status of biogas use

Total monthly fuel cost (in taka)	User		Non user		Total		χ^2	*df*	*p* value
	Number of respondents	Percent	Number of respondents	Percent	Number of respondents	Percent			
0	295	81.9	98	19.6	393	45.7			
< 300	8	2.2	31	6.2	39	4.5			
300-599	14	3.9	53	10.6	67	7.8	299.70	4	0.000
600-899	4	1.1	51	10.2	55	6.4			
≥900	39	10.9	267	53.4	306	35.6			
Total	360	100.0	500	100	860	100			

Table 4: Test of equality for the mean and variance between bio-gas user and non-user. That is, $H_0: \mu_1 = \mu_2$ and $H_0: \sigma_1^2 = \sigma_2^2$

Variables	Levene's Test for Equality of Variances				z-test for Equality of Means			
	Variance		*F*	*p* value	Mean		*Z*	*p* value
	User	Non-user			User	Non-user		
Total fuel cost	34.25E4	10.61E5	13.395	.000	168.64	1059.79	-14.443	.000

Table 5: Percentage distribution of respondents according to users' uses of bio slurry of biogas plant (multiple responses)

Uses of bio slurry	No. of respondents	Percent of cases
Use as fertilizer on own land	289	80.5
Use as fish feed	96	26.7
Sale to others	106	29.5
Give out to others at free of cost	28	7.8
Drain to water courses or drains	39	10.9
Do nothing	13	3.6
Others	3	0.8
n	574	

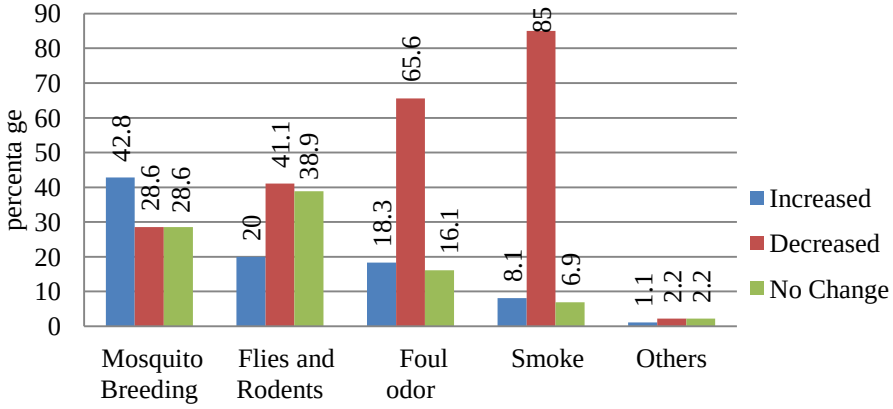

Figure 1: Percentage distribution of the change in household sanitation after the installment of biogas plant

Table 6: Association between biogas adoption and incidence of diseases

Disease /Problem	**Before Biogas plant**	**After Biogas plant**				Fisher's Exact Test	*p* value	Lambda
		NA	Same	Reduced	Worsened			
Respiratory diseases	Yes	1	24	75	-	268.75	0.000	0.720
	No	233	20	7	-			
Headache /dizziness	Yes	1	32	105	3	356.051	0.000	0.858
	No	200	11	8	-			
Eye burning /irritation	Yes	1	10	175		404.52	0.000	0.907
	No	157	10	5				
Diarrhoea and dysentery	Yes	1	18	48	2	257.65	0.000	0.681
	No	271	13	6	1			
Burning cases	Yes	4	6	68	1	278.60	0.000	0.823
	No	263	14	4	-			
Any other	Yes	0	2	2		25.85	0.000	0.750
	No	66	3	2				
H_0: There is significant association between biogas adoption and incidence of diseases								

Table 7: Descriptive statistics of the selected variable that affect the profit of biogas adoption

Variables	No. of Respondents	%	Mean	Standard deviation	Skewness	Kurtosis
Plant size (cu.m)						
<3	156	43.3				
3-6	179	49.7	3.40	2.41	13.74	209.87
6-9	10	2.8				
9-12	5	1.4				
≥12	10	2.8				
Total investment (in Tk.)						
≤ 10000	14	3.9				
10000-20000	46	12.8				
20000-30000	88	24.4	34843.2	14681.35	3.56	20.34
30000-40000	87	24.2				
40000-50000	56	15.6				
50000-60000	37	10.3				
60000+	32	8.9				
Total maintenance cost (Tk./year)						
No cost	293	81.4				
<500	13	3.6				
500-1000	14	3.9	581.34	1508.84	14.11	229.32
1000-1500	11	3.1				
1500-3000	6	1.7				
>3000	23	6.4				
No of years use biogas						
≤2	89	24.7				
3-5	121	33.6				
6-8	90	25.0	5.53	3.96	1.65	4.14
9-11	29	8.1				
≥12	31	8.6				
No. of stoves installed						
< 2	263	73.1				
2-3	69	19.2				
4-5	10	2.8	2.15	4.96	8.05	80.29
6-7	7	1.9				
≥8	11	3.1				
Raw materials of biogas plant						
Cow dung	327	90.8				
Poultry droppings	33	9.2				
Variables	No. of		Mean	Standard		

	Respondents	%		deviation	Skewness	Kurtosis
Source of raw materials						
Own farm	333	92.5				
Purchase	6	1.7				
Partially own farms, partially purchase	21	5.9				
No. of Cattles owned						
< 3	68	18.9				
3-6	188	52.2	5.45	4.31	1.51	1.74
7-10	39	10.8				
> 10	56	18.1				
No. of Poultry owned						
0-50	318	88.3				
50-550	17	4.7	151.76	622.87	5.6	34.29
550-1050	11	3.1				
>1050	14	3.9				
No. of household provide biogas	234	65.0				
Own home only	63	17.5				
1	41	11.4	1.37	5.43	8.67	92.58
2-3	10	2.8				
4-5	3	0.8				
6-7	9	2.5				
8+						
Total monthly income by selling biogas (in Tk.)						
300-600	48	13.3				
600-900	11	3.1				
900-1200	25	7.0	1343.89	6458.78	8.61	86.43
1200-2000	18	4.9				
>2000	24	6.7				
No income	234	65.0				
Approximated yearly income from bio-slurry (Tk.)						
500-2500	10	2.8				
2500-4500	12	3.3				
4500-6500	23	6.4	3255.47	7248.56	3.61	16.34
6500-8500	12	3.3				
8500 +	39	10.9				
No income	264	73.3				

Table: 8: Partial Correlation of the variables assumed to influence profit of biogas adoption

Variables	Variables									
	PS	TIC	TMC	NY	NS	NC	NP	NHH	TMIS	AYIB
PS	1.000									
TIC	.303***	1.000								
TMC	.003	.265***	1.000							
NY	-.065	-.209***	-.102*	1.000						
NS	.847***	.419***	.192***	-.119*	1.000					
NC	.738***	.212***	.138**	-.093*	.713**	1.000				
NP	.034	.140**	.005	-.004	.074	-.096	1.000			
NHH	.871***	.403***	.167**	-.131**	.983***	.722***	.064	1.000		
TMIS	.669***	.303***	.162**	-.139**	.883***	.601***	.002	.890***	1.000	
AYIB	.001	.040	.003	-.159**	.059	.067	-.005	.047	.111	1.000

***p< 0.01; **p< 0.05 and *p< 0.1

PS= Plant Size; TIC= Total Investment Cost; TMC= Total Maintenance Cost; NY=No of years use biogas; NS= No of stoves installed; RM= Raw Materials of Biogas Plant; SR= Source of Raw Materials; NC= No. of Cattles; NP= No. of Poultry; NHH= No. of household provide biogas; TMIS= Total monthly income by selling biogas; AYIB= Approximated yearly income from bio-slurry (Tk.)

Table 9: Rotated component matrix of the selected characteristics

Characteristics	Factor 1	Factor 2	Factor 3	Factor 4	Communalities
PS	**.920**	.040	-.091	-.025	.857
TIC	**.355**	.351	**.407**	.197	.453
TMC	.079	-.014	**.771**	.000	.601
NY	-.062	-.087	-.233	**-.689**	.541
NS	**.958**	.115	.148	.047	.955
RM	.009	**.901**	.025	-.015	.813
SR	.031	-.044	**.742**	.038	.555
NC	**.827**	-.170	-.002	.040	.715
NP	-.008	**.869**	-.066	-.008	.760
NHH	**.969**	.098	.127	.045	.966

Characteristics	Factor 1	Factor 2	Factor 3	Factor 4	Communalities
TMIS	**.860**	.015	.198	.105	.789
AYIB	.034	-.088	-.138	**.813**	.688
Eigen value	4.451	1.753	1.397	1.095	
Percentage of variance	37.088	14.606	11.642	9.124	
Cumulative variance (%)	37.088	51.695	63.337	72.461	
Bartlett's Test(Approx. χ^2)	2706.981***				
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.779				

***p < 0.001. Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Dictionary Based Image Compression by Removing MSB and LSB Using Huffman Coding

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Abstract

Transferring increasingly enormous amounts of im- age data over the internet is a global conversation for optimizing storage and communication. Transferring and storing a mas- sive volume of an uncompressed image data is also time-consuming and costly. Image compression is a technique used to transfer and store the enormous amount of data with a small volume which can be sent at high speed through a limited bandwidth. Most of the image compression techniques reduce redundant data to compress an image. There are many ways such as Run-length coding, Huffman coding, Shannon-Fano coding used to compress an image. In this article, by removing the most significant bit and least significant bit a new styled image compression method has been proposed using a dictionary and Huffman coding. In this technique, firstly, the input image is pre-processed, and then removing MSB and LSB, each pixel is mapped using a predefined dictionary. The method is applied on the various benchmarked images. To evaluate the performance of the proposed method average code length, compression ratio, bits per pixel, pick signal to noise ratio are used and compared with the state-of- art techniques which demonstrates an improved performance compared with the state-of-art algorithms in case of lossy image compression.

Keywords: Loss-less, Lossy, Run-length Coding, Huffman Coding, Shannon-Fano Coding, Average Code Length, Compression Ratio, Bits per Pixel and Pick Signal to Noise Ratio.

1. Introduction

Image compression is one of the most important areas in image processing. High resolution digital picture requires more transmission time over the internet which is unacceptable for multimedia based application. The digitization process generates more bits of a digital image that demand more space for storage and processing. Even though the digitization creates more bits of an image and the significantly larger file can be minimized using compression techniques. If a large image can be

compressed to less data in bytes without distortion, it will take less time for transmitting which will eventually save network bandwidth, space and give better user experience. Image compression reduces the number of bits required to represent a picture with the ability to reconstruct the image. The compression techniques either reduce substantial amount of redundancies found in an image or use coding technique [1].

There are two techniques used for compression called lossless and lossy. In the process of lossless compression technique the image data is reduced in bytes but the information of the images are kept. As a result, the reconstruction of the exact original image from the compressed data is done perfectly. The two steps functions, decorrelation and entropy coding are used in lossless image processing. At first by using different decorrelation techniques it removes spatial redundancy. And then it removes coding redundancy by using entropy coding[2]. The lossless compression techniques are used in the area where the quality of an image is crucial like medical imaging and technical drawings. On the other hand, in the lossy method, the different redundancies found in an image are reduced and some information are omitted. It requires less bits to regenerate the information of an image due to redundancy [3]. Therefore the reconstruction of the original image is not as perfect as the original one. Though the image is not the same bit by bit, the degradation of the information of the image is unnoticeable in the human eye. The lossy image compression techniques are used in the application where the reduction of the image quality is not that important such as streaming media, digital cameras and photograph. The lossless compression generates less compression of an image comparing the lossy compression.

Different image compression techniques are available under these two methods. Mostly used lossless techniques are Run Length Encoding, Statistical Encoding, Huffman encoding, Arithmetic coding, Dictionary Techniques, LZW coding, and Bit plane Encoding and the Lossy Compression Techniques are Transform Encoding, Sub-band Encoding, Block Truncation Encoding, Vector Quantization and Fractal Encoding have been discussed in the paper [4].

Researchers have a great interest on compression technique due to its importance in industry. Amir and William proposed multiresolution transform that can be used for both lossless and lossy compression. In this method, the number of bits required to represent an image is reduced by using scaling and truncations[5]. Weinberger et al used LOCO-I algorithm which is based on a simple fixed context model used for low-entropy

image regions. The compression ratios obtained by using this method is as close as that of obtained from arithmetic coding scheme [6]. Paul and Jeffrey proposed a method, called FELICS which is based on the use of two neighboring pixels. Though their proposed lossless image compression methods run faster than JPEG lossless mode but have minimal loss of compression efficiency [7].

The JPEG image compression standard is a lossy com- pression technique. Some of the information of an original image is lost when it is compressed by JPEG. When the compressed image is reconstructed the loss of the information cannot be restored. But the reduced quality is so minute that it is invisible in human eyes because human eyes discard the high frequency information. [11]. The information of the image is reduced from the transform domain. This process is known as the quantization. JPEG compression technique reduces data from an image by converting information from the value of the color into a pattern [12]. In the JPEG technique, it performs the following steps to compress the data. First it applies the discrete cosine transformation (DCT), and then does the quantization, and finally perform the entropy coding. In the DCT coefficients, it carries the Gaussian distribution. In the quantization, the DCT coefficients is approximated. When the compressed data are retrieved it performs the decoded entropy on the data and then dequantized the reduced data and finally inverse the discrete cosine transformation [13].

The original inputted image known as the range image is reduced by the process of rotations, scalings and translations of the co-ordinate axes [14]. This process reduces the size of pixels of an image into half. After averaging the image we receive the Domain Image. The original image and the domain image are partitioned into smaller blocks of pixels [15]. And then linear transformations are performed on each block of the partitioned image to obtain approximation from each block of the image. The domain block after being transformed is compared to each range block using distortion measure. The minimum distortion value is picked for storage to be processed. The coordinate value from the best approximation found in the domain block corresponding to a range block is then assigned to the reference of that range block. This co-ordinate value provides the information of the transformation of the image. W. J. Buchanan has shown how JPEG is used for image compression and JPEG-encoded image file format in the paper [16]. B.E. Usevitch has discussed the general overview of wavelet coding to understand JPEG 2000 welly

and shown a comparison between early wavelet coding with modern wavelet coding in [17].

In this paper we have proposed a dictionary based image compression by removing the Most Significant Bit (MSB) and the last two Least Significant Bit (LSB) bits using Huffman coding. First of all, an image is transformed and then removed MSB and LSB from a pixel of an image. All remaining bit patters are replaced by its corresponding dictionary value that is encoded by Huffman coding lastly. The performance of our proposed compression method is measured by comparing average code length (ACL), compression ratio (CR), bits per pixel (BPP) , Mean Square Error (MSE) and Peak Signal to Noise Ratio (PSNR) of an original image with that of the reconstructed image. The state-of-art procedures have been explained in section II. The proposed algorithm ,result analysis, conclusion and references have been given in part III, IV, V and VI respectively.

2. Literature Review

A. Huffman Coding

For lossless data compression, Huffman coding algorithm is commonly used. In this technique, it uses fewer bit to encode for those information from an image that occurs more frequently. This technique is easy to implement. It assigns variable-length of bit for encoding depending on the frequency of occurrence of the bits in an image [2]. It assigns shorter code for more frequently repeated character and longer code for infrequently repeated character. Huffman coding constructs a binary tree of nodes from the inputted character for compres- sion. It uses the priority queue to store the nodes. It creates a child for every distinctive character and then constructs min heap and assign 0 for the left child and 1 for the right child. Leaf node is created for each symbol and then inserted in the priority queue. When the queue has more than one node it pops up the two nodes with the highest priority and then create a new internal node. These two nodes are inserted as children with a frequency value that is equal to the sum of the frequencies of these two nodes. The first extracted node will be left child and the later one as right child. Finally add the new node to the priority queue [9].

For decompression technique traversing is done from root until finding the required character through the binary tree. It passes to left subtree if it encounters 0 bit otherwise move to right subtree. when it reaches to leaf node it retrieves the character and then repeat the process from the beginning[10]. The encoding procedure is given below:

1) Read an image and find its probabilities 2)Sort the probabilities in descending order
3) Build a Huffman tree connecting two lowest node at a time until a root node is left with probability 1.
4) Assign 0 and 1 to the left and right branches of the tree.

B. Run-length Coding

This lossless encoding provides a technique where it stores the single value and a count when a sequence of the same values comes with consecutive times. This approach is more economical instead of encoding individual pixel value [8]. In this approach it selects the first character from an inputted string and then appends it to the output string. After that it counts the number of succeeding occurrence of the selected character. Finally it appends the count to destination string. This process continues until it reaches to the end of string. The encoding and decoding procedure of Run-length are given below:

Run-length Encoding

1) Read an image.
2) Calculate the difference between neighboring pixels. 3)Assign 1 to the non-zero elements.
4) Find the position of the non-zero elements. 5)Find the corresponding original value.

Run-length Decoding

1) Read the values with corresponding position 2)Repeat the values till position
3) The above two steps continue until finished

C. JPEG Procedure

JPEG is a lossy coding procedure which is used to compress an image data. The encoding procedure of JPEG is given below.

1) Convert an image to YCbCr color space
2) Apply DCT transformation
3) Quantize the co-efficients
4) Encode using Huffman Coding

3. Proposed Procedure

In the suggested system, using Huffman coding and a dictionary, a Lossy image compression has been proposed by removing the first bit and last two bits. We have seen that image reduction depends on the number of probabilities. A number of probabilities is proportional to the memory used by an image. There are 256 different pixels of a real image. So, an image can have 256 different probabilities. From that point of view, we have proposed a scheme before applying Huffman encoding that reduces the number of probabilities to 32. As a result, an image can be stored in a tiny area than before. The encoding and decoding procedure are given below, and the diagram is shown in Fig 1.

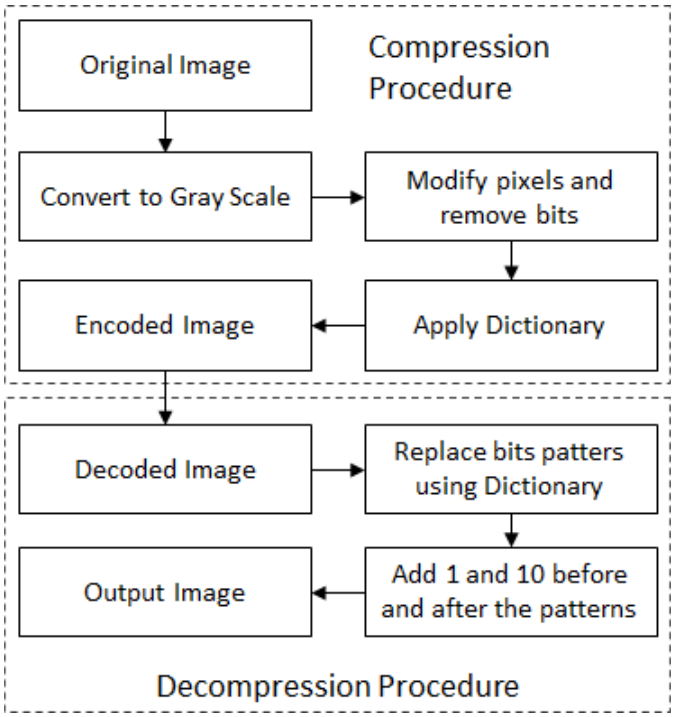

Fig. 1: Diagram for proposed encoding and decoding procedure

Encoding procedure of the proposed coding

1) Read a gray scale image and assign 0-61 to an array which works as a dictionary.
2) Change all pixels containing odd values to even by subtracting 1.
3) convert each pixel value to binary and then take the bits patter from the position 2 to 5^{th}.

4) Replace the bits patters by its corresponding dictionary value.
5) Apply Huffman coding to encode. 6)End.

Decoding procedure of the proposed coding

1) Read the encoded image
2) Decode the image using Huffman coding.
3) Replace the decoded values by its corresponding bits patter from the dictionary.
4) Append 1 and 10 before and after the bits pattern. 5)Repeat Step 4 until finished.

