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Bogra-5842, Bangladesh
Phone: +88 051 51001, 051 78602, 051 78603
Fax: +88 051 78615
Cell: +88 01713 200938, 01199 650367
Email: dgrda.bogra@yahoo.com
Web: www.rda.gov.bd

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Chandkarim Sarbik Gram Unnayan Samabaya Samity Limited : A Case Study

Md. Habibur Rahman[1]

Abstract

The report highlights the impacts of different activities of Comprehensive Village Development Programme (CVDP) on socio-economic condition of the members of Chandkarim Sarbik Gram Unnayan Samabaya Samity formed under CVDP. It is a primary cooperative society having multi-dimensional activities. It dreams to become self-reliant with their own. So it opens its door for all people of the village irrespective of class and professions. They have been able to accumulate an investable capital by which they operate their credit programme. Training plays a vital role to make them aware and use of skill and technology. Training and their own fund together have created huge opportunities of employment and income generation. They procure support and services from the upazila level department. That means, the cooperative has been able to build a linkage with the nation building departments of the upazila. This is how Chandkarim cooperative society becomes self-managed self-financed and self-driven organization.

1 Joint Director
Rural Development Academy (RDA), Bogra

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Introduction

The Co-operative Movement in this Sub-continent was launched in 1904 with a view to reduce poverty through providing credit to the small farmers, landless, artisans and so on. Under the Co-operative Act and Rules some organizations like Agriculture co-operatives, Weavers, Fishermen, Sugar-cane, Milk producers' co-operatives etc. were formed under direct supervision of the Department of Co-operatives. These traditional co-operatives could not bring significant breakthrough towards the qualitative change in life of the rural people. In the 1960's the two-tier co-operatives came into existence and accordingly Krishak Samabaya Samittee (KSS), Bittaheen Samabay Samittee (BSS) and subsequently some informal organizations were formed under Bangladesh Rural Development Board (BRDB). Besides, a huge number of groups or organizations were formed by the Non-Government Organizations. As a result of hasty formation of various village level organizations, a village has been divided into many parties or factions. Consequently, disparity among the villagers in lieu of unity and cohesion and assistance-dependent development culture have taken place. Comprehensive Village Development Programme (CVDP) has been emerged as best alternative to this traditional development approach. The strength of CVDP is the integrity among the villagers in the co-operative system. Comprehensive Village Development Programme was initiated by Bangladesh Academy for Rural Development (BARD), Comilla in 1975 in the name of `Total Village Development Programme' with a view to examine the concept of "one village one organization" in a village. The main thrust was given to mobilization of local resources and its utilization and training so that the villagers can be self-reliant irrespective of age, sex, class and professions.

The project was included in the 3rd FYP and renamed as `Comprehensive Village Development Programme'. During the Fourth FYP, Rural Development Academy (RDA), Bogra was involved with the implementation process of the project in 1991-92. At this stage CVDP was implemented by RDA and BARD in 40 villages each in Rajshahi and Khulna Divisions and Dhaka, Chittagong and Sylhet Divisions respectively. The Experimental Phase of the project was wound up in June 2004. During this phase CVDP was able to create some positive impact for the betterment of the rural people. With the intention of extending its results throughout the country, a series of discussions and seminars on potentials of CVDP were held in the Ministry of LGRD and Co-operatives and Planning Commission. Finally, the government was convinced to adopt CVDP as a model concept for rural development. It has been implemented under the aegis of Rural Development and Co-operatives Division of the Ministry of LGRD & Co-operatives. RDA, BARD, BRDB and Co-operative Department are working as implementing agencies. Presently CVDP covers 4275 villages of 66 Upazilas (sub district) throughout the country.

There formed 4275 Sarbik Gram Unnayan Samabaya Samity(Comprehensive Village Development Cooperative Society) one in each village. Main objective is to promote overall development of all segments of population of the village by bringing them under a single co-operative organization and thereby reduce poverty of them. It is expected that CVDP will contribute a lot to create comprehensive impact on socio-economic conditions of people in the project areas. To achieve this cherished goal, some general principles are followed as below:

সূচী
Contents

- One village one organization;
- Training and motivation;
- Developing capital base and launching self propelled credit programme; and
- Building linkage between village level organization and Nation Building Departments (NBDs.)

Based on the above backdrop, Chandkarim Sarbik Gram Unnayan Samabaya Samity formed in 2006 and registered in 2008 under the Cooperative Act and Rules. It is located in Sadullapur Upazila under the district of Gaibandha of Northern Bangladesh.

Objective

Expected that CVDP will contribute to create comprehensive impacts on socio-economic condition of the villagers. This report provides a pen-picture of Chandkarim Sarbik Gram Unnayan Samabaya Samity with especial focus on some indicators like mobilization, skill and technology transfer and social improvement of the cooperators.

Methodology

Data were collected from both primary and secondary sources. Some books, reports and registers were consulted. Primary data were collected through Focus Group Discussion (FGD) with the representatives of executive committee and some active members of the samity.

Findings

General information of the cooperative and cooperators

Chandkarim Sarbik Gram Unnayan Samabaya Samity was formed in 2006 and registered in 2008 under the Cooperative Act and Rules. This is a village based primary cooperative society covering the villagers of all classes and professions. Total population of Chandkarim village were 546 in 2006 having a family size of 3.64 (BMS,2006). Now it stands to about 650. Main economic activity is farming having 100.00 acres of cultivatable land. About 76% are literate and 14% illiterate; only 10% could sign their name (BMS 2006).

Chandkarim Sarbik Gram Unnayan Samabaya Samity started its activities nine years ago. The samity is supposed to enroll all the villagers irrespective of age, sex, class and professions. The trend of membership enrolment shows a gradual elevation in number throughout last several years. There are 147 (27% of total population) members from 109 households out of which women 55. At the beginning, members were only 23 (Table-1). Most of the members (40%) read up to primary level and 34% up to secondary level. Some 17% passed HSC and only 09% achieved the Bachelor degree.

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Table-1 : Membership enrolment of chandkarim cooperative society

Category of members	Periods			
	2006	2010	2015	total
Male	20	25	33	78
Female	3	20	32	55
Youth	-	4	10	14
Total	23	49	75	147

Source : Report of the Chandkarim cooperative society.

It was found that majority of members of Chandkarim cooperative are professionally involved in farming. More than 40% of the members are landless having a piece of land below 50 decimals. About 53% are small farmers and only 07% medium. There was no big farmers in the village. It means, the composition of membership is diversified and represented from all section of people.

Leadership

The Executive Committee of the society consists of nine members. Of them only three are women. Their age ranges from 22 to 40 years. Only the chairman of the society is 60 years old. Majority of them are small farmers. A total of six members read up to class IX, two higher secondary level and only the manager passed the BSS. The leadership is found literate, young and energetic.

Capital formation

The samity gives more importance to develop a capital base comprising shares and thrift deposits. According to the by-laws of the samity, a villager is to pay Taka 30/- including a share (of taka 10/-) to become a member of the cooperative. Rate of weekly savings deposits is minimal Tk.10/-. In this way the samity has been able to develop a total capital of Taka 6,89,500/- of which Tk. 1,20,000/- as paid up share capital. At the beginning the amount was only Taka 630/-. Of the total capital, male, female and associate (youth) members have owned Tk. 259000.00,Tk. 149000.00 and Tk. 15,500.00 respectively. The rest amount are admission fee, undistributed profit, various charges etc. This financial position has given the society a strong foundation based on which a self propelled micro-credit programme is being launched with their own capital.

Micro credit

CVD cooperatives give more importance on accumulating own capital so that they can use it as a primary source of credit. As such Chandkarim samity has launched their micro credit programme with a view that they could be more benefited and become self-reliant subsequently. A total of Taka 6,30,000/-has been disbursed to 67 cooperators during last year. The service charge is only 10%. The important avenues are beef fattening, poultry rearing, bio-gas production and supply, fish cultivation, sanitation, petty business, procurement of agricultural inputs etc. The loan realization rate is almost 100%. Managing Committee

mentioned that because of peer pressure proper utilization of loan was ensured and the loan recovery was found satisfactory.

The society hardly borrow money from outside source. They operate credit programme with their own. The members pointed out some advantages of this system of micro-credit which include :

- Easy access to credit.
- Low interest rate.
- Two way benefit-got soft loan and enjoyed dividend.
- No money drain out from the village.