4. Result Analysis

The outcomes and analysis have been shown in this sec- tion, and the performance of the proposed method has been evaluated based on compression ratio (CR), average code length (ACL) , bits per pixel (BPP) and pick signal to noise ratio (PSNR) . The proposed algorithm has been applied to some images of the different size shown in Fig 2, and its corresponding compressed and decompressed image list are shown in Fig. 3 and Fig. 4 respectively

Fig. 2. Original Image List

Suppose, an original image (I) of size MxN contains N probabilities (P). Now the ACL, CR and BPP are calculated using the following equation 1, 2 and 3 respectively where CL represents length of code-word of i^{th} probability. In equation 4 and 5, the reconstructed image is presented by R and MAX is the highest variation in the input image in the equation (5).

$$ACL = \sum_{i=1} P(i)CL(i) \tag{1}$$

$$CR = \frac{\text{Total bits of original image}}{\text{Total bits of compressed image}} \tag{2}$$

$$BP\,P = \frac{\text{Total bits of compressed image}}{\text{Total bits of original image}} \tag{3}$$

$$MSE = \frac{\sum_{M,N} [I(M,N) - R(M,N)]^2}{M\,xN} \tag{4}$$

$$PSNR = 10 * log_{10} \frac{\text{-}\,M\,AX^2 \Sigma}{M} \tag{5}$$

Fig. 3: Compressed image list

Fig. 4: Decompressed image list

The average code length (ACL), compression ratio (CR) and bits per pixel(BPP) of the ten images (Strawberries, Onion, Pears, Car, Toysnoflash, Tape, Yellowlily, Sevilla, Trailer, Apple, Pepper, Clementine) are shown in TABLE 1, 2 & 3. The Fig 4, Fig 5 and Fig 6 have been illustrated to see the comparison among average code length (ACL), compression ratio (CR) and bits per pixel (BPP) of the images respectively. In TABLE I, it seems that every case the proposed coding provides better results than in the state-of-art techniques. From the TABLE I, it has been calculate that the proposed coding uses 82.835%, 85.499%, 93.074%, 87.622%, 87.806%, 90.957%, 92.52%, 81.309%, 92.197%, 89.071%, 90.55%, 87.433% less memory than Huffman coding and 48.811%, 40.782%, 18.426%, 43.423%, 43.188%, 45.855%, 51.735%, 59.69%, 54.086%, 46.53%, 34.161%, 44.219% less than JPEG for the same images. Furthermore, the PSNR for almost all images are greater than 40, so the compressed images contain a good quality.

From the TABLE II, the proposed coding has compressed 82.835%, 85.499%, 93.074%, 87.622%, 87.806%, 90.957%,

Table I: Average Code Length (ACL) and PSNR

SL	Huffman Coding	JPEG	Proposed Coding	PSNR
1	4.9909	1.6736	0.8567	50.599
2	4.7825	1.1711	0.6935	51.1132
3	2.6783	0.2274	0.1855	33.1771
4	5.0000	1.0939	0.6189	51.1591
5	4.8835	1.0482	0.5955	46.7981
6	4.4852	0.7491	0.4056	49.6947
7	4.2779	0.663	0.3200	43.5627
8	4.9119	2.2776	0.9181	48.3795
9	4.9107	0.8346	0.3832	50.6915
10	2.7632	0.5648	0.3020	49.1245
11	2.6657	0.3826	0.2519	49.0500
12	2.7102	0.6106	0.3406	49.0848

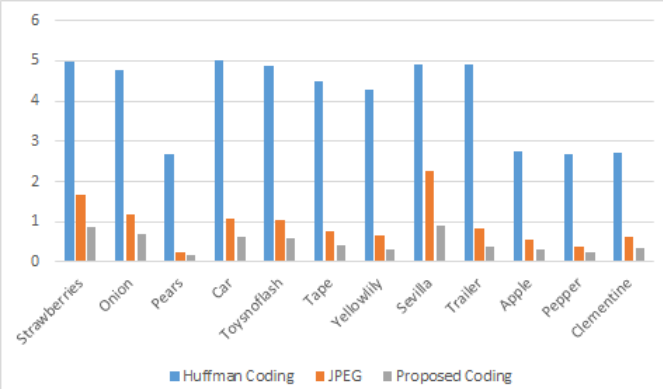

Fig. 5: Comparison of Average Code Length

92.52%, 81.309%, 92.197%, 89.071%, 90.55%, 87.433%, and 48.811 %, 40.782%, 18.426%, 43.423%, 43.188%, 45.855%, 51.735%, 59.69%, 54.086%, 46.53%, 34.161%, 44.219% more for the same images than that of Huffman coding and JPEG respectively. The bits per pixel of all images are tiny than the state-of-art techniques shown in TABLE III. The proposed algorithm allocates some bits for every pixel averagely shown in Fig 4 and provides more compression demonstrated in Fig. 5.

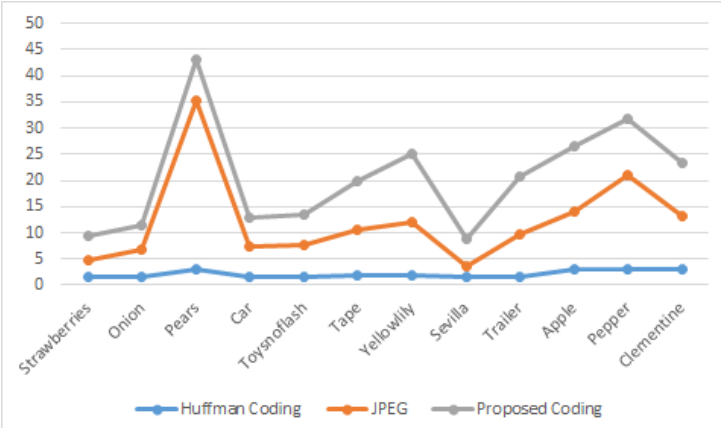

Fig. 6. Comparison of Compression Ratio

From the Fig 6, it can be said that the Huffman coding uses much more bits for a single pixel values whereas JPEG uses very few bits than Huffman coding. But, the fewest bits are used in case of proposed coding than the state-of- art techniques. From the above-mentioned point of view, it can be concluded that the proposed coding provides a better result than the state-of-art procedures.

Table II: Compression Ratio of the Ten Images

Images	Huffman Coding	JPEG	Proposed Coding
Strawberries	1.60291731	4.780114723	9.338158048
Onion	1.67276529	6.831184357	11.53568854
Pears	2.986969346	35.18029903	43.12668464
Car	1.6	7.31328275	12.92615931
Toysnoflash	1.638169346	7.632131273	13.434089
Tape	1.783643985	10.67948205	19.72386588
Yellowlily	1.870076439	12.06636501	25
Sevilla	1.628697653	3.512469266	8.713647751
Trailer	1.629095648	9.585430146	20.87682672
Apple	2.895193978	14.16430595	26.49006623
Pepper	3.001087894	20.90956613	31.75863438
Clementine	2.951811674	13.10186702	23.48796242

Table III: Bits Per Pixel of the Images

Image	Huffman Coding	JPEG	Proposed Coding
Strawberries	0.6238625	0.2092	0.1070875
Onion	0.5978125	0.1463875	0.0866875
Pears	0.3347875	0.028425	0.0231875
Car	0.625	0.1367375	0.0773625
Toysnoflash	0.6104375	0.131025	0.0744375
Tape	0.56065	0.0936375	0.0507
Yellowlily	0.5347375	0.082875	0.04
Sevilla	0.6139875	0.2847	0.1147625
Trailer	0.6138375	0.104325	0.0479
Apple	0.3454	0.0706	0.03775
Pepper	0.3332125	0.047825	0.0314875
Clementine	0.338775	0.076325	0.042575

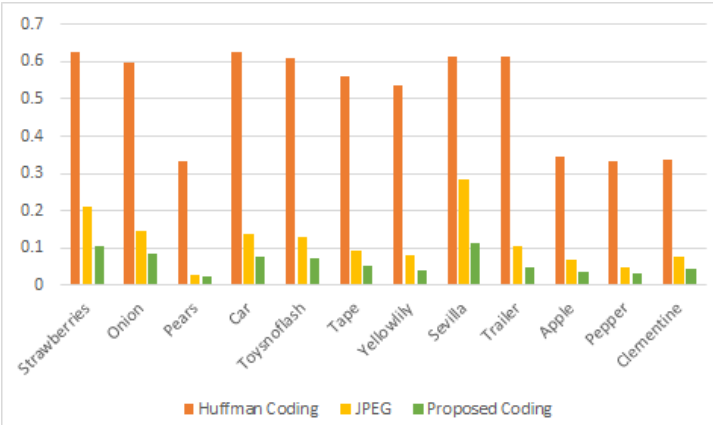

Fig. 7. Comparison of Bits Per Pixel

5. Conclusion

By removing first and last two bits of a pixel, a novel coding procedure has been proposed using a dictionary and Huffman coding in this article. The proposed procedure has been used to encode many images and almost in every case it has provided a good result. The proposed procedure is more efficient to compress an image than the state-of-art techniques but it takes

a little bit more time. This system can be applied to encode any image data, and the encoding process can be stopped at any encoding level. Since Huffman coding has limitations in their code design process, Then may miss some available code-words. The proposed algorithm use code-words at each level effectively. It has identified that the proposed procedure provides better coding performance for image compression. The suggested procedure is shown to be more efficient in compression images than other methods, such as fixed length coding, Huffman coding, Quasi-arithmetic coding, and arithmetic coding. Moreover, the recommended algorithm is fast and does not need much memory as compared to the Huffman coding.

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Unsupervised Classification Based Object Recognition Using Deep Convolutional Neural Networks

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Abstract

Day by day, the use of various sorts of robotics such as household robots and driverless carriers is increasing in many parts of the world, and a robot cannot do the work without object recognition. Object recognition has been a significant point in the field of digital medical professions. Furthermore, Image recognition is needed to extract high-dimensional data from the real world in order to produce numerical or symbolic information. In this article, a modified object recognition style has been proposed. To do the work, a convolutional neural network was trained to recognize different objects from an image and examined the accuracy of the convolutional neural network through recognizing various kinds of images. The main supplement of our work is the evaluation of the accuracy of image recognition by extending the calculation of backpropagation and by using very small filters of convolution. We explained how a significant development can be gained for higher accuracy in image recognition by using the convolutional neural network. We found these results by using Inception-v3 which is trained for the ImageNet Large Visual Recognition Challenge using the data from 2017. We also showed that the accuracy of the results from our model is better than the state-of-art models, where we achieved more accurate results.

Keywords: Object Recognition, Training, Image Classification, K-Means, Neurons, Convolutional Neural Network, Backpropagation, Inception-V3.

1. Introduction

The most important use of image recognition is googling image search. It also is an essential part in robotics such as the domestic robots or driverless transports. There are many security systems where image recognition is required such as face recognition.

Naqa et al. said that, in computational algorithms, machine learning is one of the branches of it [1]. Machine learning with the help of knowledge which is learned from the environment around it and used in imitating human knowledge.

Supervised learning can be said to be an equivalent meaning for classification. In supervised learning, labeled data are used for the directions in the learning as the training dataset [2]. Unsupervised learning can be defined as a type of machine learning with no labeled data which can be used for the training in the learning system as the training dataset. As the input patterns are not labeled the learning process is called unsupervised. In this method, clustering is used to discover the classes among the input data. [3]. Deep learning can be said to be a class of machine learning. Yann LeCun et al. mentioned that, multiple processing layers are used in Deep learning [4]. These multiple processing layers are allowed in computational tasks to learn illustrations of data with many levels of the notion. The state-of-the-art in visual object recognition, speech recognition, and object detection are hugely improved by deep learning and many other fields. Large and complex datasets are explored by deep learning where the backpropagation algorithm is used and also how a machine should change its internal parameters is indicated. Representation in each layer from the representation in the previous layer is done using these algorithms in deep learning. Md Zahangir Alom et al. proposed that deep learning methods are classified into the categories of supervised, unsupervised and semi supervised [5]. The classes of deep learning can be classified as Convolutional Neural Network (CNN), Recurrent Neural Network (RNN), Auto-Encoder (AE) and Restricted Boltzmann Machine (RBM).

LeCun et al. said that convolutional neural network is a class of deep feed forward neural network. The convolutional neural network architecture is structured as a series of stages [6]. In recent time, a great success in a large-scale image and video recognition has been achieved by convolutional neural networks [7], [8], [9]. The state-of-the-art improvements of modern inventions in the extension of convolutional neural networks have commenced in the accuracy of non-trivial identification tasks such as image classification, object recognition, video recognition and speech recognition [10]. Long, J et al. proposed convolutional networks as a powerful visual model which generates authorities of characteristics [11], [12].

S Grossberg et al. said a network whose neurons send feedbacks to each other is called recurrent neural network (RNN). A huge number of possibilities of feedbacks are included in the concept of RNN [13]. Types of Recurrent Neural Networks are Binary, Linear, Continuous-Nonlinear, Additive STM equation, Shunting STM equation, Generalized STM equation, MTM, LTM [14], [15]. RNNs are used in many sectors like Video classification, Log data analysis, Time series data analysis, Translation and Named entity recognition.

H Larochelle et al. proposed that the position of Restricted Boltzmann machines to be a supreme generative model has been confirmed by modern developments [16]. Restricted Boltzmann machines are capable of extracting useful contents from input data and constructing deep neural networks. Hinton et al., Bengio et al. and Welling et al. told that the machines can be defined as a probabilistic design where a hidden layer of binary variables is used to represent the combination of a visible layer of variables[17], [18], [19]. In the field of high dimensional data like images and text problems, it has been performing successfully.

Arranging the classes that an image belongs to is defined as Image classification. With the growth of categories' count, the problem is considered to be quite complex. Because an image belongings to several categories simultaneously, it can occur certain failures [20]. In object recognition systems object detection is the first-step [21]. For image recognition, CNN is usually hard to run on CPU. The use of GPU has greatly expedited the preparation and experiment of CNN on large-scale datasets. The AlexNet was the first successful GPU implementation of CNN, which won the visual recognition competition in the ImageNet Large Scale Visual Recognition Challenge 2012 [22]. Recurrent neural network (RNN) has its most successful applications those refer to the modeling of persistent data like handwriting recognition. Restricted Boltzmann machines are also performing remarkably in image and text involved problems.

We propose a model that will take an input of a color images and k-means clustering will be used to get clusters from the image. A desired accuracy must be provided. For each cluster the Convolution, Rectified Linear Unit (ReLU), Max Pooling and Fully connected layers' operations will be performed on the image. After the fully connected layer in network, gradient descent algorithm will be used for updating the weight for increasing accuracy and run back propagation by gradient descent algorithm until gaining the desired accuracy.

The next part of the paper in section II we will discuss existing systems. In section III we will give the whole idea of our proposed model and in section IV the results will be analyzed. Finally, in section V we will conclude the paper will be concluded.

2. Existing Systems

A. Convolutional Neural Networks (CNN)

Among all deep learning approaches the Convolutional Neural Network (CNN) is one of the most important ones. In Convolutional Neural Networks (CNN) multiple layers are trained for learning [23]. In diverse computer vision applications, it is found to be extremely efficient and it is also the most commonly used method for visual applications like image recognition, object recognition, robotics visions etc. The graphical representation of the architecture of Convolutional Neural Network is shown in FIGURE 1.

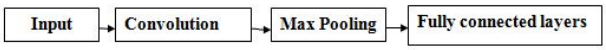

Figure 1: Convolutional Neural Network architecture.

There are three main types of layers in a Convolutional Neural Network: they are convolutional layers, pooling layers, and fully connected layers. Different roles are played by each type of layer in a Convolutional Neural Network. In FIGURE 1 we showed the Convolutional Neural Network architecture for object recognition from an image. Transformation of the input volume to an output volume of neuron activation is done in every layer of a Convolutional Neural Network, ultimately traversing to the ultimate fully connected layers, following in a mapping of the input data to a 1x1 characteristic vector. Convolutional Neural Networks have been remarkably thriving in computer vision employment, such as object recognition, face recognition, robotics vision, and many others.

1) Convolutional Layers: Generating various feature maps are done in the convolutional layers. In a Convolutional Neural Network, it employs different parts to convolve the entire input as well as the central characteristic maps. There are many advantages of the convolution operation in the convolution layers and for that, in numerous operations many researchers have recommended it as a replacement of the fully connected layers for fulfilling the target of accomplishing high-speed training sequences [24], [25]. The complete image is considered by a

complement whose elements are collected at identical positions into the feature map while the structure of a feature map is ongoing. This structure can be considered as an equivalent to the convolution operation, which is accompanied by an additive bias phase and sigmoid function:

$$z^{(f)}=\sigma(Hz^{(f-1)} + m)$$

where z stands for the depth of the convolutional layer, H is the weight matrix, and m is the bias term.

2) Pooling Layers: Reducing the spatial dimensions which are the width and height of the data size for the following convolutional layer is done in the Pooling layers. The depth dimension of the input is not affected by the pooling layer. The method executed by this layer is also known as subsampling, as the modification of size heads to a contemporaneous destruction of data. On the other hand, that kind of loss can be advantageous for the training of the network as the reduction of dimension guides to lighter computational expenses for the forthcoming layers in the network, and also works to overcome redundancy. a comprehensive technical evaluation of max pooling is provided, [26] whereas faster convergence by max pooling was shown, [27] enhancing generalization, and selection of excellent invariant features were also discussed [28,29].

3) Fully Connected Layers: The high-level argumentation in the neural network is implemented through the fully connected layers after performing operations in various convolutional and pooling layers. In a fully connected layer, all the neurons have full intermediaries to all neurons from the preceding layer. Using matrix multiplication accompanied by a bias offset their activation can be calculated. 2D characteristic maps are converted in the fully connected layers into a 1D characteristic vector. The occupied vector can be fed forward and has a determined amount of classes for classification [30]. It can also be recognized as a characteristic vector for additional processing [31].

B. Recurrent Neural Network (RNN)

In the field of artificial neural network, Recurrent Neural Network (RNN) carries a long history but recurrent neural networks can be said to be one of the best in the applications related to sequential data modeling like recognizing handwritings and speech [32]. By mapping input progressions to a series of deep layers, complex migrant dynamics can be received by an RNN and output from the hidden layers [33]. The following equations can be used.

$cj = e\ (Wycyj + Wccj\text{-}1 + aj)$

$m_t = e\ (W_{cm}c_j + a_m)$

here yj is the input, e is a hyperbolic tangent or sigmoid which is an element-wise non-linearity, cj is the hidden state with M hidden units, and at time j, pj is the output. For a input sequence y1, y2…yJ which has a length J, the sequential updates are computed as c1 (we let, c0 = 0), p1, c2, p2..., hJ , pJ .

The appearance of feedback loops is the main discrepancy between RNN and other feedforward networks in which the recurrent association in the disclosed network is provided. RNN can model the contextual knowledge of a transient progression in the recurrent structure [34]. We can follow the steps for training.

1. An input i.e. yj is provided to the network.
2. By using a combination of the current input and the previous state, calculate the current status cj.
3. For the following sequence, the current cj becomes cj-1.
4. Consolidate the knowledge from all the earlier requirements and continue as many times needed.
5. The final current state is used, if time levels are completed and the output aj is calculated.
6. The error is generated by comparing the output with the actual output.
7. 7.Finally, backpropagation is used to update the weights to finish the training of the network.

C. Deep Boltzmann Machines (DBMs)

In 1986, Hinton et al. proposed Restricted Boltzmann Machine (RBM) to be a generative stochastic neural network [35]. A Restricted Boltzmann Machine is one of the variants of the Boltzmann Machine. To form a bipartite graph by the visible units and the hidden units is a must in Restricted Boltzmann Machine and it has the restriction to form the graph. More efficient training algorithms are provided by this restriction [36], [37].

Another type of deep model using RBM is Deep Boltzmann Machines (DBMs) as their building block. Between RBM and DBM the main difference is in their architectures [38]. In the architecture of RBM, an

undirected graphical model is created by the first two layers and directed generative model is created by the lower layers, whereas in the DBM all the links are undirected. Multiple layers of hidden units are present in DBMs, where odd-numbered layers units are hypothetically self-governing but even-numbered layers are not, and when odd-numbered layers units are not self-governing in that case even-numbered layers become independent. For these circumstances, the result in the DBM is frequently unmanageable. Tractable versions of the model can be made by the suitable assortment of intercommunications between visible and hidden units. A DBM simultaneously guides all layers of a particular unsupervised model, and alternatively maximize the reasonableness directly while training the network, a stochastic based algorithm for Maximum Likelihood (SML) [39] is used in the DBM to maximize the lower bound on the likelihood. This method would resemble exposed to fall in mean local minima issuing some units completely dead. Alternatively, pre-training the layers of the DBM based a greedy layer-wise training artifice was recommended [40], which is basically similar to DBN, specifically, by accumulating RBMs and preparing each layer to autonomously form the output of the preceding layer.

DBMs can capture multiple layers of complicated descriptions of input data and also they are suitable for unsupervised training considering they can be trained on unlabeled data, but they can also be widely used for a distinguished task in a supervised form. One of the characteristics is the approximate inferring method of DBMs incubated DBMs to be separated from the other deep models, which is not as same as the usual bottom-up manner, also a top-down feedback, therefore consolidating uncertainty concerning the inputs in a more powerful manner. Moreover, in DBMs, by accompanying the estimated inclination of a variational lower bound on the reasonableness aspiration, of all layers any one can simultaneously optimize the parameters, which is extremely advantageous particularly in cases of training images from independent data beginning from separate modalities [42]. Drawbacks of DBM are also involved in its works and one of the most powerful drawbacks is the tremendous computational cost of assumption, which is essentially conditional. Various approaches have been recommended to increase the efficiency of DBMs [42, [43,44].

D. Autoencoder

The autoencoder can be said as a particular kind of artificial neural network which is applied for determining effective encodings. An autoencoder is trained to reconstruct its own inputs I, rather training a

network by predicting any target value J has given inputs I, hence, as the input vector, the output vectors carry the same dimension. Hinton et al. proposed the deep autoencoder first and is still widely inquired in modern papers [45]. Back-propagation is used to train a deep autoencoder with a modification of the gradient approach. If deviations are found to be present in the initial several layers the aforementioned model; it could be enhanced considerably ineffective. Rebuilding the standard of the training data could be caused by this method to acquire results. A decent way to eliminate this dilemma is to pre-train the system with primary weights that would be able to assume the final solution.

The restoration error is minimized in the direction of this method and the learned feature is the identification code of it. If the mean squared error measure is applied to train the network and if there is any linear hidden layer then the k hidden units learn to calculate the input in the measure of the initial k key ingredients of the data [46]. The autoencoder will behave individually from the previous if the hidden layer is nonlinear, with the capacity to apprehend multidimensional features of the input pattern [47]. To minimize the average reconstruction error, the parameters of the system are optimized. There are many options to calculate the reconstruction error; here we show the conventional squared error:

$$Z = \| y - g(k(y)) \|^2$$

Where the decoder is the function g and the reconstruction is g (k(y)) which is generated by the model. The loss function of the reconstruction could be designed by cross-entropy if the input is reproduced as probabilities of bit vectors. We show it as following:

$$Z = -\sum yi \log gi(k(y)) + (1 - yi) \log (1 - gi(k(y)))$$

Here, k(y) is presented to be a distributed representation to fulfill the goal as the design to operate to obtain the coordinates onward the main distinctions of the data, correspondingly to the source of Principal Components Analysis (PCA). Here we set that k(y) is not lossless and establishing a strong condensation for all input y is not possible here. By following this process of optimization, effects in lower reconstruction error can have effects on test examples from the corresponding pattern as the training patterns but usually large reconstruction error on individuals are determined from the input [48].

3. Proposed Method

We implemented CPU version of TensorFlow to perform our work. We tried in our work to propose a model to increase the accuracy level and to reduce the error rate while recognizing objects in an image. In our work we used inception version: 3 of ImageNet to train the network to recognize images. As platform of our work we used TensorFlow and Python as our programming language. The diagram and flowchart of the proposed procedure are shown in FIGURE-2 and FIGURE-3.

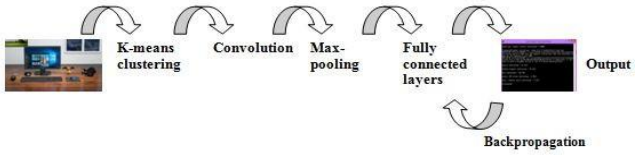

Figure 2: Diagram of proposed procedure

According to our proposed model a color image should be taken as input and k-means clustering will be used to get clusters from the image. A desired accuracy must be provided. Now, on each cluster the Convolution, Rectified Linear Unit (ReLU), Max Pooling and fully connected layers operations will be performed on the image. After the fully connected layer in network, gradient descent algorithm will be used for updating the weight for increasing accuracy. According to our proposal we propose the idea to run this back propagation by gradient descent algorithm until gaining the accuracy which was given at the beginning. We proposed an algorithm for our system. It is given below.

A. Proposed Algorithm

1. Read a color image and assign it to I
2. Clustering the image(I) using an unsupervised k-means method I = I1, I2, I3…In , Where I1, I2, I3 etc represent the various clusters.
3. Input desired accuracy (DAC).
4. Perform the Convolution, rectified linear units, Max-pooling and Fully connected layers operations on the image.
5. Calculate the accuracy (CAC) of the output image generated in step 4.
6. Repeat step 7 until (CAC< DAC)
7. Apply backpropagation of CNN using gradient descent procedure.
8. Show output recognizing all objects from the image.
9. 9.END.

4. Result Analysis

We have shown the results of our experiments in TABLE 1, 2, 3, 4 and 5. By using these results we tried to analyze our system performance according to results. We have used different types of images such as animals, flowers, musical instruments, playing stuffs, accessories and many other things. By analyzing we have understood that our system is working successfully. Some of the results are as follows.

Table 1: Single object recognition from an image.

Objects			
Results	Mouse 97.418%	Space shuttle 99.998%	Microphone 55.651%

In TABLE 1, the output of recognizing a computer mouse, Space shuttle and Microphone. Here we can see the probabilities are 97.418\%, 99.998\% and 55.61\% according to the system.

Table 2: Multiple objects recognition from an image.

Objects			
Results	Monitor 31.35%, desktop 26.362%, desk 28.738%, mouse 5.391%	Mug 55.651%, Microphone 35.374%, music instrument 15.739%	Car 53.27% Doll 46.936%

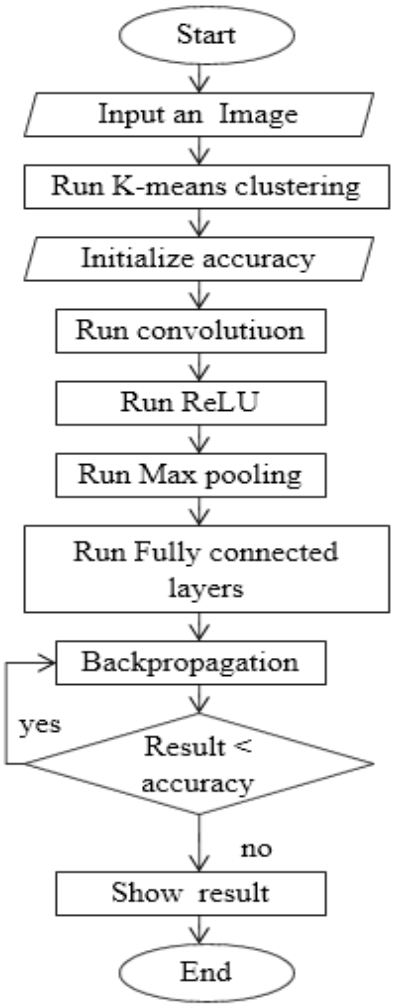

Figure 3: Flowchart of proposed procedure

In TABLE 2, the output of the 1st picture is recognizing an image with multiple objects like desktop computer, computer mouse, desk, glass, headphone. Here we can see the probability of being a monitor is 31.359\%, desktop computer is 26.362\%, desk is 28.738\%, screen is 6.881\%, mouse is 5.391\% and the rest 3\% is for other objects in the image. In the 2nd picture Mug 55.651\%, Microphone 35.374\%, music instrument 15.739\%. In the 3rd picture Car 53.27\% and Doll 46.936\%.

Table 3: Animal Recognition from an Image

Objects			
Results	German shepherd 87.878%	Cat 97.98%	Hen 91.519%

In TABLE 3, the output of recognizing a German shepherd, Cat and Hen. Here, we can see the probabilities are 87.878\%, 97.98\% and hen 91.519\%, cock 7.203\% according to the system.

Table 4: Flower Recognition from an Image

Objects			
Results	Daisy flower 97.496%	flower vase 86.547%	Rose 96.359%

In TABLE 4 the output of recognizing a daisy flower, flower vase and Rose. Here we can see the probabilities are 97.469\%, 86.54\% and 96.359\% according to the system.

Table 5: Fruit Recognition from an Image

Objects			
Results	Orange 97.108%	Lemon 98.062%	Banana 96.478%

In TABLE 5 the output of recognizing an Orange, Lemon and Banana. Here we can see the probabilities are 97.108\%, 98.062\% and 96.478\% according to the system. FIGURE 4: This bar diagram shows the accuracy

levels based on different methods of image recognition and the accuracy level of our proposed model for different images.

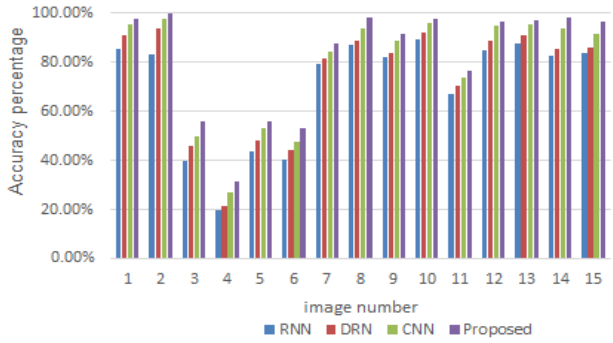

Figure 5. Bar diagram for top-1 and top-5 errors.

TABLE 6. Our proposed system results in measurement including the previous state of the art on the implemented set covering 1000 classes of images. As stated by the inspection the system reached the top-1 error of 13.9\% and top-5 error of 5.97%.

Methods	RNN	DRN	CNN	Proposed
top-1	26.19%	21.90%	21%	**13.90%**
top-5	9.73%	6.70%	3.5%	**2.97%**

FIGURE 5: This bar diagram shows the top-1 and top-5 errors of different methods of image recognition and the top-1 and top-5 errors of our proposed model for different images based on ImageNet Large Scale Image Recognition Challenge (ILSIRC-17).

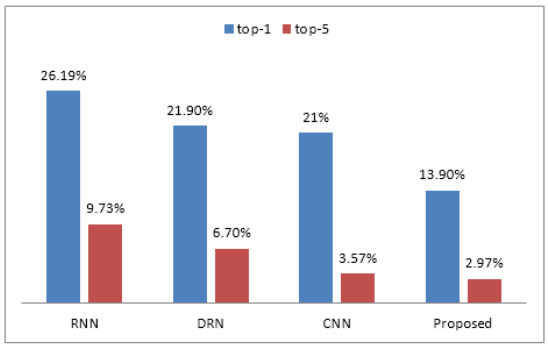

Figure 5. Bar diagram for top-1 and top-5 errors

FIGURE 6: This diagram shows how much the top-1 and top-5 errors decrease of different methods of image recognition and the amount of decrease of the top-1 and top-5 errors of our proposed model for different images based on ImageNet Large Scale Image Recognition Challenge (ILSIRC-17).

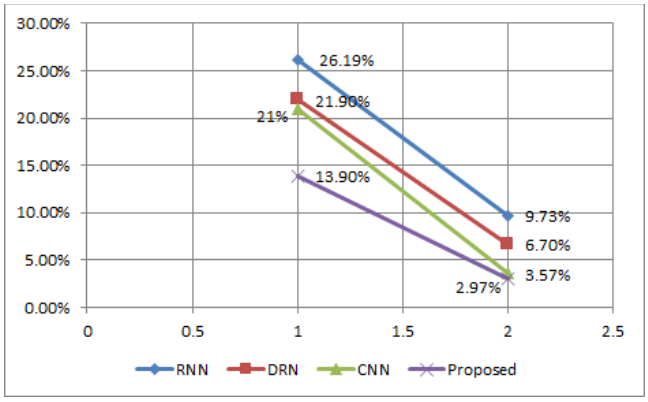

Figure 6. Error decrease rate

Here, our all evaluations are done using the data from the 2017 ImageNet Large Visual Recognition Challenge. We anticipated all the images and also we found the results to be very good in our system like 99\% accuracy and can be said 0.1\% error in most of the cases. In the next level of the work, we are looking for testing the system on other datasets and also on modified user made data set tests.

5. Conclusion

We have tried to introduce an approach that merges the powers of the unsupervised clustering method and Convolutional Neural Networks when data are not labeled or the amount of labeled data is few. We proposed a method that modifies the idea behind Convolutional Neural Network where we used the basic idea and operations and added some extra calculations which may affect time in some cases but will surely produce good accuracy levels. Moreover, we suggested a supervised pre-training and running it every time when the backpropagation is used and the weights are updated for a better result and accuracy. Our experimented results explicate that, a deep Convolutional Neural Network with the help of an unsupervised method, is capable of performing with a high level of accuracy. An important point is that our method may perform well by consuming time in some cases like complex object recognition of the

medical image of inner parts of brain or cells for high accuracy results. But we considered the accuracy of the result to be more important than the time taken by the system. Based on this concept our investigations show that the proposed method achieves a larger scale of accuracy than the state-of-the-art.

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Career Challenges and Progression: A Study on Women Academics of Private Universities in Bangladesh

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Abstract

Although the participation of female in teaching has notably increased, their career advancement is not satisfactory. It has become a crucial need to address the pitfalls for which private universities' female faculties cannot progress in their career. This study aims at describing five major challenges and barriers of women's career progression from the earlier literatures: Glass ceiling, Work-family conflict, Family as a barrier, Children as a barrier, and Gender stereotyping and discrimination and showing their degrees of influence on the female academics' career progression in the private universities of Bangladesh. Using cluster random sampling technique 167 female faculties of 15 private universities in Dhaka have been surveyed. Structural equation modeling technique has been used to analyze the hypothesis of the study. It has been found that Children, Glass ceiling, and Gender stereotyping and discrimination have a significant influence on the career stagnancy of women academics, whereas Family and Work-family conflict are not found to be significantly influential on the career stagnancy of the respondents.

Keywords: Career progression, Challenges & barriers, Private University, Women academics.

1. Introduction

The participation of women in the job market in Bangladesh has increased at an incredible rate from 4 percent in 1974 to 35.6 percent in 2016, the growth of which is much faster than the growth of male counterpart participating in the labor force (Khatun, 2018). The number of female participants in labor force has been increasing in almost all sectors including teaching, entrepreneurship, agriculture, telecommunication, transportation, hotel and restaurant, banking and insurance, readymade garments and so on. Today female participation in work outside home is no longer constrained by national borders. Almost 1, 03,000 female

workers migrated overseas in 2016, which constituted 22 percent of the total migrant workers (Siddiqui, 2016). Although the contribution of women in diversified sectors to the national economy is beyond description, the under-representation of women in the administrative and managerial positions of organizations is also visible. The National Labour Force Survey 2013 conducted by the Bureau of Statistics showed that women occupy only 12 percent of the decision making jobs in industrial and service sectors (Rahman & Khan, 2016). In the education sector where about 41.23 percent teachers are female, the gender gap in terms of holding senior or administrative positions is more pervasive (Robin, 2018). Despite promising starts, women's career advancement is halted because of social, familial or situational factors (Campopiano et al, 2017).

Lower rate in educational attainment of women than the male counterpart has been attributed as one of the major causes behind the least participation in decision making jobs and the consistent low progress in career. Although the percentage of female's educational attainment at the primary and secondary level is higher than male students, women's participation in higher secondary and tertiary level education is not satisfactory. According to the Bangladesh Education Statistics, it is only 4 percent of female having tertiary level education compared to 8.2 percent in case of male (Khatun, 2018). Financial crisis, early marriage, having babies, child-bearing mandate, care giving to other family members, conservative mindset of the family and society, insecure surroundings etc often make the women demotivated from having higher education (King & Hill, 1993).

Women are facing multifaceted challenges and barriers at so many levels, especially in the social security and physical safety. In the context of Bangladesh, women safety and security issue is more vulnerable. Our women are no longer safe as they are being continuously mistreated, harassed and molested at the work place and on the street also (Mahtab, 2018). BRAC Road Safety Program conducted a survey in 2017 and revealed that 94 percent of the office-going women had been experiencing sexual harassment in public transport (Andaleeb, 2018). Insecure environment at work and on street often hold women back to pursue the career. A lot of talented women employees may have to quit their jobs in the middle of their career because of familial responsibilities. It is usual that men can pass more time at work without having too much worry about home, but for women it is not easy to travel far away for official purposes or continue work at night because the burden of family

responsibilities at home are often much more than their male counterpart (Zheng & Wu, 2018). This asymmetric household responsibility keeps women lag behind in pursuing the career. Confidence and a sense of self worth are vital for individuals to continue a successful career. Regrettably many women around the world, especially in Bangladesh, doubt their capabilities, doubt whether they can be a change maker; whether they are good enough (Malhotra, 2017). These poor beliefs of women in themselves often pose a great threat on the way of their progress.

Although women have made substantial contribution in nearly every sphere of economy, they face gender discrimination in the workplace where their contributions are seldom recognized (Adams & Ferreira, 2009). Gender inequality occurs when men and women are not treated based on their talent, potential and intellect, but on their gender (Adams & Kirchmaier, 2013). In Bangladesh, gender bias is a phenomenon. Despite having equal qualification, women mostly are not treated the same as men in case of job placement, compensation, promotion, training opportunities, and so on (Hossain & Tisdell, 2005). Employees often show reluctance to hire women in white-colour jobs where decision making capacity, sincerity, and work experience matter the most (Ahrens et al, 2015). Gender pay gap is also extreme in Bangladesh. According to official statistics, women are paid 43 percent less than their male counterpart for the same type of work (Seppo et al, 2018). Though gender discrimination in terms of pay is rarely seen in private universities of Bangladesh, discriminations in other facets are visible as in recruitment, promotion, and also in the distribution of higher level responsibilities. Due to gender disparity, women remain marginalized and unprotected to hold the top position at work.

Like other sectors, the career growth of women in teaching especially in a private university is not satisfactory. There are 101 private universities in Bangladesh (Akteruzzaman, 2018). A good number of well-qualified female faculties are serving these universities from the very beginning of their establishment. But the rate of their career advancement is not high as compared to men. There is hardly any female faculty seen to occupy such top administrative positions as Vice-Chancellor, Pro Vice-Chancellor, Registrar, Treasurer, Dean etc. It is even more regrettable that female faculties in private universities are seldom found in such senior academic positions as Professor or Associate Professor. Previous researchers identified a lot of barriers responsible for their slow career progress in the university teaching. This study, however, is conducted to explore those

identified challenges and barriers and their degrees of influence on career progression stagnancy of female academics in private universities of Bangladesh.

2. Literature Review

Although nearly half of the labor force is constituted by women in Bangladesh, they are rarely seen to occupy the managerial position. A study in 1998 conducted in the U.S.A. by Ragins and his associates found that less than five percent of executive positions were held by women. Another study reported that not more than 13 of the world's largest 500 corporations were led by a female CEO which was insignificant compared to the total percentage of women contributing at workplace (Pai & Vaidya, 2009). If this is the scenario of developed countries, it can easily be perceived regarding the existing position of women at workplace in less developed and impoverished nations like Bangladesh. Researchers identified a number of factors behind the lack of progress of women at workplace. Many times it is attributed to the glass ceiling- a barrier to career progression which is unseen and unbreakable (Adams & Funk, 2012). In every sector the presence of glass ceiling is perceived and it is more pervasive among the female academicians (Blue, 2014), of the private university in particular. Bain and Cummings (2000) conducted a research in the USA on 10 universities and found that one-third of all academics was constituted by women, but among full professors only one of every 10 was a woman. However, glass ceiling is a huge disruption to the organization and the employee alike (Qu & Zhao, 2017). It decreases the productivity of employees by lowering the commitment level while feeling them stagnant in their career (Songini, 2009). It also allows the absenteeism rate and turnover cost to reach at the peak (Cotter et al, 2001).