Training

Training is given top priority in CVDP. Beneficiaries of Chandkarim Cooperative society are given both managerial and skill development training. Management training includes mainly Co-operative Acts and Rules, Leadership Development, Credit Management and Record Keeping. In addition, the project arranges different skill development training for the beneficiaries like poultry and cattle rearing, fish culture, vegetables and fruits production, health and sanitation, and vermy compost. Apart from these, women and unemployed youth are imparted training on tailoring, handicrafts, electrical house wiring, basic electronics, renewable energy etc. In total 63 co-operators of Chandkarim society received training on these issues. Training programme created a good deal of income opportunities.

Table-2 : Training areas and income

Name	Person	Duration	Income (Taka)
Tailoring	4		9,000/-
Plumbing & Pipe fitting	1	21	7,500/-
Solar panel	5		6,000/-
Electrical house wiring and mobile repairing	5		7,000/-
Beef fattening and fish cultivation	12		17,000/-
Mid wifery	4	3	2,100/-
Vermi compost	9		6,000/-
Bio fertilizer	18	4	13,000/-
Cooperative management, Climate change, environment protection	5	3	-
Total	**63**		**76,600/-**

Source : Training registers of the cooperative society and Interview.

Almost 100% of them was self-employed and being able to raise their income level. They also play a catalytic role in the village as per their training arena. Thus, a congenial atmosphere for development prevails at the village.

Out of 63 trained cooperators, 58 (92%) have been able to utilize their skill and knowledge achieved from training. It was reported that they earned a total amount of Taka 76,600/- per month (Table-2). It stands on an average Tk. 1,320/- per person. The profitable avenues are found tailoring, plumbing and pipe fitting, electrical house wiring and mobile repairing.

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Adoption of new technology

CVDP has a regular programme of training for technology transfer by which the cooperators can improve their livelihoods. Introduction of solar panel and production of vermi compost, tricho compost, bio-fertilizer and bio gas in Chandkarim samity brought a breakthrough to improve their overall standard of life. This cooperative purchased bio-gas technology from the Community Bio-gas Project implemented by Rural Development Academy (RDA), Bogra in 2012. From the biogas plant the society earned a net profit of Taka 9,43,000/- during last two consecutive years. It provided fulltime employment for three persons and part time for regular 12 persons. Twenty one households have been connected with bio-gas for house hold cooking and 22 with electricity. Some 62 households sale their cow dung to the bio gas plant. Thus, the cooperative and cow dung seller are benefitted each other.

Diversified uses of bio-gas has been ensured. The production of electricity, supply of water and bio-gas has brought a remarkable change in livelihood pattern of the villagers. Use of organic fertilizer has brought a change in farming system which, in turn help keep friendly environment. The use of organic fertilizer has been popularized and extended to adjacent villages and Upazilas as well.

The bio-fertilizer has got popularity among the farmers produced by the bio-gas scheme of Chandkarim society. Vermi compost has added a new momentum to this. Co-operators loudly said that yield has increased, production cost has decreased and the diseases of crops has declined than before.

Fisheries and livestock development

In Chandkarim Village there are six ponds. Now these ponds are brought under modern fish cultivation. Of those only one is operated by the cooperative. In all, three cooperators are provided training on modern fish cultivation technology. Four villagers got part time job in fish cultivation. Vermi compost is used as one of the important inputs of fish meal. Upazila Fisheries office provides technology and backup support for this purpose.

Similarly some mini farms of livestock were developed in the village. There are as many as forty cows under the bio-gas plant. Besides, another 400 cows were rearing individually by the villagers. At the beginning, the village had only 206 cattle so far. Upazila Livestock Department provides a series of vaccination on regular basis. In 2014-15, this cooperative society facilitated different vaccines to 1820 cattle and goats. Artificial insemination is a regular programme of the society.

Education

The society has motivated the school-aged children to enroll into the school. All school-aged children are sent to the school through motivation. Chandkarim Samity has already completed adult literacy programme for 60 cooperators in three batches. They can sign their name. Now the literacy rate stands at almost 100% while it was around 86% in 2006.

Health and sanitation

All the children under 05 years are brought under EPI. Women are found very enthusiastic in adopting birth control measures. Out of 150 eligible couples 99% used contraceptives. All

of them are female. Concerned Health visitor and Family Welfare Assistant of the Upazila play a vital role to facilitate the family planning materials to the community.

There are 150 households in samity area. Of those only 16 households used sanitary latrines at the inception (BMS,2006). Now the number has increased up to 150. That means 100% sanitation coverage has been ensured over the last six years. There is no open defecation while at the beginning it was. Slab and ring manufacturing unit of the samity play a direct role to maintain hygiene.

Linkage and social implications

Chandkarim society has been able to build up a working relation with the Nation Building Departments. NBDs have got a platform to work at the village. They facilitate their services to the villagers through using trained cooperators. Training has brought a positive change in their outlook and attitude towards education, health and sanitation, plantation, early marriage and dowry. They are sending their children to school, installing hand tube wells for safe drinking water and water-sealed latrine for defecation, producing vegetables to meet up their nutritional gap. All cooperators can sign their name. Mass education programme helped a lot to achieve this. The poor have become aware of their rights and role in the society. There are hardly filled cases in the police station. Because the cooperative society used to mitigate all social disputes at the office premise. They said that the social status of the co-operators has gone up.

Profit and dividends

Chandkarim CVD cooperative society made a net profit of Taka 78500/- in 2014-15. The Annual General Meeting declared 75% dividends. The rest 25% adjusted with reserve fund, cooperative development fund and other funds.

Observations

There is no major problem mentioned by the cooperators. Capital base is found not so strong. Sometimes leadership conflict appears at a mute pace. These should be taken care off. There also needs the increased rate of capital accumulation in order to make more investment. They are well motivated group of people. So they do not hesitate to adopt any new technology or skill. Very interesting thing is that they have established a Library in office of the cooperative society having more than 800 books. Newspapers are also kept. A total of 10 to 15 cooperators read books and daily news paper every day. This has contributed to develop a habit of cooperators in readings and learning.

Chandkarim society inherents some characteristics which lead to the sustainability as follows;

- Decisions are democratically taken at the community level and so a high degree of self regulation and peer pressure exists.
- No need for extensive external monitoring as progress regarding development initiative is already documented and self evident.
- Members become sector specific practitioners in their own right and so exist as a sustainable resource.
- Young leadership having three women of nine member executive committee.

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Conclusion

Chandkarim Sarbik Gram Unnayan Samabaya Samity is a grass-root level primary cooperative society having membership from all corners of the community. At the beginning, the villagers were found shaky, conservative and introverts. Under the purview of this cooperative there created a forum to come together and to do for themselves and the villagers as a whole. CVDP has facilitated motivation, training and other support-services and help them dream. Accordingly they tried to make changes their lot with their own. Leadership was observed dynamic. Thus, the inclusiveness of its activities has given a breakthrough for Chandkarim CVD cooperative society in shaping and making a model organization in Bangladesh.

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Growth Performance and Profitability of Mono-sex Tilapia Cultivation in Pond

Md. Nurul Amin[1]

Abstract

This paper is an outcome of research work of PGDRD course of RDA. The experiment was conducted to examine the growth performance and to calculate the profitability of mono-sex Tilapia cultivation in pond using two types of supplementary feed for a period of four months from July to October 2013. The study was carried out in six mini ponds of the Fish Hatchery Unit of the Rural Development Academy (RDA), Bogra each having water area of five decimal. The ponds under two treatments were stocked @ 150 mono sex tilapia fingerlings per decimal. The fingerlings were 30 days old and mean initial weight of 30.35±2 gm.. Commercially made floating pellet feed was supplied to the ponds under treatment -1 and homemade feed composed of 25% mustard oil cake and 75% rice bran was supplied to the ponds under treatment -2. In both the treatments fishes were fed @ of 5% of body weight throughout the whole experimental period. Other management was same for both the treatments. In treatment-1 and treatment-2, the average temperature were 30.50 °C and 31.25°C; transparency were 25 cm and 22 cm; p^H were 7.5 and 7.4 and dissolved oxygen content were 5.2 ml/l and 5.3 ml/l respectively. Average weight gain was 195.21 gm/fish and 140.40 gm/fish; average growth rate of individual fish was 1.62 gm/day and 1.17 gm/day in treatment 1 and treatment 2 respectively. The Specific Growth Rate (%/day) was found higher (2.18) in treatment -1 compared to treatment -2(1.93). The survival rate (%) of fish was 96% and 94% in treatment -1 and treatment -2 respectively. Production of mono-sex tilapia after four months was 3032 kg/acre in treatment -1 and 2196 kg/acre in treatment -2. Food Conversion Rario were 1.76 and 2.28 for treatment- 1 and treatment 2- respectively. The gross profit was obtained Tk.3,63,840.00/acre from treatment- 1 whereas it was Tk. 2, 19,600.00 from treatment- 2. Operational cost was Tk. 3, 05,566.00 for treatment -1 whereas it was Tk. 1, 69,566.00 for treatment- 2. The net profit was Tk. 58,274.00/acre and Tk. 50,034.00/acre from treatment -1 and- 2 respectively. The culture of mono sex tilapia using company made pellet type floating supplementary feed is more profitable than that of homemade supplementary feed composed of rice bran (75%) and mastered oil cake (25%), The commercial fish farmers who can invest sufficient fund in fish farming can use company made pellet type floating supplementary feed which will yield more production with more net profit. But the small and poor farmers who have no ability to invest more capital in fish culture can practice mono sex tilapia farming using homemade supplementary feed composed of rice bran (75%) and mastered oil cake (25%).