Some subtle and overt barriers are there which act as driving forces behind the activation of glass ceiling experienced by women in their career improvement (Barreto et al, 2009). In reality, women are rarely assigned such duties that can upgrade their professional skills and expertise, because most of the organizations think that women are unwilling to work harder and to develop unique competency to excel (King et al, 2013). Sometimes women are humiliated with comments that they have lack of stamina and are too emotional, lethargic and not suitable to move or relocate for business purposes or they may not be available in case of emergency beyond the scheduled time as they have to take care of their family members (Heilman, 2012). This kind of attitude toward women

reveals a profound disparity at workplace and throw a daunting challenge to them for advancing to the leadership position. Rigorous research reveals that gender diversity at workplace is effective as it creates a competitive environment, fosters creativity, drives restructures and leads to increased performance (Dale-Olsen et al, 2013). The benefits of gender diversity will not come into the sight if gender disparity exists. When women receive unfair justice or unequal treatment even though having similar qualification to their male counterpart, gender disparity takes place in the labor market (Wicker et al, 2012). Gender stereotype is held responsible to intensify this discrimination. Being affected by stereotype, the owners in most of the cases perceive women to have less ability than men (Hillman at al, 2007). Since the powerful insiders have got the discriminatory perception about women that they are not as smarter and qualified as men, women consequently are less likely to be trusted for managerial position (Dobbin & Jung, 2010). Some people also think that women concentrate on their family obligations much more than their professional responsibilities (Hoobler et al, 2011). Such thinking of top position holders sometimes make female's contributions at workplace invisible. This invisibility occurs when women's contributions are overlooked or poorly recognized (Martinez, 2009). Researchers document that "*women invisibility"* poses a great threat to the career progression of women (Gillis-Donovan & Moynihan-Bradt, 1990).

Another difficulty that may challenge women's career is the familial culture and tradition (Aygoren & Nordqvist, 2015). There are certain cultures in which women are discouraged to go for outside work. Traditional bindings and obstructions have forced the women to remain backward in acquiring education and pursuing career in some women-hatred cultures (Barrett & Moores, 2010). An important driver that may hinder women's work life is the lack of spousal support (Nikina et al, 2015). When the husband does not want his wife to continue her job, but the wife is willing to carry on, the conflict becomes inevitable (Rothausen, 2009). Such inconsistent situation results in mental degradation of women and subverts their work spirit. The lack of institutional support to make a proper balance between family and career is another important driver that limits opportunities for women's advancement (Buddhapriya, 2009). Stiff organizational rules and regulations often create complexity for women to take care of family-related issues (Slan & Chen, 2009). Conversely, strong societal expectation is another accountable for women's stifled career progress (Saadin et al, 2016). Sometimes careerist women experience severe abuses from society when the motherhood mandate is disturbed a

bit (Powell et al, 2017). These two diverse extremes- stiff organizational regulations and strong societal expectations- often force women towards a dilemmatic situation (Easley, 1993).

Female academics, in most of the cases, are found to have a lack of motivation to conduct the research which is the pre-requisite to get promoted in the academic ladder (West, 1995). Female faculties spend less time in research activities and attend fewer academic programs where research paper is presented or research related training is provided and in consequence of that, they fail to present healthy curriculum vitae before the authority while seeking promotion to the upper ranks and thus remain disadvantaged (Bain & Cummings, 2000). The absence of strange personality traits also plays a relevant role to impede the career progress of women (Henderson et al, 1988). Some researches reveal that most women have the lack of self-efficacy (Burke, 1996). They often doubt in their own capabilities and fear of undertaking charge of leadership thinking that they are not apt for such position (Abele & Spurk, 2009). Women are also witnessed to suffer from the deficiencies in such areas as assertiveness, initiative, leader-like attitude, ambition, outspokenness, enthusiasm, self-esteem, competitive drive and so on (Hoobler et al, 2009). They also are uninterested to work hard for carrying out challenging responsibility and are more risk averse than men (Barrett, 2014). They are more likely to perform commonplace and usual activities where less risk is involved. These weak personalities are actually the paramount characteristics of "*hidden women"* who can never be a real careerist in practice (Dhaliwal, 2000). On the contrary, the *independent women* who are tougher and more extroverts can demonstrate outstanding performance in the workplace and are more able to pursue a successful career (Gherardi, 2015).

Several researches address that women have poor interpersonal network which restricts the opportunities for women's career stability and guidance (Seierstad & Opsahl, 2011). Indeed, the development of an outstanding relationship with high officials who can provide mentoring and on time performance feedback is deemed one of the key drivers to success (Palgi & Moore, 2004). The reservation and bashfulness of women often keep them away from establishing such a rapport (Allen et al, 2004). Kilkolly-Proffit (2013) documents that women become motivated and feel much more comfortable when their leader or mentor is female rather than male. A fascinating study by Connolly & Gregory (2008) demonstrates that women's part-time employment is increasing at a rate that is now outnumbering men in part-time positions around the world. These part-

time positions have the lack of job stability, insufficient training opportunities and are poorly paid, thus sway women away from career progression pursuits. In addition, low enforcement of the labour law (Hossain, 2016), lack of conducive work environment (Shirey, 2009), lack of adequate social and financial infrastructure (Anam, 2017), lack of support from family and society (Nowshin, 2017), lack of motivation and will-power (Anderson et al, 2012), unaware of technical education or skill-based study (Skees, 2010), gender-sensitivity among men (Bernthal & Wellins, 2006), role of reproduction (Allen et al, 2016), negative social norms (Niederle & Vesterlund, 2008), gender biasness on mentorship (Ragins & Scandura, 1994) and many other such factors are held responsible to cripple the smooth growth of women's career at work.

However, women's career challenges and their progression is a hot focus amongst today's researches. A number of researches on the said field were conducted so far by the researchers of different countries. In Bangladesh, a lot of works were done on that. But the focusing areas were mainly on bankers or other corporate companies' female employees. There are a few studies conducted so far on the private universities' female faculty members who are experiencing huge challenges at work and thus their career progression is being halted recurrently. Therefore, this study aims at exploring the major challenges and barriers identified by the previous researchers and their impact on the female faculties' career advancement in the private universities of Bangladesh.

3. Objectives of the Study

The objectives of this study are:

I. To describe the challenges and barriers that female academics of a private university in Bangladesh are experiencing in their pursuit of career in accordance with the previous literature.

II. To determine the level of influence of these identified challenges and barriers on the female faculties' career advancement in the private university of Bangladesh.

4. Theoretical Framework and Hypothesis

This study assumed women's career progression in private universities as dependent variable and the challenges and barriers associated with the career progression as independent variables. The model presented in figure 1 shows the paths associated with the relationships between the variables. The outline of the theoretical model of the study is shown in the figure 1.

4.1 The Theoretical Model

Figure 1 is the theoretical model relating to the constructs with each of their corresponding items:

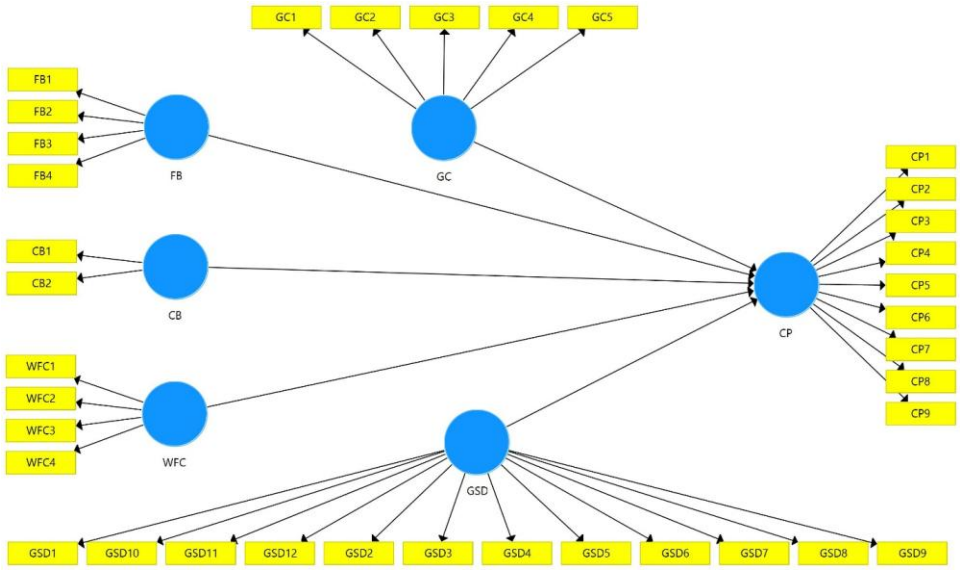

Figure 1: The theoretical model of the study

4.2 Hypothesis

In order to test the degree of influence of the challenges and barriers on the career progression of women academics in private universities of Bangladesh, this study drew the following hypotheses:

H1a: There is a significant influence of family on the career progression of the female academics in the private universities of Bangladesh.

H2a: There is a significant influence of children on the career progression of the female academics in the private universities of Bangladesh.

H3a: There is a significant influence of glass ceiling on the career progression of the female academics in the private universities of Bangladesh.

H4a: There is a significant influence of gender stereotyping and discrimination on the career progression of the female academics in the private universities of Bangladesh.

H5a: There is a significant influence of work-family conflict on the career progression of the female academics in the private universities of Bangladesh.

5. Methodology

5.1 Sampling Area and Sample Selection

This study was based on a field survey which was conducted in fifteen (15) private universities located in Dhaka city of Bangladesh. Since almost all of the private universities are Dhaka based, the study covered the Dhaka city only. Cluster Random sampling technique was used to pick up the sample. The questionnaire was sent to almost 200 respondents, amongst them 167 were returned and hence analyzed in this study.

5.2 Sources of Data

Both the primary and secondary data was used in this study. Secondary data was collected from the existing literature and different published reports in the related field and the primary data was collected through a comprehensive questionnaire survey.

5.3 Questionnaire Design

A structured close ended questionnaire was used for collecting primary data. For the closed ended questions five point Likert scale was used, where 1 = Strongly Agree, 2 = Agree, 3 = Neutral (neither agree nor disagree), 4 = Disagree, and 5 = Strongly Disagree. The questionnaire included two parts. The first part covered the demographic profile of the respondents, the second part covered the statements relating to the challenges and barriers experienced by the private university female faculties in their pursuit of career.

The career progression of the female faculties was expressed in the questionnaire (see appendix) which would ultimately measure the career stagnancy in a specific position for long time of the respondents.

Questionnaire contents included some variables related to the model of this study which consisted of frequent barriers and challenges faced by women in different organizations as their career advancement. Table 1 shows the constructs and their corresponding items with source references:

Table 1: The Constructs (variables) and Corresponding Items

Constructs (References)	Corresponding items	Items' References
Gender stereotyping and discrimination (GSD) [Ibáñez, (2017); Kattara, (2005); Tlaiss and Kauser (2010); Metz, (2005); Sandhu and Mehta (2007); Metz and Tharenou (2001).]	GSD1: Women receive much unfair judgments GSD2: Females cannot be depended on to make objective decisions GSD3: Women have to be more accomplished and dynamic GSD4: Females are not committed to their jobs GSD5: Organization provides fewer opportunities for professional development for women GSD6: Females are not as capable as men GSD7: Organizational support and trust GSD8: Females cannot work under stress GSD9: Men don't pay attention to what women say at meetings GSD10: Females cannot handle continuous hard work GSD11: Women's opinions are not considered GSD12: Persons of opposite gender seem to be uncomfortable	Kattara, (2005);Tlaiss and Kauser (2010); Sandhu and Mehta (2007);
Glass ceiling (GC) [Kattara, (2005); Sandhu and Mehta (2007); Tlaiss and Kauser (2010)]	GC1: Opportunities to upgrade personal, curricular and extra-curricular skills GC2: Extra-responsibilities to learn higher position duties GC3: Training opportunities for women GC4: Acquire higher education for higher positions GC5: "Being a female" is a barrier in itself	Kattara, (2005); Sandhu and Mehta (2007); Tlaiss and Kauser (2010)
Family as barrier (FB) [Kattara, (2005); Metz, (2005); Metz and Tharenou (2001).]	FB1: My family does not like me in this work FB2: Family members are not cooperative FB3: My family does not support for work problems Fb4: Give enough time to take care of family	Kattara, (2005); Metz, (2005);

Children as barrier (CB) [Metz (2005); Metz and Tharenou (2001).]	CB1: Take a lot of care of child/children CB2: Difficulties to perform job duties and responsibilities because of child/children	Metz and Tharenou (2001).
Work-family conflict (WFC) [Kattara, (2005); Sandhu and Mehta (2007).]	WFC1: Difficultiesto manage work and family WFC2: Feel guilty (cannot give enough time to family) WFC3: Sacrifices (e.g. social, family life) for career advancement WFC4: Imbalance infamily responsibilities and work duties	Kattara, (2005); Sandhu and Mehta (2007).
Career progression (CP) [Metz, (2005); Tharenou, et al. (1994); Nirodha, et al., (2014)]	CP1: Promotion CP2: Seminar(s)/trainings insidethe university CP3: Seminar(s)/training outside the university CP4: MS (foreign) or other foreign degree(s) during teaching CP5: Ph D or M Phil degree(s) during teaching CP6: Chairmanship or other administrative positions CP7: Chairman in charge in absence of the chairman CP8: Membership/advisorship/chairmanship of curricular/co-curricular/extra-curricular programs/organizations CP9: Chairmanship of any board or committee	Metz, (2005); Tharenou, et al. (1994); Nirodha, et al., (2014)

5.4 Tools and Techniques Used

Structural equation modeling (through Bootstrapping) technique was used to analyze the paths or to test the hypothesis of the study. The study tests the relationship between endogenous and exogenous variable by t-statistics. Statistical Package for Social Science (SPSS version 16) software was used for data processing and Smart PLS was used to analyze and interpret the results.

5.5 Limitations

Like other studies, this study is not free from limitation. Our sample consisted of 167 female faculties working in fifteen (15) private universities located in Dhaka; Bangladesh may limit the generalisability of the results. The female faculty members of the private universities located outside Dhaka did not participate in this study. The study can be strengthened by increasing the sample size as the data analysis results and findings may differ significantly when the sample size is increased or decreased. As only fifteen (15) Dhaka based private universities do not represent the whole private universities in Bangladesh, the inclusion of more universities both inside and outside Dhaka would create more diffused results and findings. At last, the questionnaire consisted of only some limited challenges barriers. There may have more challenges and barriers influencing career advancement which need to be reported in the future study.

5.6 Validity and Reliability

The reliability was assessed by considering Cronbach's alpha and composite reliability (CR). Theoretically the reliability is considered to be satisfactory when composite reliability and Cronbach's alpha have value greater than 0.70 (Hair at al, 2012). Table-2 shows that all the constructs have composite reliability values of more than 0.7 which is higher than recommended value and almost all the constructs have Cronbach's Alpha values of more than 0.7, except WFC (0.693). Since work-family conflict is advocated as one of the most influential challenges and barriers of women career progression in many literature, this construct is retained in this study nevertheless its alpha value is below 0.7. Thus, the constructs are deemed to have adequate reliability.

Table 2: Alpha, CR=Composite Reliability and AVE (Average Variance Extracted)

Constructs	Alpha	CR	AVE	CB	CP	FB	GC	GSD	WFC
CB	0.961	0.981	0.962	**0.981**					
CP	0.713	0.784	0.548	0.363	**0.741**				
FB	0.777	0.843	0.575	0.176	0.178	**0.759**			
GC	0.843	0.882	0.652	-0.016	-0.241	0.06	**0.807**		
GSD	0.803	0.871	0.629	0.015	0.148	0.263	0.273	**0.793**	
WFC	0.693	0.781	0.544	0.157	0.178	0.395	0.103	0.147	**0.737**

The validity was assessed by considering convergent and discriminant. The convergent validity is considered to be satisfactory when measurement constructs have an average variance extracted

(AVE) of at least 0.50 and items loading are well above 0.50 (Hair et al, 2012). Table-3 shows the item loadings. The item loadings, ranged from 0.659 to 0.982 are greater than the recommended level and the AVE (in the table 2), ranged from 0.544 to 0.962 which are also higher than the recommended value. Therefore, conditions for convergent validity are met.

Table 3: Items' Cross Loadings

Items'	CB	CP	FB	GC	GSD	WFC
CB1	0.982					
CB2	0.98					
CP1		0.776				
CP7		0.685				
CP9		0.758				
FB1			0.742			
FB2			0.659			
FB3			0.774			
FB4			0.847			
GC1				0.874		
GC2				0.854		
GC3				0.763		
GC4				0.729		
GSD1					0.808	
GSD3					0.708	
GSD4					0.852	
GSD6					0.797	
WFC1						0.793
WFC2						0.705
WFC3						0.711

The discriminant validity was assessed by considering the square root of the AVE and cross loading matrix. For satisfactory discriminant validity the square root of the AVE of a construct must be larger than its correlation with other constructs (Henseler et al. 2015). The square root of the AVE of each latent construct, bolded on the diagonal, shown in Table-2, are greater than their corresponding correlation, representing that the data used for this study has a good discriminant validity. And all other inter-item correlations are below the .80 threshold (Sarstedt, 2014) indicating the distinctness of each construct.

5.7 Model Fit Indices

The goodness of fit of the model is measured by two fit indices as: Standardized Root Mean Square Residual (SRMR) and Normed Fit Index (NFI). A value less than 0.10 or of 0.08 (Hu and Bentler, 1998) are considered a good fit. The NFI is then defined as 1 minus the Chi^2 value of the proposed model divided by the Chi^2 values of the null model. Consequently, the NFI results in values between 0 and 1. The closer the NFI to 1, the better the fit. NFI values above 0.9 usually represent acceptable fit (Lohmöller, 1988). Table 4 shows the value of model fit indices of the model. It shows that the value of SRMR for the estimated model is .065 which is lower than the model fit threshold and the value of NFI is .909 which is higher than the model fit threshold.

Table 4: The Model fit Indices

Fit indices	Saturated Model	Estimated Model
SRMR	0.051	0.065
d_ULS	0.237	0.388
d_G1	0.163	0.184
d_G2	0.088	0.104
Chi-Square	55.332	64.697
NFI	0.922	0.909

5.8 Testing of Hypotheses

The structural model was constructed to identify the path relationships among the constructs in the research model. Bootstrap method was used to test the hypothesis. The study tests the relationship between endogenous

and exogenous variable by *t-statistics* and *P value*. The study found that CB (*t* = 4.001), GC (*t* = 3.747) and GSD (t= 2.494) had a significant effect on the career progress of women faculties in private universities since these had the *t* value of more than 1.96, while FB (*t* = 0.429) and WFC (*t*= 1.368) had no significant effect on the career progress of women faculties in private universities. Therefore, among the hypothesis, H2, H3, and H4 were supported. On the other hand, hypotheses H1and H5 were not supported. The remarks and results are shown at a glance in table 5.

Table 5: Testing of Hypotheses

Paths	Hypotheses	Sample Mean	Standard Deviation	T Statistics	P Values	Remarks
FB -> CP	H1a	0.071	0.097	0.429	0.668	Not supported
CB -> CP	H2a	0.318	0.083	4.001	0	Supported
GC -> CP	H3a	-0.313	0.081	3.747	0	Supported
GSD -> CP	H4a	0.208	0.079	2.494	0.013	Supported
WFC -> CP	H5a	0.131	0.082	1.368	0.171	Not supported

5.9 The Structural Model

Figure 2 shows the structural model of the study. It shows the *t* values for every path and the corresponding items under each construct (variable). With the comparison of the theoretical model, the corresponding items of some constructs are eliminated because of their poor loading values in order to get a good model fit.