Note: *Three students of PGDRD course (2nd batch) Ms. Razia Khatun, Md. Alomgir Mondol and Md. Abdullah-Al-Mamun contributed a lot in conducted the field work of the experiment.*

1 Joint Director
Rural Development Academy (RDA), Bogra

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Introduction

Fisheries play a vital role in the socio-economic development of the peoples of Bangladesh. It is one of the fastest growing sectors of the economy. The fisheries sector accounted for about 4.43% of the gross domestic product (GDP) in 2010-2011 (DoF, 2012). This sector provides employment to about 1.4 million full-time (depending mainly on fishing) and 12 million part-time fishers (partly/seasonally depending on fishing) for livelihood and trade and another 3.08 million people are engaged in fish and shrimp farming both at subsistence and commercial level. Thus nearly 10% of the total population directly and indirectly depends on fisheries sector for their livelihood (Mazid, 2002). Fish has always been an important part of the diet of the people of Bangladesh. Nutritionally, fish provides about 63% of the total animal protein intake to the people of the country (DoF, 2009). It has emerged as a dynamic sector of the economy with a growth rate far in excess of other activities. Over the last two decades, fish cultivation or aquaculture has extended quite rapidly and since then there has been a dramatic increase in fish production. With increase in human population and diminished natural fisheries resources, aquaculture is rapidly gaining importance. Pond aquaculture is growing fast in many resource-constrained Asian countries including Bangladesh.

Tilapia is one of the most important freshwater fish in the world aquaculture. It is widely cultured in many tropical and subtropical countries of the world. By production volume, tilapia culture is one of the largest freshwater aquaculture species worldwide and is mostly produced using semi-intensive systems in developing countries (Thomas and Michael, 1999). Tilapia farming is widespread in many Asian countries including China, Indonesia, Philippines, Thailand and Vietnam due to its rapid growth, high market demand and increasing consumer acceptance (ADB, 2005b). With increasing popularity among consumers, tilapia has become the world's second most important cultured fish after carps. Tilapia has good resistance to poor water quality and disease, tolerance to a wide range of environmental conditions, ability to convert efficiently the organic and domestic waste into high quality protein, rapid growth rate and good flavour (Ballarin and Hallar, 1982)

There is a long history of tilapia farming in Bangladesh and it was expected that tilapia would act as a miracle fish in aquaculture (Nesar and Faisal, 2009). In order to meet the soaring demand for food, there is a huge potential of tilapia farming in Bangladesh. The tilapia (Oreochromis mossambicus) was introduced to Bangladesh from Thailand in 1954 (Ahmed et al., 1996). However, this species was not widely accepted for aquaculture because of its early maturation, frequently breeding and slow growth rate. Nile tilapia (O. niloticus), a far superior farmed tilapia (faster growing and more manageable than the Mozambique tilapia) was introduced to Bangladesh from Thailand by the UNICEF (United Nations International Children's Emergency Fund) in 1974(ADB, 2005b). But it was not established as a culture species due to lack of appropriate management practices. Later on, O. niloticus was again introduced into Bangladesh in 1986 from Thailand (Hussain, 2004) as previous stock of the two species had mixed. One of the problems faced by the farmers regarding culture of O. niloticus was it's prolific pond breeding resulting in over population leading to stunted growth(Gupta and shah,1992). The Bangladesh Fisheries Research Institute (BFRI)

reintroduced Nile tilapia and Red tilapia from Thailand in 1987 and 1988 (Gupta et al., 1992). Genetically improved Farmed Tilapia (GIFT) was introduced to Bangladesh by International Centre for Living Aquatic Resources Management ICLARM and BFRI in 1994 (Hussain et al., 2004). Performance of GIFT was found to be significantly superior to that of tilapia previously introduced. Technology was developed to produce all male tilapia or sex-reversed GIFT locally known as mono-sex tilapia, because of avoid unwanted reproduction. Male tilapia grows faster than female (ADB, 2005b).

Among the Southeast Asian countries, Bangladesh in particular abounds with hundreds and thousands of seasonal water bodies in the form of ditches, shallow ponds, road side canals and borrow pits which retain water for 4-6 months, where carp species cannot be cultured. No doubt, these water bodies have tremendous potential for aquaculture of fish species with short life cycle and characteristics of faster growth rate and require low input support (Hussain et al., 2000).

All male mono-sex Tilapia has good potential for the enhancement of production in the fishery sector of Bangladesh. Rapid growth rates, high tolerance to adverse environmental conditions, efficient feed conversion rate, resistance to disease and good consumer acceptance are making it popular to the fish farmers of rural and semi-urban areas of Bangladesh. In recent years mono sex Tilapia culture practice is increasing day by day in Bangladesh. Regular application of supplementary feed is essential for semi-intensive or intensive cultivation of mono-sex Tilapia. But the price of ingredients of supplementary feed and the readymade supplementary feed is increasing rapidly, and consequently, the profit margin derived from mono-sex Tilapia production is decreasing. Besides, most of the farmers who are small and poor have no ability to invest much for purchasing costly pellet type supplementary feed made by different company. These small and poor farmers usually apply low cost homemade supplementary feed compost of rice bran, oil cake etc. In this situation, it is imperative and demands of the time to find out the effect of different types of supplementary feed on growth of mono-sex Tilapia and profitability of mono-sex Tilapia cultivation. The findings of the study will be informative and useful for the farmers who are cultivating mono-sex Tilapia in their farms. The findings will also be useful to the other fish farmers in taking decision for selecting mono-sex Tilapia as culture species.

Objectives of the study

The broad objective of the study is to know the growth performance and profitability of mono-sex Tilapia cultivation in pond. The specific objectives of the study are to:

1. examine the growth rate of mono-sex Tilapia;
2. assess the effect of different types of supplementary feed on growth of mono-sex Tilapia;
3. calculate the profitability of mono-sex Tilapia cultivation in pond; and
4. identify the problems of mono-sex Tilapia cultivation.

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Materials and methods

Experiment site

The experiment was conducted in six experimental ponds each of five decimal water area, located adjacent to the Fish hatchery of the Rural Development Academy, Bogra. The study was carried out for a period of four months from July to October, 2013.

Pond preparation

As the ponds were already dried in the dry season, there were no undesirable fish, insect and other aquatic organism in the experimental ponds. There were some weeds which were removed manually. Lime was applied at a dose of 1 kg/decimal by spreading homogeneously in the ponds. Fertilization of the ponds was done with decomposed cow-dung, urea, and TSP (Triple Super Phosphate) @ 7 kg/decimal, 200gm/decimal and 100gm/decimal respectively. The water depth was maintained at a level of 1.2 - 1.4 m during the experiment period.

Experiment design and stocking

The experiment was conducted in six mini ponds with two treatments i.e. Treatement-1 and Treatement-2 having three replications. The ponds under both treatments were stocked @ 150 mono sex Tilapia fingerlings per decimal. The fingerlings of mono sex Tilapia of 30 days old and mean initial weight of 15.35±2 gms were taken from Rural Development Academy, Fish Hatchery, Bogra.

Post stocking management

Fertilization

After stocking of fingerlings, throughout the study period fertilization of the ponds was done fortnightly with decomposed cow dung, urea and triple super phosphate (TSP). Cow dung, urea and TSP were applied @ 3 kg/decimal 100 g/decimal and 50 g/decimal. Urea and TSP were applied after dissolving them in water in a bucket and then sprayed over the pond surface manually.