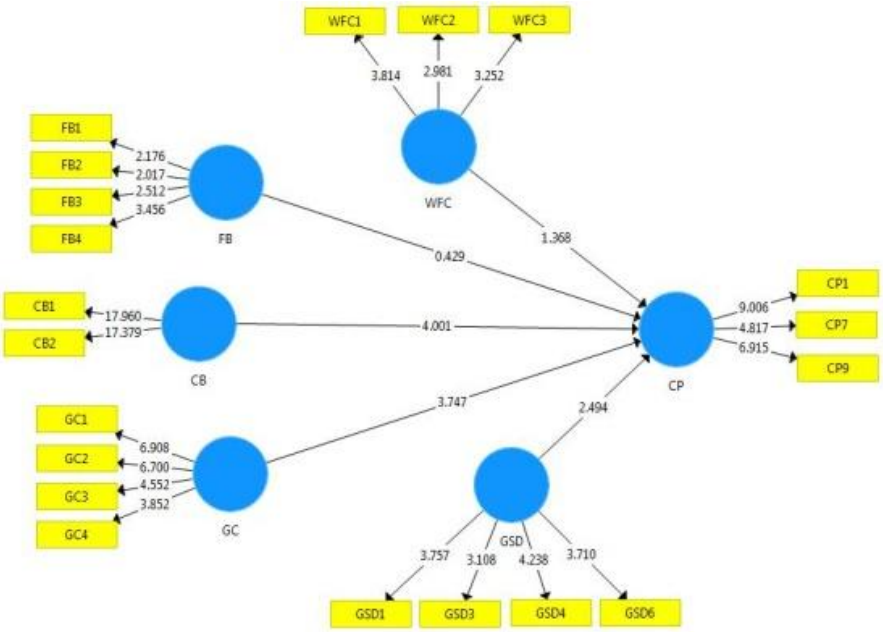

Figure 2: The structural model of the study

6. Practical and Managerial Implications

The findings of this study will help the faculties serving in different private universities of Bangladesh to be concerned, aware and careful about the challenges and barriers experienced by the female academics in their career progression. It will also be useful to the concerned authority the of university, family, and society at large to realize the fact and to improve the overall culture to lessen the barriers and thus help continue and advance the teaching career of the female faculties without having many hurdles.

7. Conclusion

This paper explores the degree of influence of some important obstacles on female academic career progression in the private universities of Bangladesh and finds three most influential barriers affecting female academic career advancement: gender stereotyping and discrimination, glass ceiling, and having children. Most female academics experience that they are rarely assigned such duties by the top management that can upgrade their personal, curricular, and extra-curricular skills which are needed for a higher position's responsibility. They are also provided with little opportunities or insufficient facilities to receive higher training for

top position. In addition, this paper suggests that women academics are being stereotyped and discriminated in numerous ways due to prevailing of traditional and stereotypical gender norms. Females are thought to be too emotional and less dynamic and consequently are unable to make any objective decision. Some people also think that women feel uneasy to work under stress and are unfit to perform in continuous hard work. Some conservative organizations show reluctance to hire women due to their reproduction role and child-bearing mandate. It is assumed that, because of being married, having babies, and caring children, women may face problem to perform the assigned duties and responsibilities and thus disturb the pace of work in the organization.

However, this study has sought to provide guidance to the academics, university authorities, and all concerned as to some obstacles associated with female academic career progression. Despite equal contribution to teaching in private universities, this paper presents some evidence to address that women academics of private universities in Bangladesh still face significant barriers which affect greatly their professional development and career advancement.

8. Future Research Direction

Authors of this study hope that this work would be of further help for researchers to identify pragmatic interventions in order to

I. Minimize the negative consequences derived from these identified challenges and barriers on female academics' career advancement in private universities of Bangladesh.

II. Create a safe and women-friendly environment helpful to continue a smooth career and climb to the top of the professional ladder.

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Appendix: The Questionnaire

Dear Madam,

We, Md. Atiqur Rahman, Lecturer and Md. Jahangir Alam, Assistant Professor of the department of Management, Bangladesh University of Business and Technology (BUBT) are requesting you to participate in a survey to provide your response that will help to identify **"the factors preventing female faculties' career advancement in the universities of Bangladesh"**. The information will be used only true academic purpose. No individual data will be reported.

PART I: RESPONDENT'S DEMOGRAPHIC INFORMATION

Age: 1. 20-29 2. 30-39 3. 40-549 4. 50-59 5. 60-70

Job title: 1. Lecturer 2. Assistant Professor 3. Associate Professor 4. Professor

Institution: 1. Public University 2. Private University 3. National University 4. Others

Education: 1. Graduate level 2. Post graduate level (Masters) 3. M Phil 4. Ph. D

Job Nature: 1. Permanent 2. Temporary 3. Part time

Experience: 1. 1-3 years 2. 3-6 years 3. 6-9 years 4. 9-12years 5. 12-15 years

Marital status: 1. Unmarried 2. Married 3. Divorced

Number of Children: 1. 1-2 2. More than 2 3. No children

PART II: FACTORS PREVENTING FEMALE FACULTIES' CAREER ADVANCEMENT

Following statements concern your perception/experience about your organization and the work-family issues. Please give tick mark on the right boxes against each statement.

Family (Statements about family related barriers)

	1	**2**	**3**	**4**	**5**
Family provides me with little support in					

performing job duties.					
Because of working outside the home, family cooperation in my house related duties is very few.					
Family shows little interest in overcoming my work related problems.					
It is found difficult to pay too much attention to career development because I need to take care of my family.					

(1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree & 5=Strongly Disagree)

Children (Statements relating to children)

# This part is only for those who have child/children	**1**	**2**	**3**	**4**	**5**
Paying too much attention to career advancement is little bit tough for me because of taking care of child/children.					
Sometimes I face problem to perform the assigned duties and responsibilities because of caring of child/children.					

(1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree & 5=Strongly Disagree)

Work-family conflict (Statements relating to Work-family conflict)

	1	**2**	**3**	**4**	**5**
Keeping balance between work and family is difficult for the female job holder like me.					
I feel guilty for not spending enough time with family members due to job.					
I have made lots of sacrifices (e.g. social, family life) in favor of my career advancements					

My family responsibilities sometimes create uneasiness to respond to urgent work duties.					

(1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree & 5=Strongly Disagree)

Gender stereotyping and discrimination (Statements relating to Gender discrimination in your organization)

	1	**2**	**3**	**4**	**5**
Women receive much unfair judgments compared to men.					
Organization thinks that, 'Females are too emotional, so they are unable to make objective decision'.					
Organization believes that, 'women need to be more accomplished and dynamic in their jobs for being promoted to the higher position'.					
Organization thinks that, 'male are more committed to their jobs compared to women'.					
Organization provides more opportunities for professional development for men than women.					
Sometimes organization thinks that, 'men are more capable than female'.					
I think men receive much organizational support and trust compared to women.					
Organization thinks that, 'Females feel less enjoyed to work under stresses'.					
Authority pays little attention to what women say at meetings.					
Organization thinks that, 'Females are unfit to perform in continuous hard work'.					

Organization thinks that, men's opinions are more important in decision making than female.					
Superiors and Colleagues of the opposite gender seem to be a little bit uncomfortable working with me because of my gender.					

(1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree & 5=Strongly Disagree)

Existence of the glass ceiling (Statements relating to Existence of the glass ceiling in your organization)

	1	**2**	**3**	**4**	**5**
Rarely I have been assigned such duties that can upgrade my personal, curricular and extra-curricular skills.					
Organization gives me very little extra-responsibility to learn higher position duties.					
Organization provides me with little opportunities to be trained for higher positions.					
Organization provides insufficient facilities to upgrade my skill and education (acquire higher education for higher positions)					
"Being a female" is a barrier in itself preventing me from moving up to a higher position					

(1=Strongly Agree, 2=Agree, 3=Neutral, 4=Disagree & 5=Strongly Disagree)

Career progression (Statements relating to Career progression in your university)

	1	**2**
I have got at least one promotion		
I have participated in seminar(s)/training arranged by this university		

I have participated in seminar/training arranged by other universities (Home or abroad)		
I have obtained MS (foreign) or other foreign degree(s) during my teaching in this university		
I have obtained (or ongoing) Ph. D or M Phil degree(s) during my teaching in this university		
I am/was the chairman of my department		
I have acted chairman in charge in absence of the chairman of the department		
I am/was the member/advisor/chairman of curricular/co-curricular/extra-curricular programs/organizations of this university		
I perform/ performed responsibility as a chairman of any of the boards or committees of this university		

(1=Yes and 2=No)

The Impact of CEO Disclosure Beliefs on Earnings and Strategy Disclosure Volume: A Study on DSE Enlisted Companies

Mohammad Saifuddin
Subrina Akter

Abstract

This study aims to explore the association between managerial disclosure beliefs and companies' nature in disclosing information to the market. It conveys a cognitional aspect that holds beliefs underlying the performance of behaviors. Therefore, managerial disclosure beliefs are related to voluntary disclosure practices of a firm. Managerial disclosure beliefs are measured through a survey (Stratified Random Sampling) of 73 companies' (enlisted in Dhaka Stock Exchange -DSE) CEOs with a questionnaire of 27 belief statements. Voluntary disclosures of companies are measured from annual reports (2016-2017) of the selected companies. Factor analysis is performed to reduce 27 belief statements (independent variables) to a manageable number of variables (factors). Then regression analysis is applied to investigate influential factors affecting voluntary disclosure. The results show that managerial disclosure beliefs predict more than 55 percent of the variation in the volume of both earnings and strategy disclosures. Specially, CEOs of companies who believe that disclosure of self-report, bad news, reduction of investor's information gathering cost or reduction cost of raising capital have certain benefits disclose more than other companies. Further, CEOs of companies who believe that disclosing information to market (for example, analysts' forecast, warning about bad news etc.) would affect market less likely to disclose information than those CEOs who do not believe. However, low disclosure companies were found to have CEOs who believe that the forecast disclosure exceeds competitive costs, forecast disclosure harm to managerial reputation, forecast disclosure exceeds union costs and strategy disclosure exceeds union costs. These results reflect the importance of managerial disclosure beliefs in explaining and predicting the nature of voluntary disclosure among companies.

Keywords: Managerial Beliefs, Earnings Disclosure, Strategy Disclosure, Factor Analysis, Regression Analysis.

1. Introduction

Corporate disclosure includes statutory disclosure and voluntary disclosure. Statutory disclosure includes that information needs to be disclosed by the corporations under the provisions of different laws. But there is some information which totally depends on the willingness of the managerial body to be disclosed. That means the disclosure of those information is not mandatory. They mainly depend on the managerial disclosure beliefs. This type of information is subject to voluntary disclosure.

Previously, Verrecchia (1983) modeled voluntary disclosure as a set of cost/benefit trade-offs where the firm only disclosed information arbitrarily to the market when benefits of disclosure exceed the proprietary cost. In this research, costs were measured in terms of the actual effect of disclosing information on the firm's future cash flows and include costs due to adverse actions by competitors and labor unions. It was empirically investigated that the firms with CEOs who believe that disclosure has certain benefits like reduction of cost of raising capital (bring goodwill to their companies) disclose more than the other companies. (A. Jane Craighead and Jon Hartwick, 19981).

In Bangladesh the statutory disclosure is mainly controlled by Companies Act, 1994 and Bangladesh Securities and Exchange Commission guidelines and other existing laws. This statutory disclosure has a direct impact on the market. On the other hand, voluntary disclosure may have a direct or indirect impact on the market. A. Jane Craighead and Jon Hartwick in their study cited, "Psychology and organizational behavior, attitude and cognitive theories have traditionally suggested that thoughts or beliefs underlie the performance of behaviors" (A. Jane Craighead and Jon Hartwick, 1998, p.241). Here in this study an attempt has been taken to consider beliefs of CEO regarding disclosure and its effect on the volume of voluntary disclosure about corporate earnings and strategy.

This study explores the nature of managerial disclosure beliefs and their relations to the firm's voluntary disclosure behavior using survey and other secondary sources of data. The results indicate that there is a significant relationship between certain managerial beliefs and the volume of voluntary disclosure of a firm. On average more than 50 percent variation of the volume of earnings and strategy disclosures of DSE (Dhaka Stock Exchange) enlisted companies can be predicted by the managerial disclosure beliefs. More precisely, CEOs of the companies

who believe that disclosing information would benefit their companies are supposed to disclose more information compared to others who do not.

2. Importance of the Study

Most of the theories and studies were taken place in the context of developed countries but the situation and factors of developing countries or countries with poor economic conditions have never been considered. A very few works have been done on the voluntary disclosure of the corporations. But theories on the effect of managerial beliefs on voluntary disclosure has never been empirically tested in Bangladesh perspective. However, dishonesty in disclosing information of companies creates gaps between true condition of the market and investors, which led the investors in the dark situation. So, this study would help to analyze the psychological behavior of CEOS of the DSE enlisted companies about the patterns of disclosure information to market in Bangladesh from a new aspect or thinking.

3. Literature Review

The corporate disclosure of different Bangladeshi corporations has been characterized by inadequacy, lack of reliability and accountability. In an article of *bdnews24* published on 27 December 2017, it was opined by Professor M. Baki Khalili, (Director of Centre for Corporate Governance and Finance Studies, University of Dhaka) that the investors sometimes face loss because of purchasing the share of such companies which have transactions in the market but do not actually have any productions (Umme Habiba,2017). In Bangladesh annual reports published by the corporation plays a vital role in case of investments which contain both statutory disclosure and voluntary disclosure.

However, there are several theories and studies which suggested that managerial disclosure beliefs have an impact on the volume of disclosure about corporate earnings and strategy. According to Dirsmith and Lewis (1982), "Managers believe that some reporting tactics are more effective than others when the firm is experiencing declining performance". According to Fishbein and Ajzen's theory, "A manager's attitude towards discloser is affected by his or her beliefs about the effects of disclosure on both the firm and him or her" (Craighead and Hartwick, 1998).

The market uses different information as published by the corporations. In most cases the corporate annual report has been accepted as a vehicle that

provides useful information to users and analysts for better investment decision making (Arshad, R. and Ismail R.F., 2011). In contrast, sometimes annual reports or financial reports may be inadequate for decision making. However, in case of forecast disclosure, different experts have contradictory opinions regarding managerial beliefs. Managerial beliefs may also have an impact in case of costs and benefits of disclosure for the firm. Lev suggested that voluntary disclosure reduces the permanent information gap between the firm and the market and results in a lower cost of capital and improved terms of trade. Again, several experts opined that managerial beliefs may also have an impact on the costs and benefits of disclosure for the manager. For example, Healy and Fama both expressed their opinion on the managerial beliefs regarding the costs and benefits of disclosure for the manager.

This study therefore identifies and assesses three different sets of managerial disclosure beliefs: (a) beliefs about how the market uses disclosure information in Bangladesh; (b) beliefs about the costs and benefits of disclosure for the firm in the context of Bangladesh; and (c) beliefs about personal costs and benefits of disclosure for the manager in the context of Bangladesh. There are many theories and literatures regarding these beliefs which are as follows:

3.1 Beliefs About How the Market Uses Information

There are several contradictory opinions regarding managerial beliefs about utilization of the disclosed information by markets. Craighead and Hartwick pointed out to some contrast opinion in their study. According to their study some managers believe the market is naïve and fixated on earnings data and in contrast a minority of managers believe the market is quite sophisticated and capable of interpreting the uncertainty associated with earnings forecasts (Craighead and Hartwick, 1998). While studying the communication of information in different economic environments, Dirsmith and Lewis (1982) observed, managers believe that in a stable market it is important to document historical improvements but in a dynamic market they must convince investors of the firm's ability to adapt. Again, Craighead and Hartwick's (1998) study referred to a number of disclosure phenomena, such as the attribution by management of positive events to internal firm factors and of negative results to factors outside management control. Such reporting strategies suggest managers believe in the effectiveness of impression management techniques.

3.2 Beliefs About the Costs and Benefits of Disclosure for the Firm

Another set of managerial disclosure belief include the beliefs regarding the costs and benefits of disclosure for the firm. Craighead and Hartwick (1998) referred to Lev's opinion which suggested that voluntary disclosure reduces the permanent information gap between the firm and the market and results in a lower cost of capital and improved terms of trade. Various empirical studies demonstrate the complex nature of disclosure choices. It has been shown that capital-dependent firms may voluntarily disclose bad news in order to deter a competitor even though such action is costly from a capital perspective (Clarkson et al. 1994). Proprietary costs are also affected by actions by other parties such as labor unions. Waterhouse et al. (1993) find that firms change their disclosure patterns in the period preceding union contract negotiations and suggest that the increased disclosure can be attributed to managerial efforts to influence the outcome of the negotiations. According to Craighead and Hartwick (1998), in such a setting, managers' beliefs regarding the proprietary costs associated with information disclosure are dominated by their beliefs about the potential benefits of strategic disclosure.

3.3 Beliefs About the Costs and Benefits of Disclosure for the Manager

The third category of managerial disclosure beliefs includes beliefs about the effects of disclosure on the manager himself or herself, in terms of reputation, compensation or continued organizational tenure. The literature reveals management's attempts to boost profits in the short-term when compensation is tied to accounting performance (Healy 1985). Considering this theory, Craighead and Hartwick (1998) opined that managers may use disclosure in an attempt to maximize personal compensation when compensation depends on share price. Fama (1980) provides a longer-term rationale for managers to participate in a firm's voluntary disclosure activities. According to him, manager's reputation in the market for managerial services may affect to his future earnings. In this case managers should not only perform his duties but also maintain communications with the market for his or her best interest.

Bangladesh has recently been recognized as a developing country from least developed country by the UN. As per the condition of UN, a least developed country must fulfill three criteria like: Gross National Income (GNI) per capita, Human Assets Index (HAI) and Economic Vulnerability Index (EVI). Bangladesh has fulfilled all three criteria. The CDP, a United Nations panel, will review Bangladesh's progress in 2021, and the

country's official graduation from the LDC category will take place after a three-year transition period. If the country maintains its position in all the three categories for the next six years, it will eventually graduate from the LDC bloc (Daily Star). This period is very important and it is going to be very crucial for Bangladesh. The economic growth of a country is represented by several sectors and company is one of them. There are four basic pillars like transparency, fairness, responsibility and accountability of corporate governance. Bangladesh needs to observe the transactions of the companies. Bangladesh can observe and control the statutory disclosures as there are several legislations. But the importance of voluntary disclosure cannot be ignored as there are many incidents which show that voluntary disclosure may affect a company's functions and thus hinders the economic growth of a country. Considering those theories and opinions of different scholars regarding managerial beliefs, this study carries much importance.

4. Research Objectives

The main goal of the study is to explore whether there is any impact of CEO disclosure on disclosure volume. The specific objectives of this study are:

- To develop some measures of managerial disclosure beliefs.
- To assess the impact of CEO disclosure beliefs on disclosure volume.
- To explore the influential factors (disclosure beliefs) which affect disclosure volume.

5. Methodology

5.1 Research Method

To assess the impact of CEO disclosure beliefs on the volume of earnings disclosure and strategy disclosure, *causal-comparative* research will be conducted. Broadly, speaking, this is a quantitative research. In this study, CEO disclosure beliefs are considered as independent variables and the volume of earnings disclosure and strategy disclosure are dependent variables.

5.2 Measuring Managerial Disclosure Beliefs

Reviewing previous literatures, twenty-seven belief statements/opinions regarding voluntary disclosure activities are developed from literature. These statements are mentioned in research instrument part. These statements address three areas:

(1) Managerial beliefs about how the market uses information (question 1-19);

(2) Managerial beliefs about the proprietary costs and benefits of disclosure for the firm (questions 20-23);

(3) Managerial beliefs about the effects of disclosure on the manager personally (questions 24-27).