Feeding

Two treatments were conducted with two types of supplementary feed. Commercially made floating pellet feed was supplied to the ponds under treatment -1 and homemade feed composed of 25% mustard oil cake and 75% rice bran was supplied to the ponds under treatment -2. In both the treatments fishes were fed @ of 5% of body weight throughout the whole experiment period.

Water quality parameter monitoring

The four important water quality parameters such as water temperature, transparency, p^H and dissolved oxygen were monitored monthly throughout the study period. All samplings were done between 9:00-10:00 am. Water temperature and transparency were measured by

using Celsius Thermometer and a Secchi disk respectively. Water p^H and dissolved oxygen were measured using a pocket size p^H Meter (HANNA) and a commercial kit box (Model: FF-3, USA) respectively.

Growth and production monitoring

The growth and production of fishes were measured fortnightly through random sampling method. The weight of fish (in gm) was taken by using a portable balance (Model: OHAUS). Growth performance and feed conversion were measured in terms of final individual fish weight (g), survival rate (%), specific growth rate (SGR, % day -1), feed conversion ratio (FCR), and food intake (% body weight). Growth response parameters were calculated as follows:

I. Weight gain (g) = Mean final weight (g) - mean initial weight (g)
II. Average daily weight gain (g/day) = Total weight gain (g)/ Culture duration (days)
III. SGR (% day-1) = [(ln final weight – ln initial weight) / time (days)] X 100
IV. FCR = total dry feed fed (g) / total wet weight gain (g)
V. Feed intake = total dry feed fed (g/fish)
VI. Production = No. of fish harvested X final mean weight of fish

A simple economic analysis was done to estimate the net profit from different treatments.

Results and discussion

Water quality parameters

The results of the water quality parameters such as temperature, p^H, dissolved oxygen and transparency during the experimental period are presented in Tables -1.

Table -1: Average values of water quality parameters of pond under different treatments.

	Water Quality Parameters	Values	
		T1	T2
1.	Temperature (0C)	25.0	22.0
2.	Transparency (cm)	30.50	31.25
3.	p^H	7.5	7.2
4.	Dissolved Oxygen (mg/l)	5.2	5.3

Water temperature (°C)

The water temperature ranging from 25°C to 35°C is suitable for culture of fish (Aminul, 1996). In the present study the water temperature varied from 26.45°C to 31.60°C in different treatments which was favorable for fish culture. The mean values of temperature in treatment-1 and treatment-2 were 30.50°C and 31.25°C respectively. The lowest water temperature 26.45°C was found in fourth sampling at October in treatment-1 and the highest temperature 31.60°C was found in second sampling at August in treatment-2. Dewan et al., (1991) recorded the water temperature ranged from 29.3 to 34.0°C whereas Kohinoor (2000)

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observed the water temperature ranged from 24.2 to 33.3^{0}C. So the results of this study were within the range of the findings of above authors.

Transparency

Water transparency is generally expressed as the level of productivity of water body and also indicates the concentration of plankton in the water body. During the study period the water transparency varied from 16cm to 28cm in different treatments. The mean values of water transparency were 25 cm and 22 cm for treatment-1 and 2 respectively. The maximum value of transparency (28 cms) was recorded in first sampling at August in treatment-1 and the minimum value of transparency (16 cms) was recorded in fourth sampling at October in treatment -2. There was no significant variation of transparency among two treatments. The transparency of productive water bodies should be 40 cm or less. In the present experiment the water transparency values were within productive ranges. The present findings agreed with the findings of Kohinoor (2000) who recorded transparency values ranging from 15 to 58 cm. Wahab et al. (1995) found transparency ranging from 15 to 75 in poly-culture pond. Rahman (1992) concluded that the transparency of productive water bodies should be 40 cm or less.

Water p^H

Water p^H of the experiment ponds in different treatments was more or less similar. Almost neutral p^H values ranging from 7.2 to 7.6 were recorded in different ponds under two treatments. The mean values of water p^H were 7.5, and 7.4 in treatment-1 and treatment-2 respectively. The highest value of water p^H (7.6) was found in treatment-1 in third sampling at September, and the lowest water p^H (7.4) was found in treatment-2 in first sampling at July. The observed value of p^H (7.2 to 7.6) recorded in present study indicate that p^H in all treatments were within the range and suitable for fish culture. An acidic p^H of water reduces the growth, metabolism and other physiological activities of fishes. Kohinoor et al. (1998) reported p^H 7.2 to 7.3 in the research ponds of BAU Campus, Mymensingh. Rahman et al., (2012) recorded the mean values of water p^H in three treatments 7.26, 7.27 and 7.30 which were close to the present findings.

Dissolved Oxygen (DO)

Dissolved Oxygen is most important parameter of a cultured pond. Higher concentration of DO ensures higher growth of aquatic animals. Dissolved Oxygen concentration in different ponds was found to be very close in both the treatments. During the study DO contents of the water varied from 5.4 mg/l to 5.7 mg/l. The mean values of DO content obtained from treatment-1 and treatment-2 were 5.2 ml/l and 5.3 ml/l respectively. The maximum DO content 5.7 mg/l was recorded from a pond under treatment-2 at September, while the minimum DO content 5.4 mg/l was recorded from two ponds under treatment-1 at July. Dissolved oxygen content of a productive pond should be 5 ml/l or more (Rahman, 1992). Findings of the present study agreed with these recommended level. Rahman et al., (2012) reported that the DO contents of the water varied from 6.1 mg/l to 6.7 mg/l. in the experiment ponds.

Growth performance and production of mono-sex Tilapia

In the present study, final weight, daily weight gain (DWG), specific growth rate (SGR), survival rate, food conversion ratio (FCR) and production of mono-sex tilapia (Oreochromis niloticus) in the ponds were observed and calculated (table – 2). At the end of study period the mean weight of fish was 210.56 gm and 155.75 gm in treatment-1 and 2 respectively. The highest average growth rate 1.62 gm/day was found in treatment-1 whereas average growth rate 1.17 gm/day was found in treatment-2. SGR (%/day) was found higher (2.18) in treatment-1 compared to treatment- 2 (1.93). Within the study period of four months average weight gain was 195.21 gm/fish and 140.40 gm/fish in treatment-1 and treatment-2 respectively. The survival rate (%) of fish was 96% and 94% in treatmen-1 and 2 respectively. Production of mono-sex Tilapia within four months was 3032 kg/acre in treatment-1 and 2196 kg/acre in treatment-2. FCR were 1.76 and 2.28 for treatment-1 and treatment-2 respectively.

Table 2: Growth parameters of mono-sex Tilapia during the study period

Growth Parameters	Treatments	
	T1	T2
Initial mean weight (g/fish)	15.35	15.35
Final mean weight (g/fish)	210.56	155.75
Weight gain (g/fish)	195.21	140.40
Average daily weight gain (g/fish)	1.62	1.17
Specific Growth Rate (%/day)	2.18	1.93
Food conversion ratio (FCR)	1.76	2.28
Survival (%)	96	94
Total fish production from 15 decimal (kg)	454.80	329.41
Fish production (kg/acre/ 4 months)	3032	2196

Profitability of mono-sex Tilapia cultivation

The expenditure and profitability of mono-sex Tilapia cultivation are shown in table 3 and table 4 respectively. In the present study total operational cost was Tk. 45,835.00 for treatment-1, whereas it was only Tk. 25,435.00 for treatment-2. The higher cost was incurred for treatment-1 only because of supplementary feed. Other costs were same for both the treatments. The gross profit was obtained Tk.54, 576.00 from treatment-1 whereas it was only Tk. 32,941.00 from treatment-2. The net profit was Tk. 8,741.00 and Tk. 7,506.00 from treatment-1 and 2 respectively.

Table 3: Expenditure of mono-sex Tilapia culture in pond with two types of supplementary feed.

Item of expenditure	Cost (BDT)	
	T1	T2
Pond preparation	560.00	560.00
Fingerlings	1575.00	1575.00

Item of expenditure	Cost (BDT)	
	T1	T2
Supplementary feed (800kg X 48.00)	38,400.00	(750kg X 24.00)18,000.00
Fertilizer	1,300.00	1,300.00
Labour	2,000.00	2,000.00
Fish harvesting	1,200.00	1,200.00
Miscellaneous	800.00	800.00
Total expenditure	**45,835.00**	**25,435.00**

Table 4: Profitability of mono-sex Tilapia culture in pond.

Item	Treatments	
	T1	T2
Fish production (kg)	454.80	329.41
Selling price of fish (Tk/kg)	120.00	100.00
Gross profit from fish sale (Tk)	54,576.00	32,941.00
Total operational cost (Tk)	45,835.00	25,435.00
Net profit from 15 decimal (Tk)	8,741.00	7,506.00
Net profit (Tk/acre/4months)	**58,273.33**	**50,040.00**

Discussions

Growth performance and profitability of mono-sex Tilapia cultivation in pond using two types of supplementary feed was investigated in this experiment. Performance of pellet type and floating commercial readymade feed was compared to homemade traditional supplementary feed composed of rice bran (75%) and mustered oil cake (25%). It was found that at the end of the experiment final mean weight of fish, daily weight gain, specific growth rate (SGR%/ day), fish survival rate, feed conversion ratio (FCR), total fish production, total cost, total profit and net profit were higher in case of using commercial readymade floating feed. The fish production rate was 3,032 kg/acre in four months and net profit was Tk.58,273.33/acre for using commercial readymade floating feed. On the other hand, the fish production rate of 2,196 kg/acre and net profit of Tk. 50,040.00/acre in four months were obtained for using homemade supplementary feed composed of rice bran (75%) and mastered oil cake (25%). A total of 800 kg commercial readymade feed and 750 kg homemade supplementary feed was required for treatment-1 and 2 respectively. The price of commercial readymade feed was Tk 48.00/kg and homemade supplementary feed was Tk 24.00/kg. The operational cost of mono sex Tilapia culture using commercial readymade feed was 80.20 % higher than that of homemade supplementary feed. The results indicated that production rate and net profit of mono sex Tilapia culture using commercial readymade feed were 38.07% and 16.45% higher respectively than that of homemade supplementary feed. The results of the present study were compared with other authors. Chandra et al. (2013) found a production rate of 3,666 kg/acre in four months which is 20.91% higher than that of the present study Accordingly net profit (Tk 1, 42,190.00/acre in four months) obtained from the study of Chandra et al.,

(2013) was 29.90% higher than that of the present result. This might be due to the fact that the stocking density of the experiment culture was 250 fingerlings/ decimal. Besides, the soil and water of Mymensingh might be more fertile than that of Bogra.

Conclusion

The culture of mono sex Tilapia using commercial readymade floating pellet supplementary feed is more profitable than that of homemade supplementary feed composed of rice bran (75%) and mustered oil cake (25%). The culture of mono sex Tilapia using homemade supplementary feed required less amount of investment and the net profitable is also less. The commercial fish farmers who can invest sufficient fund in fish farming can use company made pellet type floating supplementary feed which will yield more production with more net profit. But the small and poor farmers who have no ability to invest more capital in fish culture can practice mono sex Tilapia farming using homemade supplementary feed composed of rice bran (75%) and mustered oil cake (25%).

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Business Opportunity of Trichoderma Composting Technology

Swagata Bagchi[1]

Abstract

The reckless use of synthetic chemicals along with restless cropping, high-yielding varieties, drought and salinity have resulted in to an utterly spoiled soil condition. The OM status has declined to 0.5–0.9% in some places while it should be near to 5% with good water retaining capacity Farmers apply these poisonous chemical directly on the fields without following proper caution thus attributing a serious health risk to the both producers and consumers. Apart from acute illness, various deadly chronic diseases are nesting in their bodies. On the top of that fertilized plants lure insects more which demands higher inputs of chemicals. Leachate of those flow down to the adjacent water bodies and destroy the aquatic life. The total ecosystem is getting discoursed. Trichoderma is an essential natural fungus which has a great virtue of decomposing all kinds of organic matter back to the soil. Consequently the OM status of soil escalates which means soil becomes more fertile. RDA scientists have successfully developed Trichoderma compost model. They have studied that Trichoderma compost are capable of reviving soil in field level. Besides, Tricho-compost can also minimize the need and use of the chemical fertilizer concurrently making the soil more fertile, good water retaining and enabling high crop yield. So in a capitalistic globalized world where rapid outreach of Trichoderma compost technology has no alternative but introducing it at commercial scale. By reviewing the above facts along with rural socio-economic condition, locally available technology, established organization and market, this paper has generated some idea for the extension of Trichoderma compost technology through business opportunity perspective.

1 Assistant Director
Rural Development Academy (RDA), Bogra

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Introduction

The population of Bangladesh is estimated at 158,512,570 as of July 1 2014 (*www.worldometers.info/world-population/bangladesh-population*). Now to guarantee food security for so many mouth population growths has to be restricted from its inclining course and production of food is to be increased in many folds. As a result the use of chemical fertilizer has to be increased so farmers of Bangladesh mostly depend on the chemical fertilizer for supplying plant nutrients to gr ow more food. But imbalanced application of those chemicals simultaneously depletes the soil nutrients leading to production decline as well as deterioration of physical and chemical properties of soil and also enhances loses of organic matter through leaching and transformation by other means.

Organic matter is considered the life of the soil and soil fertility. Therefore, the land without sufficient organic matter is generally labeled as dead soil meaning that it is incapable of producing any type of vegetation. The severe loss of organic matter in Bangladesh soil is posing a substantial threat to the future of farmers and the national food security. The results of soil tests in different parts of the country shows that, the average ratio of organic matter in 100 gm of soil has come down to below one gram aganist the minimum required level of above 5 gm To be more precise the ratio of organic matter in soil has decreased to even 0.6 percent in some places over the past 5-6 decades . The resulting drastic fall in fertility has been aggravated mainly by unplanned use of chemical fertilizers, increased cropping intensity, cultivation of more high yielding varieties, frequent drought, increase in salinity and adverse effect of climate change etc.

Most of the soil types of Bangladesg show an improved response when OM is incorporated along with inorganic fertilizers (*BARC, 1997*). But due to the lack of knowledge farmers are not providing adequate amount of quality organic fertilizers into the soil. It has been reported that organic fertilizer which contain living cell of different microorganisms can prevent the depletion of the organic matter and increases water retention capacity (*Jeyabal and Kuppuswamy, 2001*). It has also been reported that application of organic fertilizer increases yield and reduces environmental pollution (*Mia and Shamsuddin, 2010*). It is therefore a growing concern is a growing concern that the adoption of ecological farming practices can only reverse the declining trend in agricultural productivity and environmental protection (*Aveyard, 1988)* The household wastes , farmyard wastes agro-industrial wastes and farm wastes can be a great source of soil organic matter are available in the country.It is estimated that in cities and rural areas of Bangladesh nearly 700 million ton organic wastes is generated annually (*Brunner and Fellner., 2007*). Such large quantities of organic wastes generated also pose a problem for safe disposal. Most of these organic residues are burned currently or used as land fillings.

Composting of organic solid wastes can be a great alternative in the form of integrated municipal solid and agricultural waste management and, in particular, the diversion of biodegradable from land filling (*Bilitewski et. al., 2005*). At the post-consumer stage, this can be achieved by composting practices ranging from large-scale facilities to home (or yard) composting. Increasing costs for inorganic fertilizers also point towards the use of composting technology as an alternative. But the traditional way of composting is technically

defaulted and retains minimal amount of nutrients for the plants. So applying those in the lands ultimately accomplish nothing. What farmers need is a compost of good quality that has sufficient nutrients, attribute of bio-agent and decomposed within the shortest period of time and all of them could be found in tricho-compost, a bio-fertilizer that have a revolutionary potential in organic farming.

RDA is carrying out research on *Trichoderma* fungus for the last 03 years and they have developed *effective Trichoderma* activator for rapid composting of organic wastes.. It enhances the de-composition of organic materials and converted into quality compost within 4-5 weeks whereas the traditional method takes 3-5 months. It is also a potent biocontrol agent and used extensively for soil born diseases successfully against pathogenic belonging to various genera, *viz Fusarium, Phytophthora, Sclerotia, Phomopsis* etc. The Tricho-compost significantly increases soil fertility and gives better crop yield as for example more than 5-6 tons/ hectare than traditional production. RDA sciencetist and other researcher have found that it can also acts as bio-pesticide. It is well documented that the interaction of *Trichoderma* strains of tricho-compost with the plant may promote growth increase nutrient availability and enhances disease resistance (*Mia and Shamsuddin, 2010*). Tricho-compost also helps to breakdown and minimizing the toxic effects of pesticide and herbicide in soil. It helps to transform the inorganic matter into available plant nutrients. It increases the water holding capacity of soil for plants.