Items are measured on seven-point semantic differential scales, usually anchored on the left with *Strongly Disagree* and on the right with *Strongly Agree.*

5.3 Earnings Disclosure and Strategy Disclosure

Earnings disclosure refers to information which includes earnings analysis, earnings announcement or earnings forecasts, different financial ratios, earnings per share etc., while strategy disclosure refers to information about strategical decision, policy note, advertising strategy, cost control intensity, dividend policy, financing strategy, growth strategy, pricing strategy, product distribution strategy, product lines, R&D intensity or plant closures or expansions etc.

5.4 Measuring Disclosure Volume

Most of the study is conducted with index measures of disclosure in corporate financial statements (Cerf 1961; Buzby 1974,1975; Singhvi and Desai 1971) and some of research is conducted with disclosure amount surveyed press releases and stock exchange fillings (Gibbins et al. 1990). In this study the volume of voluntary disclosures are partitioned in two categories-earnings disclosure volume and strategy disclosure volume.

Earnings disclosure volume is simply assessed by counting the number of disclosure containing earning analysis, earning announcements or earnings forecasts published in annual report of 2016-2017. Similarly, strategy disclosure volume is also computed by counting the number of disclosure mentioned in policy note, or strategy including a change in advertising strategy, cost control intensity, dividend policy, financing strategy, growth strategy, pricing strategy, product distribution strategy, product lines, R&D intensity or plant closures or expansions. After counting earnings and strategy disclosure from the annual reports of the selected companies mean and standard deviations of these two disclosures were computed. The sample exhibited that the mean score of earnings disclosure is 24.66 with standard deviation 4.38. While the mean score of strategy disclosure

(14.53) is found to be smaller than that of earnings disclosure with standard deviation 3.83.

5.5 Study Population and Sampling Frame

Due to availability of secondary data (needed to measure earnings disclosure volume and strategy disclosure volume) specially from the annual report of 2016-17, all companies enlisted in DSE (Dhaka Stock Exchange Ltd.) are considered as study or target population. So, list of all companies is sampling frame. To achieve a representative sample from all sectors, companies are categorized in ten sectors; which are considered as strata (table 1). Final sample size (73 companies) was determined by the following formula:

$$n = \frac{\frac{z_{\frac{\alpha}{2}}^2 pq}{d^2}}{1 + \frac{1}{N}\left(\frac{z_{\frac{\alpha}{2}}^2 pq}{d^2} - 1\right)} = 73;$$

$$Where, N = 301;\ \alpha = 5\% = 0.05; p = 0.5; q = 0.5; d = 0.10; Z_{\alpha/2} = 1.96.$$

Then, based on proportionate stratified sampling[1]; sub-sample from each stratum has been drawn (M. Nurul Islam, 2005). The sample size of each stratum has been shown in also in table1.

5.6 Data Collection Procedure

A questionnaire containing 27 belief statement was sent to CEOs of 73 companies in the form of email survey using google form. A cover letter was attached explaining that the results of the study would be only used for academic purpose and the identity of companies' CEO would remain anonymous. A total of 32 responses that is 44 percent of the sample, was obtained from different sectors.

6. Analysis

6.1 Summarization Procedures for Managerial Disclosure Beliefs

To explore the response patterns between items and to reduce the

[1] Here, according to proportionate stratified sampling, sampling fraction, $f = \frac{n}{N} = \frac{73}{301} = 0.243$

dimension of belief statements to a manageable number of variables for analysis, principal component factor analysis with varimax (orthogonal) rotation was applied to 27 belief statements. The factor analysis extracted seven factors with eigen value exceeding 1. 00, explaining approximately 86 percent of the variance in the questions. The extracted factors with eigen values greater than 1.00 ensure that any retained factor accounts for at least as much variance as a single item (Hair et al. 1987,247). However, from factor solution, it was seen that the eigen value for the seventh factor just exceeded 1.00, with a value of 1.04 and only item 24 loaded on this factor with loading 0.82. Since, all extracted factors explained approximately 86 percent variation of 27 belief statements, no factor was omitted. Table 2 shows the rotated factor matrix and belief statement loadings on the seven factors. The eigen values and percentage of variance explained by each factor appears at the bottom of the table.

Table 2 implies that, items or belief statements 26, 27, 5, 2, 20 and 22 are related to factor 1. These items actually indicate both costs of forecast disclosure and strategy disclosure. Except item 2, other items have positive loadings on the factor 1. So, factor 1 can be labeled as *Costs of Disclosure.* In an earning forecast disclosure setting, this factor represents the proprietary cost/benefit trade-off suggested by Verrecchia (1983) and would be expected to be *negatively associated* with the volume of disclosure. Thus, companies that actively disclose information are likely to have managers who believe that the costs of such disclosure are minimal. Otherwise, companies with managers who believe that such disclosure creates great cost would be less likely to disclose information concerning both earnings forecast and strategy.

Factor 2 consists of items 8, 17, 23, 25, 10 and 11. These items are related to disclosure beliefs about forecast and strategy information which may affect market. Items 8, 17, 23 and 10 have positive loadings on this factor. These loadings indicate that, the firm's manager believes that any disclosure of earnings forecast or strategy may affect the market. However, items 11 and 25 have negative loadings indicates that, firm's manager believes that, disclosing strategy would not prevent adverse share price effect in the market and he/she also thinks that, market reputation somehow depends on firm's earnings performance. Hence, factor 2 can be labeled as *Market Use of Forecast and Strategy Information.*

Factor 3 is similar to factor 2 in the sense that it deals with a way of managing the market through the provision of information. Items 1, 3, 12 and 16 are loaded positively and item 7 loaded negatively on factor 3. Item

1 and 3 suggest that decreased earnings should be interpreted with taking full responsibility of management. However, items 12, 7 and 16 imply that, explaining significant change in the strategy would prevent unrealistic expectations by disclosing change before it takes place. As a consequent, this factor can be labeled as *Managing the Interpretation Earnings and Strategy*, which describes many of the impression management phenomenon noted by Bettman and Weitz 1983) and Staw et al. (1983).

Factor 4 relates to benefit to disclosure in the market. Item 15 and 18 have positive loadings, while item 13 has a negative loading. Item 15 and 18 implies that self-report bad news has less impact on the market and reduces investors' information gathering costs. On the other hand, item 13 suggests that it would be better to under-disclose strategic information to the market than to over-disclose. So, from the above discussion, factor 4 can be considered as *Benefits of Disclosure to Market.*

Factor 5 has heavy loading of items 4, 19 and 9. Item 4 states that disclose of steady growth in earning per share of the firm is very important to the investor, while item 9 indicates that current earning per share used more than analysts' forecast in its valuation. Item 19 describes that, continuous communication of information about earnings and strategy reduce cost of raising capital. Thus, factor 5 can be identified as *Importance of Disclosing earning per share for Investor and Market.*

Factor 6 also relates to a particular view of the market along with costs of strategy disclosure. Item 21, 14 and 6 are highly loaded on factor 6. Thus, the factor is labeled as *Costs of Strategy disclosure and The Naive Market.* Statements 6 and 14 refer to beliefs that, there is little need to disclose information about future corporate strategy if the firm shows steady growth in earnings per share and the market bad news is reduced by announcing good news simultaneously. Item 21 refers to the potential benefit from disclosing information about the future corporate strategy to the market exceeds the potential cost from firm's union(s) or employees also have access to this information.

Finally, item 24 itself is labeled as a factor which is related to the belief that, reputation of a firm is enhanced when there exists communication to the market about good deeds of the firm. So, factor 7 can be labeled as *Discloser of Goodwill in Market.*

6.2 Disclosure Beliefs held by the Respondent

Due to some constraints like time and budget, only 32 CEO's belief statements are collected. Since belief statements (refer as item) are scored from 1 (strongly disagree) to 7 (strongly agree) with a score of 4 representing the mod-point; item mean scores are also varied from 1 to 7. Hence, the mean scores actually indicate extent of agreement or disagreement of CEO beliefs towards voluntary disclosure. Factor wise mean scores and variances are also presented in Table 2.

Table 2 reveals that, the sample of CEOs has slightly strong and positive beliefs about managing the interpretation of earnings and strategy disclosure (factor 3). But belief seems to be inconsistent having different variance. It is also seen from Table 2 that, beliefs score about benefits of disclosure to market (factor 4) and importance of disclosing earning per share for investor and market (factor 5) are also higher than mid-point 4, indicating positive and strong beliefs of CEOs. Great variation is observed in belief of CEOs about costs of disclosure (factor 1). This suggests that CEOs' beliefs differ from firm to firm. By looking at the factor 3, it can be said that beliefs about usage of forecast and strategy information in market are on average. Variance of belief statements are also similar except item 25. Lastly, beliefs about reactions to bad news managed with good news and disclosing good information are also positive and strong. In the context of costs of disclosure, belief about "strategy disclosure exceeds union costs" is negative. CEOs are in neutral position in the question of forecasting unnecessary when earning growth is steady.

6.3 The Prediction of Disclosure Volume

To provide a justification of managerial disclosure beliefs, *factor scores* of seven belief factors were used as explanatory or independent variables in two sets of regression models predicting the volume of disclosure, one set for the prediction of earnings disclosure volume and one set for the prediction of strategy disclosure volume. As the factor scores are extracted from a varimax rotation, the inter-correlation among factors will be zero, which minimizes completely the problem of multi-collinearity. Expected results for each of the seven factors were explained previously in Table 2 and are summarized in Table 3 along with the results of the multiple linear regression analysis.

Belief predictor model exhibits that, seven belief factors sufficiently explain the disclosure volumes. From Table 3, it is seen that the adjusted R-square for the *earnings disclosure* model is 0.90, while it is lower at

0.55 for the *strategy disclosure* model. Thus, more than 50 percent of the variance in both earnings disclosure volume and strategy disclosure volume can be explained by the disclosure beliefs' stated by the CEO of the firm. However, significant F-ratios (41.71 and 6.32) of both the models suggest in 99 percent cases belief predictors would perfectly predict both earning disclosure and strategy disclosure volume. In addition, it is found that, out of seven factors, five factors (factors 1, 2, 3, 5 and 6) are significant at minimum one percent level of significance in earnings disclosure model, while, four factors (1, 2, 5 and 6) are found to be significant in strategy disclosure model. However, relations of seven factors with earning disclosure are found positive as hypothesized relation except factor 1, 5 and 6. Similarly, relation of factor 4 is negatively related to strategy disclosure (but insignificant). Factor 1 and 6 are also significantly related positively to strategy disclosure. So, it can be noted that factors 1, 2, 5 and 6 are found to be significant in both models. This result indicates that, *Cost of disclosure, Market Use of Forecast and Strategy Information, Importance of Disclosing earning per share for Investor and Market* and *Costs of Strategy disclosure and The Naive Market* have a positive impact on both earnings and strategy disclosure.

7. Discussion and Conclusion

Several researches had been conducted to investigate the factors which affect volume of disclosures of corporate companies. Some remarkable researches investigated the utility of using economic variables such as firm size (Watts and Zimmerman 1978, 1979,1986), the level of capital-market dependency (Gibbins et al. 1990; Lang and Lundholm 1993), ownership structure (Ruland et al. 1990) and regulated status (Gibbins et al. 1990; Frankel 1995) to predict voluntary disclosure. The results of the present study imply that the DSE enlisted companies' earnings and strategy disclosure are also affected by managerial beliefs and it can be said that the use of such beliefs as independent variables can intensify the ability to forecast and explain the volume of companies' voluntary disclosures.

Aggregately, the significant belief factors suggest that CEOs of high disclosure companies showed beware about the benefits of disclosing information in their annual report as well to the market, believing that voluntary disclosure affects the companies' competitive advantage by increasing share liquidity and down warding the companies cost of capital. On the other hand, companies whose CEOs believe that disclosing more information would harm their profit and other economic conditions seemed to

be in a restrictive mode. So, this study will help to understand the economic status of a company based on disclosures of voluntary information.

This study is mostly driven by a previous study done by A. Jane Craighead and Jon Hartwick in 1998. Similar to their study, one of the main objectives of present study was developing a measures of managerial disclosure beliefs adjusted for DSE enlisted companies of Bangladesh and to explore whether such beliefs relate to companies' disclosure behavior. Though these objectives seem to have been achieved, replication of the study is required to generalize findings. As CEO's belief was measured from the field survey and disclosure volume had been computed from annual report (secondary source), so it cannot be stated with confidence that CEO's beliefs are causal factors of voluntary disclosures, rather it can be said that CEO's beliefs are associated with voluntary disclosures.

Since the study conducted on 44 percent of the sample and voluntary disclosures were computed from a single year (2016 to 2017) annual report, so by increasing sample size and taking several years' annual report further studies should be carried on to achieve better results.

This study tried to investigate only whether there was any significant impact of disclosure beliefs on voluntary disclosure of firms of DSE enlisted companies during a year-2016 to 2017. But increasing time period might give different results. However, voluntary disclosure could vary from industry type or for other dimensions-which were not considered in this study. Another limitation was behavioral attitude of CEOs. If CEOs were very much honest in expressing their opinions, then this study would serve an authentic result.

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APPENDIX

Research Instrument: A questionnaire was developed containing 27 belief statements which were provided to sampled companies' CEO to record their extent of agreement. The response scale for all statements, except items 20 to 23 were measured in 7-point scale, anchored on the left with *Strongly Disagree (1)* and on the right with anchored *Strongly Agree (7).* Items 20 to 23 also used a 7-point scale but were anchored on the left with *Benefits Exceed Costs (1)* and on the right with anchored *Costs Exceed Benefits (7).* The 27 belief statements are stated below:

1. When earnings per share have decreased from the prior year, the negative market impact of such news can be reduced if the firm interprets the decrease in terms of firm's corporate strategy.
2. When earnings per share have decreased from the prior year, it is important to highlight factors affecting performance which were outside management's control.
3. Management enhances the impression of control when it takes full responsibility for poor earnings.
4. It is very important to the investor for the firm to show steady growth in earnings per share.
5. There is little need to disclose information about future corporate strategy when firm shows steady growth in earnings per share.
6. There is little need to disclose earnings forecasts when a firm shows steady growth in earnings per share.
7. When a firm does unusually well in a year, the market can be prevented from developing unrealistic expectations for the next year, if management explains the nature of this performance.
8. In its valuation of your firm, the market makes significant use of analysts' earnings forecasts.
9. In its valuation of your firm, the market makes more use of current earnings per share than analysts' forecasts of future financial performance.
10. It is risky for management to disclose earnings forecasts because the market does not understand the uncertainty associated with these forecasts.
11. In its valuation of your firm, investors make more use of current earnings per share than information related to future corporate strategy.

12. When a firm makes a significant change in strategy (e.g., launches a new product line, opens or closes a plant, changes the level of investment in research and development, etc.) management can prevent adverse share price-effects by explaining the nature of this change to the market.
13. It is better to under-disclose strategic information to the market than to over-disclose.
14. The market impact of bad news is reduced when the firm is able to make a simultaneous announcement of good news.
15. The market impact of bad news (e.g., an event that will decrease expected earnings) is less if the firm discloses it before the market learns of the bad news from other sources.
16. Disclosing a change in strategy to the market before it takes place, will reduce any adverse market effects arising from the change.
17. When earnings per share are less than forecast, the market's reactions to this bad news is reduced if it is warned of this change prior to the next regular earnings' report.
18. Communicating information about earnings and strategy to the market will reduce investors' information gathering costs and stimulate their interest in a firm's shares.
19. The cost to a firm of raising capital on the market is reduced through the continuous communication of information about earnings and strategy which builds investors' confidence and a better understating of the firm.
20. The potential benefit from disclosing earnings' forecasts to the market exceeds the potential cost from the company's union(s) and/ or employees also having access to this information.
21. The potential benefit from disclosing information about future corporate strategy to the market exceeds the potential cost from the union(s) and /or employees also having access to this information.
22. The potential benefit from disclosing earnings forecasts to the market exceeds the potential cost from the competitors also having access to this information.
23. The potential benefits from disclosing information about future corporate strategy to the market exceeds the potential cost from the competitors also having access to this information.

24. Company's reputation is enhanced by communicating to the market all the good things the company is doing.
25. Company's reputation depends mainly on its earnings' performance.
26. CEO can harm reputation of company more by disclosing earnings' forecasts than by not disclosing them.
27. CEO can harm reputation of company more by disclosing information about future corporate strategy than by not disclosing it.

Table 1: List of Strata and Sample Size

Strata	Name of the Industry	Population stratum size (N_i)	Sample stratum size ($n_i = 0.243 * N_i$)
Stratum 1	Textile	48	12
Stratum 2	Insurance	47	11
Stratum 3	Engineering	36	9
Stratum 4	Bank	30	7
Stratum 5	Pharmaceuticals & Chemicals	28	7
Stratum 6	Financial Institutions	23	6
Stratum 7	Food & Allied	18	4
Stratum 8	Fuel & Power	18	4
Stratum 9	Miscellaneous	12	3
Stratum 10	Others*	41	10
Total		$N = 301$	$n = 73$

**Others= IT, Cement, Tannery Industries, Ceramics Sector, Services & Real Estate, Travel & Leisure, Jute, Paper & Printing, Telecommunication*

Table 2: Factor Analysis of Managerial Disclosure Beliefs

			Factor Loading on Rotated Factor Matrix						
	Mean	**Variance**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Factor 1: Costs of Disclosure									
26 forecast disclosure harm to managerial reputation	3.72	3.05	**0.83**	-0.25	0.19	-0.17	0.08	-0.02	0.16
27 strategy disclosure harm to managerial reputation	4.22	3.47	**0.78**	-0.12	0.13	-0.11	-0.24	0.23	-0.31

			Factor Loading on Rotated Factor Matrix						
	Mean	**Variance**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5 disclosing strategy information unnecessary in case of steady earnings growth	4.19	5.51	**0.76**	-0.44	0.04	0.05	0.06	0.28	0.16
2 explains decreased earnings with outside factors	5.22*	4.05	**-0.65**	0.07	-0.15	-0.06	0.45	-0.10	-0.38
20 forecast disclosure exceeds union costs	2.78	2.63	**0.57**	0.19	0.56	-0.05	0.06	0.27	0.25
22 forecast disclosure exceeds competitive costs	3.91	1.70	**0.57**	-0.03	0.18	0.56	-0.40	0.00	0.15
Factor 2: Market Use of Forecast and Strategy Information									
8 market makes significant use of analysts' forecasts	4.88	1.15	-0.02	**0.84**	-0.17	0.02	-0.08	-0.03	-0.29
17 warn market to reduce reaction to bad news	4.50	1.10	-0.20	**0.82**	0.02	-0.13	-0.15	-0.06	0.36
23 strategy disclosure exceeds competitive costs	4.50	1.10	-0.03	**0.77**	0.42	0.15	0.02	0.19	0.36
25 managerial reputation depends mainly on earnings	4.03*	4.61	0.53	**-0.73**	0.10	0.04	0.07	0.01	0.05
10 market does not understand forecast uncertainty	4.25	2.39	-0.30	**0.61**	0.41	0.06	-0.04	0.32	-0.05

			Factor Loading on Rotated Factor Matrix						
	Mean	**Variance**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
11 earning used more than strategy in valuation	4.03*	1.52	0.44	**-0.53**	0.27	-0.49	0.11	-0.23	-0.10
Factor 3: Managing the Interpretation Earnings and Strategy									
1 interpret decreased earnings in terms of strategy	5.03*	3.13	-0.31	0.06	**-0.87**	-0.10	0.12	0.06	0.02
3 take full responsibility for poor earnings	4.69*	1.64	-0.17	-0.05	**-0.77**	0.07	-0.28	-0.30	-0.01
12 explain significant change in strategy	5.78*	0.69	-0.05	-0.05	**-0.73**	0.45	-0.32	-0.15	-0.01
7 prevent unrealistic expectations	5.97	0.68	-0.47	0.13	**0.67**	0.27	-0.20	-0.27	-0.32
16 disclose change before it takes place	4.81*	2.03	-0.35	0.27	**-0.51**	0.16	0.06	-0.45	0.05
Factor 4: Benefits of Disclosure to Market									
15 self-report bad news before market hears	5.38	2.56	0.13	-0.09	0.10	**0.91**	-0.21	-0.12	0.03
18 reduce investors' information gathering costs	4.66	3.01	-0.33	0.41	-0.07	**0.79**	-0.04	0.06	-0.09
13 better to under-disclose strategy information	4.94*	2.32	0.14	0.31	0.18	**-0.67**	0.39	0.25	-0.18