Justification of the study

The big advantage of making tricho-compost is the recycling of organic solid, agricultural and animal waste. It is environment friendly and costs effective. It can decrease the use and cost of chemical fertilizer, but is yet to be available at farmer's level. Thus extension of tricho-compost technology to the grass root level should get more concern. Production of trichocompost at commercial scale and marketing availability in the market would draw a better scenario in ensuring its use. What this paper tried here is to explore some business options and model to facilitate the extension of tricho-compost technology.

Objectives

a) General objectives

The sole purpose of this research is to explore and discover the possible ways targeting the extension of *Trichoderma* composting technology as a business model to the grass root level.

b) Specific objectives

The specific objectives are as follows:

1. To investigate the business opportunity of Trichoderma composting technology.
2. To formulate models for the extension of *Trichoderma* composting technology.

Methodology

This study is based on surveys and obtained knowledge after thorough consulting with 30 farmers of Kamarpara and 10 SAAO of Amrul Union in the upaziila of Shajahanpur in

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Bogra district. 10 dealers of Shajahanpur upazilla were also interviewed to explore the possible business opportunity. The actual facts of rural socio-economic condition, locally available technology, established organization and fertilizer market were reviewed for this paper to generate some idea for the extension of Trichoderma composting technology through business perspective.

Results & Discussion

Keeping social entrepreneurship in mind, trichocompost business could draw a significant response. New entrepreneurs of trichocompost can run a profitable business while at the same time contributing to the country's social and environmental health. Any business demands a competitive market to survive. This already exists in fertilizer and pesticides industries. All farmers buy and apply these chemicals. Packaged and certified trichocompost can be placed on the rack of the dealers' shops to compete with other chemicals.

There is, however, a lack of communication between public agricultural sciencetists/extentionist and farmers. This facilitates dealers to act as 'doctors' of crop diseases and prescribe crop care medicines that are available in the store to the farmers. Dealers exploit in this way to maximize their own profit. Farmers, on the other hand, are ignorant and indulgent of fertilizer dealers, purchasing those chemicals blindly. They are even more likely to buy fertilizer in colorful and attractive packaging disregarding their rate of application, quality and procedural aspects. However, farmers can be motivated by a written prescription by a field staff (SAAO) working in the field with other farmers. Farmers are likely to trust the consultancy of this kind of people especially in written form. Creation and expansion of trichocompost market should take note of these facts and fill the void. Market expansion naturally involves information dissemination. Publicity is a key to open a bigger market. By ensuring field consultancy, results demonstration nice packets and advertisement, the dealers can attract more farmers for greater sale.

We must not forget the social and environmental value of trichocompost business. The technology of producing trichocompost is relatively easy and can be taught without much difficulty. So if farmers are interested to take up training or share experience by discussion with other farmers to produce it by themselves, it should be supported by government and non government organization. It will result in market expansion since more people will know about it. However, doing business with a product that has revolutionary potential in sustainable agriculture puts the burden of ethics on the businessman.

The following models are formulated emphasizing information and technology extension.

Person to person extension (encouraging the farmer to become independent trichocompost producer and seller)

Farmers will teach other farmers the technology of producing trichocompost themselves, as well as selling in the market. Farmers always apply 'paush', a traditional form of organic fertilizer composed of animal dung and domestic waste. This does not enhance the quality of soil since the process of producing it compromises its essence and effectiveness. Made under the open sky, fighting with the scorching heat, leaching out the marrow of the compost by the rain water and wind, what remains cannot be labeled as quality organic fertilizer. So

following the easy process of making tricho-compost using tricho-suspension can change the farmers' perspective on organic fertilizer. Better land with better crop is an advertisement itself as farmers rely more on other farmers. It can improve the individual farmers' livelihoods as well. Building up new project proposals concerning *Trichoderma* formulation technology extension and asking reputed company like autocropcare and donor agencies like katalyst should get intense priority. Proper funding and direction can spread this environmentally sustainable technology further to reach every corner of our country.

Company based local business

Villagers will provide the company with raw materials and in return the company will sell them tricho-compost of expected quality at a low price rate. The company can invest more and produce in a larger scale to supply to the outer market as well. Stability in this business will be achieved if both parties agree upon a win-win situation about material exchange and price rate. As an alternative, villagers can sell the raw materials to the company. In this way, organic waste and refuse will gain a monetary value and will be managed in a more environmentally sound way. Wastes such as poultry litter and cow dung are widely available in the villages. Villagers will be encouraged to rear more poultry and livestock if they get a good price for the waste. It can have a significant impact in improving the farmers' livelihoods. Presently, a large amount of cow dung is used as fuel leaving less to apply on the field in the form of traditional frivolous 'paush' compost. Now if this cow dung and other organic waste is sold, and returns gained in the form of high quality tricho-compost then more people will use it, get better yield, more profit and more secure people and soil.

Business conducted by *samabay samiti*

Somobay somiti can act as an enterprise and produce trichocompost on a commercial scale. The profit will be divided among the members. People will be encouraged to expand markets and use will increase on a large scale.As for example Comprehensive Village Development Program are running a lot of rural development program in various district through co-operative society. The members of these co-operative societies run their own activities by their own capital and they are now carrying out also vermicomposting business. So trichocompost business can be a large entrepreneurship for them.

Commercial production of tricho-compost

Tricho-compost is now manufactured and distributed commercially. The raw material used to make tricho-compost is widely available in the village households. Almost every house rears cattle and poultry. Besides, water hyacinths, rice straw, maize and potato peels (mixed waste) is also easily accessible. Manufacturers just have to collect the *Trichoderma* suspension from RDA or any other authorized institution. If producers want to go for a larger scale, they can build their own *Trichoderma* culturing laboratory. It will cost approximately TK-12-15 lac since all the machines and apparatus can be found in our country. An estimation of production cost of 1000 kg Tricho-compost is as follows from the experience of RDA.

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Table-1: Budget estimation of 1000 kg tricho-compost production

Sl. no.	job details	per ton (1000 kg)	suspension needed	Units of expenditure	amount in Taka
1.	Cow dung and waste collection	1000 kg		1000	1000
2.	suspension-2	10 pc x 500 ml	5000 ml	25 taka/500 ml	250
3.	labor for pit mining	10 pits x 2 days		250 tk/ day	500
4.	spraying	10 pits x 2 days		250 tk/ day	500
5.	turning pits/every week	5 times	total turning 10x5 times	50 times x 250	1250
6.	shed	10 pits		10 x 300 tk/ shed	3000
7.	drying with sheds	for 10 pits need 2 days		10 pits x 250tk/ day x 2 days	1000
8.	cost of packeging	200 packets		10 tk printing/5 kg packs	2000
9.	labor cost for packeging	2 labors		2 person x 250 t/day	1000
10	others				3000
11.	**grand total**				**13,500**

Now if Tk-13,500 is spent for producing 1000kg tricho-compost, so the cost of 1 kg is Tk-12.5. If the manufacturer sells tricho-compost for 16 taka per kg, the net profit from per ton will be (16,000-13,500) = 2,500 taka. Within 45 days tricho-compost will be ready to get packaged and delivered.

Although the production is going on mostly in the villages but commercial production could be operated along the periphery of the capital and district level as well. Big markets of vegetables and slaughter houses can provide necessary amount of mixed organic waste easily. Good transportation can comprise distribution network spreading all over the country. A place like Gabtoli, Dhaka near the Buriganga river, a big cattle market and the highway meets all the necessary requirements to run production and business smoothly. The business is quite profitable but obviously needs a proper marketing scheme. Further discussion is illustrated in the suggestion part.

Conclusion & recommendation

By reviewing the above facts along with rural socio-economic condition, locally available technology, established organization and market, this paper has generated some idea for the extension of *Trichoderma* technology through business perspective.

- To promote tricho-compost in the existing fertilizer and pesticide market, government has to play a very crucial role. The local market is overwhelmed with hundreds of unnecessary and unknown chemicals. Easy access and availability intrigues the farmers to buy and use more chemicals than ever. Although the soil becomes poor due to the over and unregulated applications of different chemicals still farmers are bound to increase the fertilizer and pesticide input to maintain a standard level of yield. A synergic impact is also evident here that chemical fertilizer such as Urea makes the plant fragile and tasty what attracts more pests and other harmful insects and microorganisms to invade. So purchasing of colorful packets containing high poisoning potential continues which not only puts the farmer in a massive health hazard but also threatens the health of soil, product consumers and overall ecological system.
- Now if the government does not try to manipulate the market, we will have to face a disastrous consequence. For market creation and expansion, we have to follow a holistic approach. Government should facilitate the farmers or new entrepreneurs or any other commercial business regarding tricho-compost by providing subsidy, logistic support and financial help where needed.
- At the same time import of unknown chemicals must be stopped. Importers will have to consult with experts first and then import the necessary chemicals in a regulated amount. A massive publicity and campaigning must be conducted to notify all the stakeholders associated with agriculture about the multifunctional harmful effect of using chemicals in crop production. If farmers are duly notified and find tricho-compost in the shelves of the nearest dealer, no doubt they will buy and use it.
- Another way to manipulate market is to increase the price of chemicals and decrease the price of organics such as tricho-compost. If framers can buy organics in a cheaper rate and the yield is also elevated, they will go for organics more likely.
- Remembering the psychology of farmers, the packets must have to be colorful and attractive. Different donor agencies should come forward in this regard. A good funding can magnify the publicity. If SAAO or field staff could be trained in every Union, then they could roam the villages and prescribe the organic medicines such as tricho-compost to the affected farmers and motivate them more.
- Moreover the task of follow up, feedback and news of facing obstacles by the farmers could reach to the experts through the agro field consultants. More communication will lead to a greater state of agricultural condition. Thus to join the worldwide march of achieving sustainability and to get back our people from the inevitable miserable destiny, organic revolution like Trichoderma technology must be introduced immediately. Let this organic revolution sweep away all the poisonous chemicals from our mother earth.

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Communication and Globalization: The Problems and Prospects in Bangladesh

Fahmida Sultana[1]

Rayhan Miah[2]

Abstract

Globalization has wide range of consequence for modern world especially for development of communication. Changes had occurred in Bangladesh economy, politics, society, social formation, culture, environment, education, family etc for Globalization. Global communication had both positive and negative impact. Objective of the study focused on the opportunities which global communication had brought for Bangladesh as well as remedial measures to solve the problems of globalization in Bangladesh. The paper was based on secondary data source which were relevant books, articles, reports, websites, journals, and documents from the concerned organizations. Findings showed being a part of global village; Bangladesh had been changing her condition by taking the positive consequence of globalization. On the other hand Bangladesh also was losing traditional views, culture, belief, and norms. It was kind of giving chances to developed countries and other international originations to set up a new colonialism within the country. Successful Global communication depended only when world population would be treat as one single brotherhood and were ready to live in a spirit of sharing and cooperation rather than in the spirit of deprivation and competition. Therefore a thorough understanding of the effect of globalization is needed to use its advantages for improving country condition.

Keywords: Globalization, Communication, International Trade, Knowledge, Environment

1 Associate Professor
Department of Development Studies, University of Dhaka.

2 Program Officer
Centre for Entrepreneurship Development, BRAC University.

Introduction

Globalization is a single word. It has wide range of consequence for the modern world. It is a term in which there is no single identification by which anyone can say that this is globalization and that is not. In brief, globalization is the economic, political and cultural processes through which the world is becoming more interconnected and interdependent, leading to the creation of a single 'world space' or system (Intriligator, 2003). The concept of globalization was started to use largely after the emergence of the term "Global Village[1]" by Marshal Mcluhan during 1960 and 1970s.

The world economy globalizes as national economies integrate into the international economy through trade; foreign direct investment; short-term capital flows; international movement of workers and people in general and flows of technology (Bhagwati, 2004). All of these activities have been possible only for the development of the growing communication among the countries of the world.

This has created new opportunities for many; but not for all. It has also placed pressures on the global environment and on natural resources, straining the capacity of the environment to sustain itself and exposing human dependence on our environment. A globalized economy can also produce globalized externalities and enhance global inequities (Daly, 1993). Local environmental and economic decisions can contribute to global solutions and prosperity, but the environmental costs, as well as the economic ramifications of our actions, can be externalized to places and people who are so far away as to seem invisible (Roegen, 1971).

Although the debates on the definition and importance of globalization have been vigorous over time, we believe that the truly relevant policy questions today are about who benefits and who does not; how the benefits and the costs of these processes can be shared fairly; how the opportunities can be maximized by all; and how the risks can be minimized.

In addressing these questions, one can understand globalization to be a complex set of dynamics offering many opportunities to better the human condition, but also involving significant potential threats.

Globalization has great impact on Bangladesh in different sectors. Lots of changes have occurred in our economy, politics, society, social formation, culture, environment, education, family etc. Sometimes it may have positive and negative impact.

The purpose of this paper is to identify both the potential benefits and the potential costs from the communication and globalization in Bangladesh.

Objectives

The overall objective of this study is to identify the problems and prospects of globalization in Bangladesh. This study also focuses on the opportunities which globalization has brought for Bangladesh as well as remedial measures to solve the problems of globalization in Bangladesh. The concept of global village is used as theoretical lens to analyze the problems and prospect of globalization in Bangladesh.

1 The term is clarified later

Methodology

This paper was based on secondary data. The secondary data sources were relevant books, articles, reports, websites, journals, and the publications from the concerned organization. Five steps were followed for data collection those were:

- Framing questions for a review
- Identifying relevant work
- Assessing the quality of studies
- Summarizing the evidence
- Interpreting the findings

Conceptual framework

Globalization

Globalization can be referred to as a phenomenon, a process, a state or a concept. It has evolved partly due to the trend for increasing international trade across national boundaries and the conduct of business activities in more than one country with the development of transport and communication. Put simply, it is a process that refers to the growth of inter-dependencies between national markets and industries on a worldwide scale. This growing interdependence between national economies has resulted in a trend towards global markets, global production and global competition (Brooks, Weatherston and Wilkinson, 2010).

There are nearly as many definitions of globalization as authors who write on the subject. One review, by Scholte, provides a classification of at least five broad sets of definitions:

Globalization as internationalization: The "global" in globalization is viewed "as simply another adjective to describe cross-border relations between countries." It describes the growth in international exchange and interdependence.

Globalization as liberalization: Removing government imposed restrictions on movements between countries.

Globalization as universalization: Process of spreading ideas and experiences to people at all corners of the earth so that aspirations and experiences around the world become harmonized.

Globalization as westernization or modernization: The social structures of modernity (capitalism, industrialism, etc.) are spread the world over, destroying cultures and local self-determination in the process.

Globalization as deterritorialization: Process of the "reconfiguration of geography, so that social space is no longer wholly mapped in terms of territorial places, territorial distances and territorial borders."

Theory of global village

Marshall Mcluhan (1911-1980) developed and popularized the concept of the global village during the 1960s and 1970s. Influenced by James Joyce's Finnegans Wake and Wyndham Lewis's America and Cosmic Man, Mcluhan devoted much of his carrier to understanding

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how technologies influenced human interaction, perception, and cultural change. The emergence of the global village was one measure of technological influence (Jackson, 2010). The global village develops when technologies collapse physical and perceptual time and space, a collapse in which cultural and spatial differences collide and epistemologies of human otherness change. Travel technologies such as roads, boats, cars, trains, and planes and information technologies such as books, radio, television, and the internet allow people to move faster and easier, physically and perceptually, to places once considered far away. When this collapse happens, when human relations to geography blur, one culture –the village –begins to emerge (Mcluhan & Fiore, 1968).

Problems of globalization of Bangladesh

In Bangladesh, globalization is creating many problems including economy, politics, society, culture, family, environment and so on. Now we are going to discuss about the problems of globalization in Bangladesh.

Problems on economy

At first, we will see the problems of globalization on Bangladesh economy. We know the impact of globalization on national economies is not a recent phenomenon. Industrialized nations and imperialist powers have enforced globalization and liberalization processes of trade, finance and services since late nineteenth century. By the middle of twentieth century, it got its momentum; and the third quarter of the twentieth century saw an enormous increase in the world trade and commerce. There has been a tremendous expansion in world trade, Foreign Direct Investment (FDI), and cross-border financial flows over the last thirty years due to the worldwide wave of economic liberalization. The world is, therefore, transforming itself into a marketplace. Export-oriented industrialization strategy extending to the global market rather than import substitution has now become the norm of globalization (Islam, 2011).