			Factor Loading on Rotated Factor Matrix						
	Mean	**Variance**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Factor 5: Importance of Disclosing earning per share for Investor and Market									
4 disclose steady growth in earning per share	5.66	0.49	-0.14	-0.34	0.01	-0.21	**0.87**	0.05	-0.11
19 reduce cost of raising capital	6.09	0.86	-0.18	0.06	0.00	-0.17	**0.79**	-0.30	-0.15
9 earnings used more than forecast in valuation	4.41	1.22	0.28	-0.15	0.38	-0.16	**0.69**	0.24	-0.05
Factor 6: Costs of Strategy disclosure and The Naive Market									
21 strategy disclosure exceeds union costs	3.47	1.55	0.11	0.42	0.12	-0.01	0.03	**0.84**	-0.05
14 reactions to bad news managed with good news	4.53	2.84	0.14	-0.07	0.37	-0.59	-0.03	**0.64**	-0.14
6 forecast unnecessary if steady earnings growth	4.00	4.39	0.36	-0.24	0.04	-0.22	-0.17	**0.62**	0.45
Factor 7: Disclosure of Goodwill in Market									
24 disclose good information	5.59	1.60	0.20	0.11	-0.10	0.19	-0.36	-0.05	**0.82**

			Factor Loading on Rotated Factor Matrix						
	Mean	**Variance**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Factor Eigenvalue			7.37	4.95	4.68	2.47	1.36	1.35	1.04
Percentage of Variance			27.3	18.3	17.3	9.2	5.0	5.0	3.8
Cumulative Variance			27.3	45.6	63.0	72.1	77.2	82.2	86.0

* Item has negative loading

Table 3: Regression Results for Earnings and Strategy Disclosure Volume

	Earnings Disclosure		Strategy Disclosure	
Belief predictor model:		**Significance**		**Significance**
Predictor variables	**Beta**	**(t-statistic)**	**Beta**	**(t-statistic)**
Factor 1: Costs of Disclosure	**0.5**	**12.03*** **	**0.31**	**4.56*** **
Factor 2: Market Use of Forecast and Strategy Information	**0.19**	**4.65*** **	**0.21**	**3.05** **
Factor 3: Managing the Interpretation Earnings and Strategy	**0.16**	**3.75** **	0.02	0.25
Factor 4: Benefits of Disclosure to Market	0.00	0.10	-0.02	-0.32
Factor 5: Importance of Disclosing earning per share for Investor and Market	**0.20**	**4.86*** **	**0.14**	**2.12***
Factor 6: Costs of Strategy disclosure and The Naive Market	**0.39**	**9.36*** **	**0.21**	**3.08** **
Factor 7: Disclosing Goodwill in Market	0.03	60.00	0.00	0.004
Adjusted R-square; F statistic	**0.90**	**41.71*** **	**0.55**	**6.32*** **
n=32; 31degrees of freedom				

p< .05; p< .01; p< .001

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Sustainable Development through Green Products: The Case of Personal Care Products of Bangladesh

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Takrima Jannat

Abstract

An increasing number of consumers are changing their buying habit from conventional personal care products to green and eco-friendly personal care products. In response to this, many traditional personal care manufacturers are now opening a new branch in their product lines, and labeling it as "green" to grab this promising market. Consumers from the developed countries including the USA and Western Europe were found to be more conscious about the environment. Many studies on these topics have been done in developed countries, but there is still a need to undertake such studies in the context of developing countries. Most studies have focused on the general environmental behavior instead of specifically on sustainable development through green products and green personal care products in the Bangladeshi context. Therefore, gaps exist in the literature with regards to this area. Hence, this is an attempt to examine how consumers perceive green personal care products in their brand experiences for sustainable development and which factors that influence consumers to purchase it. The researcher examined five independent variables (environmental sustainability, economic sustainability, societal sustainability, health sustainability and green promotion) against the dependent variable, behavioral intention to purchase green personal care products. This study belongs to both quantitative and qualitative research designs and non-probability convenience sampling technique and undertakes to select 342 green personal care product users from Dhaka City areas. Analysis is done using statistical tools such as Descriptive Statistics, Hypothesis Testing, and Structural Equation Modeling (SEM). The research findings suggest increasing green promotional campaign that might enable green marketers to formulate effective marketing strategy to target greater segment of consumers. The originality of this research reveals a vital source of information for national and international marketers to be highly concerned about environmental protection and have strong beliefs that green product can definitely be used as a tool for gaining competition and sustainable growth for Bangladesh.

Keywords: Green product, sustainability, eco-friendly, personal care products, intention to purchase.

1. Introduction

Business and consumers today confront with one of the biggest challenges to protect and preserve the earth resources and the environment. They have become more concerned with the natural environment and are realizing that their production, consumption and purchasing behavior will have a direct impact on the environment (Laroche, Bergeron and Barbaro-Forleo, 2001). Following this concept a large number of consumers are changing their buying habit from conventional personal care products to green personal care products or eco-friendly products. Here eco-friendly refers to those products which are environmentally safe and made with natural elements. Understanding consumption decision of consumers is a key success of any business (Nair and Prakash 2007). So business organizations are spending billions of dollars for opening new divisions in their product lines labelled as "green" to grab this promising market. According to Hartmann and Ibanez (2006), most of the developing countries are now taking initiatives to promote green marketplaces to develop a sustainable living place. These initiatives cover delivering and promoting greener and cleaner alternatives to consumers. The growing concerns about environment, eco-system and nature have caused the increasing space of green personal care products. Consumers are now increasingly interested in activities that can protect the environment in the best way. A great deal of empirical research has been carried out to identify the interest among consumers in using and purchasing green products (Mintel, 1991; Jacob and Jolly, 2012). So, consumers can play a major role by supporting green or recycled products. However sustainable development has become a significant topic in the last decade. Sustainable development is a system of resource utilization that aims to meet human needs by preserving the environment so that these needs can be met not only at present but also in the future (Singh and Jaswal, 2015). The production and consumption of green skin care products can directly contribute to the long-term development of a country in the area of environment, society, economy, as well as health sectors.

1.1 Background of the Study

Since 1970's, especially in 1990's, green personal care products are getting popularity because of the concerns of the environment and society. Hence, there was a rapid growth in this area of research in those decades.

Nowadays social and environmental concerns play an important role on consumer purchasing decisions (Prothero, 1996; Menon et al., 1999). Consumers realize that it may have a direct impact on their purchasing behavior. Hence they tend to purchase environmentally friendly goods these days. According to Laroche et al. (2001), "customers adapted to this new threatening situation by considering environmental issues when shopping (e.g checking if the product is wrapped in recycled material) and by purchasing only ecologically compatible products (e. g. biodegradable paint, CFC- free hairspray or unbleached coffee filter). This trend of green buying favored the surfacing of a new segment of consumers known as green consumers or green consumerism". Research indicates that 92% of MNCs from Europe changed their products to address growing concerns of environmental pollution (Vandermerwe and Oliff, 1990; Jacob and Jolly, 2012). Consumers from developing countries including the USA and Western Europe were found to be more conscious about the environment (Curlo, 1999; Jacob and Jolly, 2012).

A green product can be defined as "a product which the design and/or attributes (and/or production and/or strategy), uses recycling resources, and which benefits the impact on the environment, or reduces toxic damage on the environment in the entirety of the life-cycle (Durif and Julien, 2009). The concept of green personal care product has also gained significant popularity in Bangladesh because of environment and social sustainability. The people of Bangladesh are also showing interest in purchasing green personal care products because now they are more concerned about environment, health and society. Purchase intention is simply defined as an intention to buy products or services for personal use. It can also be described as an internal wish, desire and willingness of the people to buy a less harmful and environmental friendly products. This research is very important as organizations apply green schemes to increase perceive worth of their product and decrease perceived risk of their goods. Green goods are very beneficial for marketers because these are extra popular in the marketplace (Muhammad et al., 2013).

There has been many research conducted in this area. However there is limited research work on Bangladeshi context. Most studies have focused on the marketing mix elements or general environmental behavior of green products instead of specifically on sustainable development through green personal care products in Bangladeshi context. Therefore gaps exist in the literature with regards to this area. According to Fanelli (2018), if a personal care product is labeled as natural it usually means that it contains

no artificial fragrance or preservative. Natural personal care products are made with quality ingredients derived from plants including aloe, hops and citrus fruits effectively cleansed without the use of harsh chemicals. Eco- friendly personal care products contain no harsh chemicals and are designed especially to be soft and nourishing for skin.

This study aims at examining the sustainable development through green personal care products in Bangladesh. The specific objectives are to analyze the factors that influence consumers to the purchase intention of green personal care products and to examine the relationships between the dimensions of green personal care products with green consumers' purchase intention. The conceptual and hypotheses development are grounded on related literature. The researchers examined five independent variables (environmental sustainability, economic sustainability, societal sustainability, health sustainability and green promotion) against the dependent variable behavioral intention to purchase green personal care products. The research findings would enable green marketers to execute effective marketing strategy to target greater segment of consumers. This research will also work as a vital source of information for national and international marketers about purchase intention of consumers about green personal care products in Bangladesh.

2. Literature Review

Based on theoretical framework, five independent variables are hypothesized to affect the dependent variables. These variables have been analyzed in the study to determine their importance and significance in consumers' decisions to purchase green personal care products. The intention of consumers to purchase green personal care products may be affected by these variables either positively or negatively based on their hypothesized argument and prior research.

2.1 Environmental Sustainability

Environmental concern refers to "the belief, stance and the degree of concern an individual holds towards the environment" (Said et al., 2003, pp. 307, Lee et al., 2011). A study conducted by Lee (2008) revealed that an environment concern was found to have a significant relationship on green purchasing behavior. Oyewole, P. (2001) in his paper presents a conceptual link among green marketing, environment justice and industry ecology. It argues for greater awareness of environmental justice in the practice of green marketing. So, Environmental sustainability is an

important dimension in the field of green personal care product purchasing. This leads to the first hypothesis:

H1: Environmental sustainability has a positive influence on consumers to purchase green personal care products in Bangladesh.

2.2 Economic Sustainability

Sustainable development should be construed as economic growth that has been made more equitable and environmentally suitable. Schmidheiny (1992) alerts us to the illusive suggestion that sustainable development is a chore for developing nations only: but development is more than growth or quantitative change. The World Business Council for Sustainable Development (Adams, 2008) brings together through economic growth, ecological balance and social progress.

H2: Economic sustainability has a positive influence on consumers to purchase green personal care products in Bangladesh.

2.3 Societal Sustainability

Societal sustainability occurs when a person's action or thought is influenced by third party. According to Lee (2008), social influence was found to be the most important predictor in his study of purchasing behavior of Hong Kong consumers. Govt. in turn must keep up the pressure to comply with environmental standards that society at large can set as appropriate for better quality of life (Saha and Darnton, 2005)

H3: Societal sustainability has a positive influence on consumers to purchase green personal care products in Bangladesh.

2.4 Health Sustainability

Now a day's the awareness on green product by the people has increased which shows the importance of green products. It is not only because of awareness, it is also because of the bad impact on human health (Rajasekararn et al 2013). Artificial fertilizers, manures and pesticides create problem even causing cancer.

H4: Health sustainability has a positive influence on consumers to purchase green personal care products in Bangladesh.

2.5 Green Promotion

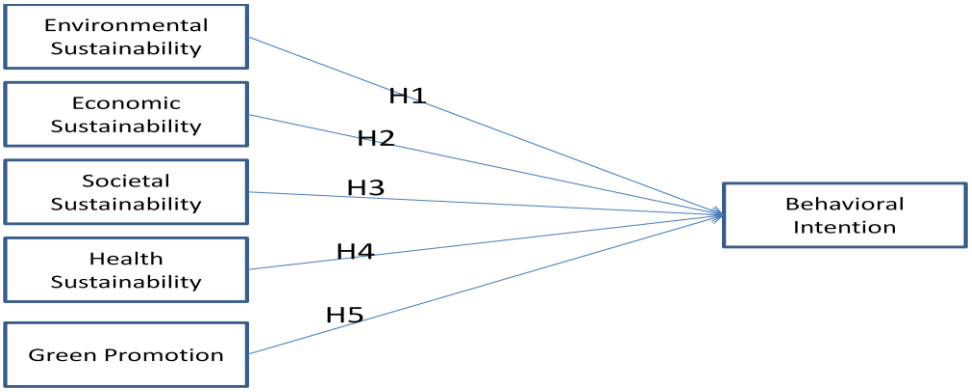
Muhammad et al (2013) has mentioned that green advertising plays an important role in the maximum sale of the companies. Green promotion is doing significant part in enhancing the sale. Weng et al. (2013) found that

most consumers reported that they are aware of the existence of advertisements.

H5: Green promotion has a positive influence on consumers to purchase green personal care products in Bangladesh.

2.6 Variable Identification

The present researchers examined five independent variables mentioned above (environmental sustainability, economic sustainability, societal sustainability, health sustainability and green promotion) against the dependent variable behavioral intention to purchase green personal care products.



3. Methodology

a. Measurement Instruments

The authors developed the measurement items from prior studies to ensure the validity of all measures. The detailed items of each construct and their references are shown in the following table.

Table 1: Summary of Construct with Measurement Items

Construct	Statement	Ref.
Environmental Sustainability (ENS)	ENS1. I purchase green personal care products because it is environment friendly	Ahmad et al. (2010), Lee et al., (2011)
	ENS2. I like to purchase green personal care products because it satisfies my long lasting needs.	
	ENS3. I prefer to purchase green personal care products because the green firms utilize natural	

Construct	Statement	Ref.
	resources properly.	
	ENS4. I purchase green personal care products because the packaging material is recyclable.	
	ENS5.I intend to purchase green personal care products because the production process of this product is eco-friendly.	
Economic Sustainability (ECS)	ECS1. I purchase green personal care products because the price is less than the traditional product.	Saxena et al., (2010)
	ECS2. I like to purchase green personal care products because the green firms maintain competitive pricing to their customers.	
	ECS3. I prefer to purchase green personal care products because the profitability affects economic growth of our country.	
	ECS4. I also intend to purchase green personal care products because the green firms are creating employment opportunities.	
	ECS5.I purchase green personal care products because green firms emphasize on reduction of resource wastage.	
Societal Sustainability (SCS)	SCS1. I purchase green personal care products because it is good for mankind.	Saha and Darnton, (2005), Chan, (2013)
	SCS2. I like to purchase green personal care products because it reduces anxiety about side effects.	
	SCS3. I intend to purchase green personal care products because it enhances sustainable social life.	
	SCS4. I prefer to purchase green personal care products because it is reliable than conventional product.	
	SCS5.I purchase green personal care products because it increases social awareness.	
Health Sustainability (HES)	HES1. I always prefer to purchase green personal care products because it has no side effects as it is not using any artificial ingredients or chemicals.	Major R. Rajasekararn et al (2013).
	HES2. I intend to purchase green personal care	

Construct	Statement	Ref.
	products because it is easy to adopt.	
	HES3. I prefer to purchase green personal care products because it is good for long-term use.	
	HES4. I also purchase green personal care products because it is eco-efficient and trust worthy for better health.	
	HES5.I think to purchase green personal care products because it provides more health related value than conventional products.	
Green Promotion (GRP)	GRP1. Campaign of green personal care products encourages me to purchase green personal care product.	Weng, 2013, Jacob and Jolly, 2012
	GRP2. Green Promotion is important to enhance sales volume of green personal care products.	
	GRP3. Green promotion has a positive influence on consumers to purchase green personal care products.	
	GRP4. Campaign of green product encourages customers to take part in positive environmental actions.	
	GRP5.Green promotion increases awareness about green personal care products.	
Behavioral Intention to Purchase (BIP)	BIP1. I will purchase green personal care products regularly	Chan, (2013)
	BIP2. I will purchase green personal care products in near future	
	BIP3. I will purchase green personal care products because it is good for health.	

3.1 Questionnaire Design and Data Collection

A well structured questionnaire was developed in English and divided into part A and part B. Part A consists of total 25 items under 5 dimensions presented in the research model, shown in Table 1, using 7-point Likert scale ranging from "1 = strongly disagree" to "7 = strongly agree". Part B contains the demographic information of respondents. Here respondents were asked information about their age, gender, occupation, last education, and monthly income. A pilot study was conducted from 20 selected senior faculty members of Business from the University of

Dhaka, Bangladesh University of Professionals (BUP) and Bangladesh University of Business and Technology (BUBT) to test the effectiveness and appropriateness of the questionnaire. The reason for selecting them is their technical knowledge, and experience in using the green personal care products. The feedback from the pilot study was used to review and finalize the questionnaire with specific adjustments.

There is a considerable variation in the opinions observed in the literature in regard to the selection/calculation of optimum sample size in different types of statistical analysis (Hoque and Sorwar, 2017; Hair et al., 1998). For example, statistical analysis including structural equation modeling (SEM) recommends sampling of 200 as fair and 300 as good (Hoque and Sorwar, 2017 and Kline, 2015). Hair et al. also recommended a sample size of 200 to test a model using SEM. In Hoelter, 200 was suggested as a 'critical sample size' that can be used in any common estimation procedure for valid results (Hoque and Sorwar, 2017 and Hoelter, 1983. Roscoe reported that in a multivariate research, such as multiple regression analysis, the sample size should be at least 10 times the number of items in the study (Hoque and Sorwar, 2017 and Roscoe, 1975). In this study, the proposed multivariate regression model consists of 28 items including both independent and dependent variables. Moreover, 342 respondents were interviewed by using convenience sampling technique as survey instrument. Convenience sampling is "a type of non-probability sampling which involves the sample being drawn from that part of the population which is close to hand" (Hoque 2016, Ritchie J et al. 2003). Moreover, it is cost effective and has been widely used in (Information Systems (IS) research (Hoque 2016, Eze UC et al. 2011).As per Roscoe and previous studies, a sample size of 300 was selected in this study for data analysis using SEM (Hoque and Sorwar, 2017 and Roscoe, 1975).

Prior to commencing the research, ethical approval was sought and obtained from the Faculty of Business, Bangladesh University of Business and Technology (BUBT) as more information was collected from students of BUBT. The authors also contacted the Dean of Faculty of Business and the Director of BUBT Research Center to seek permission to collect data from students. All participants in the research were given information sheets which clearly explained the purpose of the study. Respondents were also made aware of their rights to withdraw participation at any time during the study. Respondents were also made aware of the fact that they may request the findings of the research once it is completed. The survey was conducted in June-July 2018. The population includes the people who

live in Dhaka City of Bangladesh and use green personal care products. Dhaka City Corporation is the largest and most populated urban territory developed around a central place of Dhaka, the capital city of Bangladesh. It is associated with the task of running the affairs of the city Dhaka and covers a population of about 9 million (Hoque and Sorwar, 2017). The questionnaires were personally distributed to the individuals who were willing to participate and instructed them to fill up the questionnaire.

3.2 Data Analysis

Data were analyzed by using the Partial Least Squares (PLS) method, a statistical analysis technique based on the Structural Equation Modeling (SEM), to test and validate the proposed model and the relationships among the hypothesized constructs. SEM is a widely accepted paradigm to measure the validity of theories with empirical data (Hoque and Sorwar, 2017; Gotz et al. 2010). Smart PLS software, one of the well-known software applications for PLS-SEM, was used to analyze the data (Hoque and Sorwar, 2017; Hair et al. 2013). It is an extensive statistical representation of general linear modeling. One of the notable applications of SEM is that it can be applied to explore out the relationships among latent constructs and which are indicated by multiple measures. SEM is composed of two the evaluation of twin models: measurement model and a path model. Path models is an extensive form of multiple regression model in which various multiple regression are estimated concurrently (Hoque, 2016, Cohen et al. 2013). In addition to that path analysis can be regarded as a special case of SEM in which the structural relations among latent variables are molded. The collected data from filled questionnaire were input into Microsoft excel and imported into Smart PLS software for statistical analysis. However, the frequency distribution of the respondents was done by using Statistical Packages for Social Sciences (SPSS) versions 23.

4. Data Analysis and Results

4.1 Demographic Characteristics of Sample

The researchers distributed 388 questionnaires, of which 342 were received, completed for further analysis and 15 incomplete questionnaires were excluded from the study. The demographic characteristics of respondents are presented in Table 2 and it shows that 49.1% males and 50% females participated in the study. So, there was no major gap between the genders of respondents. The majority of respondents (50%)

were aged between 21 and 30 years. Most of the respondents' (73.7%) last education was bachelors. Almost 60.5% participants were service holders, where 34% respondent's incomes were ranging from 15001-30000.

4.2 Measurement Model

In this study, the validity and reliability of the measures have been examined before testing the hypothesis. The reliability was assessed by considering Cronbach's alpha and composite reliability. The reliability is considered to be satisfactory when composite reliability and Cronbach's alpha have the value greater than 0.70. Convergent validity is considered to be satisfactory when measurement constructs have an average variance extracted (AVE) of at least 0.50 and items loading are well above 0.50 (M. R. Hoque 2016 and J.F. Hair Jr et al. 1995). Table 3 presents the composite reliability, Cronbach's alpha and average variance extracted (AVE), while Table 4 shows the item loading. The measurement model was evaluated by probing the internal reliability, convergent and discriminant validity (Hoque and Sorwar, 2017; Hair et al. 2013). The internal reliability was assessed considering Cronbach's alpha (α) and composite reliability where the level of 0.70 is an indicator for acceptable internal consistency (Hoque and Sorwar, 2017; Hair et al. 1998). Convergent validity was appraised by an average variance extracted (AVE) and items loading with at least 0.50 of AVE for construct validity (Hoque and Sorwar, 2017; Hair et al.). The loadings, AVE, composite reliability and Cronbach's alpha (α) are presented in Table 3.

It can be seen from the Table 3 that the calculated Cronbach's alpha (α) values ranged from 0.7239 to0.9599 and composite reliability values ranged from 0.8430to 0.9689, which suggests strong internal reliability. Table 3 also shows that the estimated constructs loading ranged from 0.7850 to 0.9500 and AVE ranged from 0.6417 to 0.8617 are larger than the recommended levels. Hence, the situations for convergent validity are fulfilled in this study. Moreover, The values of all factor loadings shown in Table 5 in confirmatory factor analysis of the measurement model surpassed 0.5 and were significant at 5 percent level of significance (p = 0.05). In contrast, in this study, the researchers also assessed the discriminant validity by the square root of the AVE and cross loading matrix. The square root of the AVE of a construct should be greater than its correlation with other constructs for satisfactory discriminant validity (Hoque and Sorwar, 2017). The diagonal elements must be larger than the entries in corresponding columns and rows to satisfy discriminant validity (Hoque and Sorwar, 2017). The results shown in Table 4 reveals that all constructs in this study confirm the discriminant validity of the data.

4.3 Hypothesis Testing

The structural model was established to recognize the relationships among the constructs in the research model. This paper examined the relationship between dependent and independent variables by path coefficient (β) and *t*-statistics. The PLS results for the structural model are shown in Table 5.The results show that the relationships between ENS and BIP (t = 4.514, β = 0.264, p <0.05), ECS and BIP (t = 2.944, β = 0.127, p < 0.05), SCS and BIP (t = 2.522, β = 0.158, p < 0.05), HES and BIP (t = 4.973, β = 0.283, p < 0.05) and GRP and BIP (t = 3.556, β = 0.156, p <0.05)were significant. Thus H1, H2, H3, and H4, and H5 all the hypotheses were supported in the existing study.

5. Discussion

This study applied the conceptual model to determine the consumers' 'behavioral intention to purchase the green personal care products. The empirical findings have provided insights into the constructs such as ENS, ECS, SCS, HES and GRP are influencing the respondents to use green personal care products of Bangladesh. Hence, all the variables have statistically significant impacts on the sustainable development through green products. The study provides empirical support for the hypotheses proposed in relation to Behavioral Intention to Purchase (BIP).The findings are consistent with the results of previous studies. The five constructs are important for marketers in a number of important ways. For example, the first one is **Environmental Sustainability (ENS)** which comprises of five elements (shown in Table 1: measurement items). The t value of ENS (shown in table 5) indicates that the first hypothesis 'Environmental sustainability has a positive influence on consumers to purchase green personal care products in Bangladesh' is supported and there is a significant and positive relationship between Environmental Sustainability (ENS) and Behavioral Intention to Purchase (BIP) the green personal care products. Christopher, Get all. (2008) found that environmental consciousness have positive impacts on consumers' purchasing decision on green products. One of the studies of Rizwan, Met all revealed that the perceived environmental responsibility has the strong positive relationship with the green purchase intention. In the second hypothesis, the t value of **Economic Sustainability (ECS)** also suggests the positive relationship between Economic Sustainability (ECS) and Behavioral Intention to Purchase (BIP) the green personal care products and this hypothesis 'Economic sustainability has a positive influence on

consumers to purchase green personal care products in Bangladeshi's supported too. The third, the hypothesis of **Societal Sustainability (SCS)** 'Societal sustainability has a positive influence on consumers to purchase green personal care products in Bangladesh' is supported as the t value meets the requirements and there is a positive relationship between Economic Sustainability (ECS) and Behavioral Intention to Purchase (BIP) the green personal care products. The fourth one, **Health Sustainability (HES)** embraces a greater t value which directs to support the fourth hypothesis 'Health sustainability has a positive influence on consumers to purchase green personal care products in Bangladesh' and specifies the significant relationship between Economic Sustainability (ECS) and Behavioral Intention to Purchase (BIP) the green personal care products. Likewise, the final construct, **Green Promotion (GRP)** has also a significant relationship with the Behavioral Intention to the green personal care products of Bangladesh as the t value supports this hypothesis 'Green promotion has a positive influence on consumers to purchase green personal care products in Bangladesh'.

6. Implications

The findings of this study offer significant contributions to the green consumers, policy makers, and green marketers who are directly and indirectly involved in producing and consuming green products in Bangladesh. It can be assumed that this study is the first effort developing the constructs with sustainability concepts along with green product items with specific variables, i.e., environmental, economic, societal, health sustainability, and green promotion and empirically testing them to validate their applicability in purchasing green personal care products in context of a developing country like Bangladesh. The study finds that the conceptual model makes a significant contribution to the literature in that it is one of the few to investigate the sustainable factors influencing the purchase of green personal care products among the green consumers in the context of developing nations. The findings of this study offer practical implications for the benefits of improving the quality of the traditional products in the context of a developing country. In this paper, the empirical findings provide practical guidelines to the successful marketing of green personal care products and increasing the intention to purchase it in developing countries. With an increased knowledge of the consumer perception of green personal care products, an expected benefit for green products' manufacturers and marketers is to understand the challenges/issues in regards to the sustainable design, packaging, and

successful marketing of green personal care products in Bangladesh. Furthermore, due to a generic approach, the findings of this study could be easily modified to assist other developing countries in the planning and up-take of producing and serving the green consumers.

7. Limitations and Future Research Directions

There are some limitations in this study. Firstly, in this study the authors surveyed only Dhaka city; other urban areas in Bangladesh may cause some concern about the generalizability of the findings. Future research should give more concentration to mostly poor and uneducated people of Bangladesh who have little understanding about green products. Secondly, this study employed convenience sampling method as the survey instrument which may be the non-representative of the entire population and results may be biased. Although, there are some limitations, this paper is the milestones and future scope for researchers in developing countries to understand the sustainable production and consumption of green personal care products and identifying the factors that influence the green consumers purchasing of this products. Identified factors in this article can provide necessary assistance to the development and design of green products. New product manufacturers and marketers should concentrate in designing their products that are easy to use and have considerations of sustainability issues. National, multinational, and Fast Moving Consumer Goods (FMCG) organizations can provide adequate training and support to their employees and take initiatives to increase green promotion for its stakeholders to make aware in marketing and purchasing green personal care products. Government should provide a facilitating environment where citizens are encouraged to buy and use/consume green personal care products.

8. Conclusion

This study attempts to identify the factors that influence purchasing green personal care products for sustainable development of a developing country like Bangladesh. The study found that environmental, economic, societal, health sustainability, and green promotion significantly influence the green consumer's behavioral intention to purchase green personal care products. The results of the study, in the same way, statistically found that there are significant relations between the five independent variables and one dependent variable consumers' behavioral intentions to use green personal care products. The results are consistent with some other studies

that the findings truly reflect on the environment, economic, societal, and health sustainability, and green promotion aspects of developing countries like Bangladesh. The findings of the study contribute to the body of research informing concept of green products, green personal care products, its design and development to maximize its awareness and purchase intention of these products in developing countries. The findings provide some valuable information for sustainable development through personal care of green products 'producers, product planners, marketers and policy makers to develop strategy and policy for the successful marketing and implementation and acceleration of the green personal care products' acceptance among the green consumers/end users in a developing environment such as Bangladesh.

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Appendices

Table 2: Demographic characteristics of Respondents

Variables	Description	Frequency	Percentage
Age	21-30 31-40 41-50	171 147 24	50 43 7
Last Education	Below SSC SSC HSC Bachelor Masters	9 6 69 252 6	2.6 1.8 20.2 73.7 1.8
Gender	Male Female others	168 171 3	49.1 50.0 .9
Occupation	Students Businessmen Service holder Housewife Others	99 18 207 15 3	28.9 5.3 60.5 4.4 .9
Monthly income	Below 15000 15001-30000 30001-45000 45001-60000 Above 60000	99 117 93 30 3	28.9 34.2 27.2 8.8 .9

Table 3: The Measurement Model

Constructs	Items	Loadings	AVE	CR	Cronbach's alpha
Environmental Sustainability (ENS)	ENS1	0.8760	0.7632	0.9416	0.9223
	ENS2	0.8660			
	ENS3	0.8670			
	ENS4	0.8480			
	ENS5	0.9190			
Economic	ECS1	0.8830	0.7984	09519	0.9370

Constructs	Items	Loadings	AVE	CR	Cronbach's alpha
Sustainability (ECS)	ECS2	0.8990			
	ECS3	0.9020			
	ECS4	0.9010			
	ECS5	0.8830			
Societal Sustainability (SCS)	SCS1	0.9000	08059	0.9540	0.9397
	SCS2	0.9040			
	SCS3	0.9030			
	SCS4	0.8610			
	SCS5	0.9180			
Health Sustainability (HES)	HES1	0.9170	0.8388	0.9630	0.9518
	HES2	0.9200			
	HES3	0.9040			
	HES4	0.8880			
	HES5	0.9500			
Green Promotion (GRP)	GRP1	0.9090	0.8617	0.9689	0.9599
	GRP2	0.9360			
	GRP3	0.9390			
	GRP4	0.9110			
	GRP5	0.9460			
Behavioral Intention to Purchase (BIP)	BIP1	0.8160	0.6417	0.8430	0.7239
	BIP2	0.7850			
	BIP3	0.8020			

AVE: Average Variance Extracted, CR=Composite Reliabilit

Table 4:Correlation matrix and square root of the AVE.

	BIP	ECS	ENS	GRP	HES	SCS
BIP	0.801					
ECS	0.3803	0.8983				
ENS	0.5598	0.2935	0.8736			
GRP	0.3939	0.2672	0.2597	0.9282		
HES	0.5724	0.2787	0.4876	0.3127	0.9158	
SCS	0.5247	0.3564	0.5134	0.3061	0.4918	0.8977

Table 5:Factor loadings

	BIP	**ECS**	**ENS**	**GRP**	**HES**	**SCS**
BIP1	**0.816**	0.3348	0.4739	0.3602	0.5428	0.4558
BIP2	**0.7846**	0.3243	0.4884	0.3446	0.4344	0.4249
BIP3	**0.8023**	0.2379	0.3622	0.2165	0.3728	0.3657
ECS1	0.3187	**0.8828**	0.2343	0.2734	0.2149	0.3061
ECS2	0.2972	**0.8986**	0.2517	0.2838	0.2011	0.3096
ECS3	0.3623	**0.9017**	0.3034	0.2118	0.2849	0.3491
ECS4	0.3782	**0.9014**	0.2651	0.2176	0.2685	0.3145
ECS5	0.3307	**0.8829**	0.2505	0.219	0.264	0.3099
ENS1	0.4952	0.2394	**0.8759**	0.2439	0.4438	0.4467
ENS2	0.468	0.2683	**0.8665**	0.2361	0.4151	0.4567
ENS3	0.4747	0.2698	**0.8674**	0.1771	0.4202	0.4114
ENS4	0.4662	0.2759	**0.8477**	0.2326	0.3943	0.4545
ENS5	0.5363	0.2338	**0.9095**	0.2433	0.4535	0.4726
GRP1	0.371	0.2477	0.2351	**0.9089**	0.3068	0.2958
GRP2	0.3805	0.2861	0.2394	**0.9362**	0.2841	0.2874
GRP3	0.3946	0.231	0.2709	**0.9385**	0.3012	0.3025
GRP4	0.302	0.2426	0.2217	**0.9108**	0.2683	0.2438
GRP5	0.3674	0.2327	0.2338	**0.9465**	0.2875	0.2835

	BIP	ECS	ENS	GRP	HES	SCS
HES1	0.5041	0.1957	0.4405	0.2475	**0.9166**	0.4137
HES2	0.5364	0.2615	0.4441	0.2985	**0.9199**	0.4478
HES3	0.5437	0.2838	0.426	0.304	**0.9036**	0.4825
HES4	0.4965	0.2679	0.4256	0.3081	**0.8883**	0.4297
HES5	0.5374	0.2646	0.4952	0.2732	**0.9498**	0.4748
SCS1	0.4705	0.3114	0.485	0.22	0.4296	**0.9**
SCS2	0.488	0.3194	0.456	0.3075	0.437	**0.9035**
SCS3	0.4912	0.3529	0.4774	0.2683	0.4465	**0.9032**
SCS4	0.4297	0.297	0.4154	0.288	0.4391	**0.8614**
SCS5	0.4723	0.3165	0.4676	0.2913	0.4563	**0.9194**

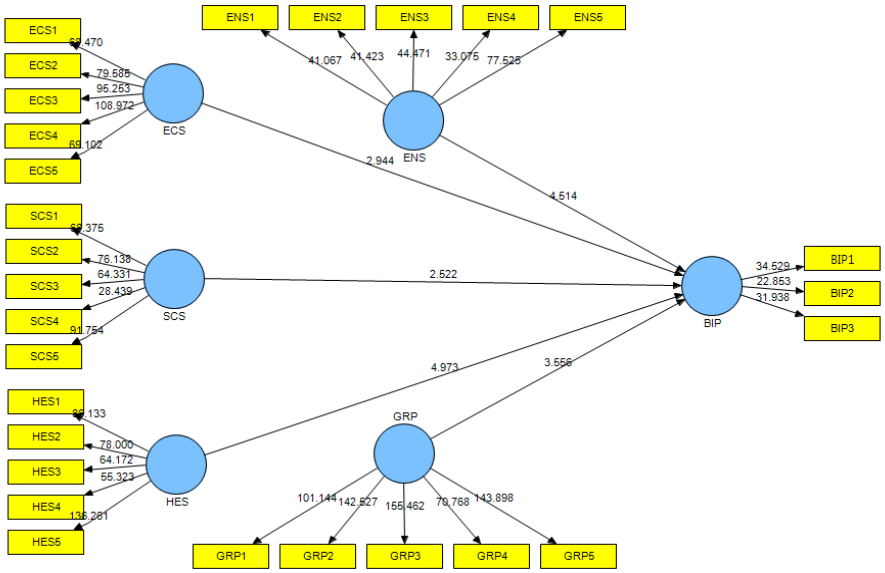

Figure 1: Structural Equation Modeling Results

Table 6: The Structural Equation Model (Hypotheses Testing Results)

Hypothesis	Path	B	t-Statistics	Comments
H1	ENS -> BIP	0.264	4.514	Supported
H2	ECS -> BIP	0.127	2.944	Supported
H3	SCS -> BIP	0.158	2.522	Supported
H4	HES -> BIP	0.283	4.973	Supported
H5	GRP -> BIP	0.156	3.556	Supported

Significant at $P < 0.05$

Questionnaire

Dear Respondent,

The following survey is to assess the sustainable development through green personal care products in developing country like Bangladesh. This effort is totally for the purpose of academic attainment. Your opinion will remain confidential and will not be used for commercial purpose. Thank you in advance for your valuable time and co-operation. Mark the following statements based on your opinion with tick mark (√). Where, 1=Strongly Disagree; 2= Disagree; 3= Moderately Disagree, 4= Neither Disagree nor Agree; 5= Moderately Agree, 6= Agree, 7= Strongly Agree.

A. Opinion against each statement

Items	Statement	1	2	3	4	5	6	7
Environmental Sustainability (ENS)								
ENS1	I purchase green personal care products because it is environment friendly							
ENS2	I like to purchase green personal care products because it satisfies my long lasting needs.							
ENS3	I prefer to purchase green personal care products because the green firms utilize natural resources properly.							
ENS4	I purchase green personal care products because the packaging material is recyclable.							
ENS5	I intend to purchase green personal care products because the production process of this product is							

	eco-friendly.							
Economic Sustainability (ECS)								
ECS1	I purchase green personal care products because the price is less than the traditional product.							
ECS2	I like to purchase green personal care products because the green firms maintain competitive pricing to their customers.							
ECS3	I prefer to purchase green personal care products because the profitability affects economic growth of our country.							
ECS4	I also intend to purchase green personal care products because the green firms are creating employment opportunities.							
ECS5	I purchase green personal care products because green firms emphasize on reduction of resource wastage.							
Societal Sustainability (SCS)								
SCS1	I purchase green personal care products because it is good for mankind.							
SCS2	I like to purchase green personal care products because it reduces anxiety about side effects.							
SCS3	I intend to purchase green personal care products because it enhances sustainable social life.							
SCS4	I prefer to purchase green personal care products because it is reliable than conventional product.							
SCS5	I Purchase green personal care products because it increases social awareness.							
Health Sustainability (HES)								
HES1	I always prefer to purchase green personal care products because it has no side effects as it is not using any artificial ingredients or chemicals.							
HES2	I intend to purchase green personal care products because it is easy to adopt.							
HES3	I prefer to purchase green personal care products because it is good for long-term use.							
HES4	I also purchase green personal care products because it is eco-efficient and trust worthy for better health.							

HES5	I think to purchase green personal care products because it provides more health related value than conventional products.							
Green Promotion (GRP)								
GRP1	Campaign of green personal care products encourages me to purchase green personal care product.							
GRP2	Green Promotion is important to enhance sales volume of green personal care products.							
GRP3	Green promotion has a positive influence on consumers to purchase green personal care products.							
GRP4	Campaign of green product encourages customers to take part in positive environmental actions.							
GRP5	Green promotion increases awareness about green personal care products.							
Behavioral Intention to Purchase (BIP)								
BIP1	I will purchase green personal care products regularly							
BIP2	I will purchase green personal care products in near future							
BIP3	I will purchase green personal care products because it is good for health.							

B. Demographic information (please, put a tick mark in appropriate box)

Age		**Last Education**		**Gender**		**Occupation**		**Monthly Income (BDT)**	
Below 20	i	Below SSC	i	Male	i	Students	i	Below 15000	i
20-30	ii	SSC	ii	Female	ii	Businessmen	ii	15000-30000	ii
30-40	iii	HSC	iii	Other	iii	Service holders	iii	30000-45000	iii
40-50	iv	Bachelor	iv			Housewife	iv	45000- 60000	iv
Above 50	v	Masters	v			Others	v	Above 60000	v
		MPhil/PhD	vi						

Thank You

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