In this context, the impact of globalization on the Bangladesh economy may not be impressive, but it is not insignificant compared to the economies of some developing countries of the world. Though globalization has a positive impact on our economy but in many times it creates problems for our economy. In the name of globalization foreign investors come to Bangladesh and invest here. By their investment Bangladesh is benefitted. But they invest here for their own interest because they maximize their profit. In Bangladesh, labor wages are very low comparing among other countries of the world. Many international organizations like International Monetary Fund (IMF), World Bank (WB), World Trade Organisation (WTO), Asian Development Bank (ADB), Islamic Development Bank (IDB) etc give us loan in many sector of economy. But in the name of giving loan they imposed difficult condition which is sometimes impossible to follow. After the independence of Bangladesh many development plan was planned by the government of Bangladesh with the help of many developed country and international organization. But most of the development plane was failed to implement in proper manner because the condition which was given by the developed was against to the development plane. Three year plane, five of fifteen year plane of development was failed to implement. But we lost our money and many other resources for this kind of plan.

Problems on politics

Secondly, globalization has negative impact on our politics. As we know, since her emergence in 1971, Bangladesh is continuously struggling to make herself a democratically developed nation. Though we faced different types of government from the emergence of Bangladesh but now we are under the democratic government. Globalization influenced our politics in many times and till today. We have faced a lot of political crisis since our independence and in this crisis many developed country and international organization influenced our politics. They influence our policy making, development plane, in election and other political issues (Ibid, 2011). They give money to our political party for their interest in the election. Foreign investor and local investor affect our general election by giving money and other support to our political party. They think that if the political party can come to the power it will be helpful to them to influence them in policy making and the investors will maximize their interest by the help of that political party. For example : United Nation Development Program (UNDP) country director Renata log dessalian, British high commissioner Stephen Evans, USA ambassador Patricia a Beautaness and other country's ambassador influenced our politics during last caretaker government. They influenced caretaker government to impose state of emergency. They also influenced caretaker government in different policy making. Even during tenth parliamentary election USA, European Union and many other western countries was trying to stop the election process. But they have failed at that time. But now they are continuously creating pressure on the government to hold a new election with a short period of time. These above phenomenon imply that Bangladesh government and politics is being influenced by the developed country and the different international organization of the world which is the result of globalization.

Problems on society and culture

Thirdly, globalization is creating problems for the society and culture of Bangladesh. As we know, it is not easy to analyze the economic or political aspects of globalization in isolation. Today, we live in a global society. It is not a unitary society nor is it an ideological community or a state, but it is a single power network (Mann, 1993). Here, globalization involves the development of something like a global culture (Robertson, 1992).

In this context, the society of Bangladesh is melting port of cultures, religions, and races. Although there are difference in religion but Bengalis are homogeneous in origin. The population of Bangladesh by religion, according to a recent statistical survey, was 86.6 percent Muslims, 12.1 percent Hindu, 0.6 percent Buddhist,0.3 percent Christian and 0.3 percent others. Bangladesh has tradition forms of society and has its own culture. By which people of Bangladesh is different from any other people of the world. But for globalization of culture, our traditional society and culture are gradually changing. Now a day's people of our country are being individualistic by the influence of globalization. For it, our traditional society is broken down. Our traditional culture is also changing. We are Bangalese and we have different cultural festival like phohela Baishak , pohela Falgun, Novanno, Ponna, Halkhata, etc. Globalization has introduced our self with many other festival like, Valentine day, friendship day, mother's day, father's day etc which is not the part of our traditional culture. But we observe these types of festival with festive mode which is the result of development of the mass media like television, radio, and internet. If we make a survey within our urban area like Dhaka or Chittagong we will find that there are many Bangladeshi who really don't

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know about our traditional culture but they know very much about western culture and festival. Our young people are really influenced by the western culture. They wear western dress, eat western food. The influence of Hollywood and Bollywood cinemas, songs, dances are tremendous on our young people. For example: if tom cruise or Angelina jolly wear a new model dress then it will be found to our country within a short time. Even without playing the new Hindi song, we cannot think of a cultural functions or rag day in the university or college. These activities are creating cultural hegemony of western and Indian culture over our tradition culture.

Problems on family structure

Fourthly, it has impact on the structure of the family. It is visible that from the dawn of human civilization, the family has been the focal point of bondage, love, affection, sympathy, and sometimes conflict resolution between family members. From this perspective, a man in Bangladesh gets his identity through the family to which he belongs. Here, the family continues to exist as a primary unit, which provides one of the strongest bonds, despite some intervening variables invading its pristine structural and functional norms (Islam, 2011).

In the face of rapidly expanded global impact on industrialization, privatization, discovery of oil and gas fields and communication network, the structure of family in Bangladesh is undergoing some qualitative and quantitative changes. Commercialization and rapid urbanization has resulted into break down of traditional large family into nucleus one. It has changed the pattern of gender relationship in our family and society. For this, people are being individualistic and they break the traditional family bondage. Another important impact of globalization is to eradicate illiteracy from society. It is interesting to note here that at one time enrollment of boys in all levels of education was much higher than that of girls, but today, the ratio for boys and girls seems to be identical. Probably this dramatic change has been possible due to the response of Non-Government Organizations (NGOs) and other foreign donors. This is an example of globalization's impact on education in Bangladesh. The spread of education, which is now available both for males and females, has changed their entire lifestyle because with this change, opportunities for employment have become a available and resulted in the exportation of manpower and migration of labor forces. As a result, the pattern of traditional large families is breaking into smaller families, the nuclear family. Although the effects of globalization are greatly felt in almost in all spheres of family life, they may not be taken as absolute. Bangladesh is primarily an agrarian rural society and most of the people living posh urban areas still maintain a link either with their parents or grandparents living in rural areas or in urban settings. It appears that the nuclear families have not forsaken the values, cultures, bondage and kinship ties which are inherent in the joint family, and herein lays the basic difference between a Bangladeshi and Western nuclear family. Despite the global implication of family values or cultures in the current century, the idealistic values and virtues of a joint family, which form a "school of love", are not totally done away with (Islam, 2011).

Problems on environment

Fifthly, Globalization has badly impacted on the environment. There is no doubt that the future of Bangladesh is inextricably bound up with the fate of the natural environment. The country is already facing severe environmental hazards. These include: intense cultivation

that threatens soil fertility and swamps the country with agro chemicals, excessive extraction of water for irrigation that depresses the water level, flood control measures that block fish migration paths, and commercial fish farming that floods agricultural land with saltwater. Added to these is the high density of population, the pollution from human excreta and industrial production, and a host of other issues from deforestation to shrinking biological diversity to the threat of inundation resulting from global warming, and Bangladesh has the making of an environmental crisis. Recently, arsenic has been detected in tube-well waters in most areas of the countryside in Bangladesh. By this time thousands of people were affected by the intolerable levels of arsenic in the water. If it is not checked, it may invade the whole of Bangladesh within a very short time. This is mainly because the water level has gone down alarmingly (Ibid, 2011)

It is now open secret that sustainable development without proper accountability of natural resources is futile. Besides all the above environmental problems, Bangladesh is already facing severe environment hazard as a result of global effect on environment for which Bangladesh is not responsible. For example: three major flood have occurred within ten years, cyclone sidr, cyclone Aila, Nargis, and lastly Mohasen have been occurred because of environment pollution. Globalization increase industrialization, commercialization, and privatization. For this, carbon di oxide is increasing day by day. As a result the temperature of the world is increasing in a high speed. Our climate is going to be changed for this consequence. Water level of the see is rising. It has been assumed that many low lying areas including Bangladesh may go under water due to climate change.

Problems on health

Sixthly, Globalization has also effect on the health of the people of Bangladesh. Globalizations make us closer to other nation of the world. Many men and women of our country are being married with men and women of other country of the world. If one disease is appeared in one country then it spread to other country of the world in short time. For example: AIDS, Shoin flow, are appeared in USA and Mexico but now these diseases are found all over the world. Bangladesh is not of them. In Bangladesh there are many AIDS and Shoin flow affected people.

Problems on income distribution

Lastly, though globalization has brought about a revolution in the development of our country but it also enhances the gap between the rich and poor. If we look we will find that many industry and wealth are in the hand of few people. There are around 31.5% people live under the poverty line and around 17.5% people live under extreme poverty line (Bangladesh Economic Review, 2013). But if we look at some areas in Dhaka city such as Gulshan, Baridhara, Bonani,Uttara,and Dhanmondi, we will find that there are lots of amenities which even absent within New York and the other developed city in the world. This is happened because the wealth is in the hand of few people. Capitalism is the concept related with globalization in which the ownership is recognized. In this consequence, globalization creates the discrimination of wealth within rich and poor.

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Prospect of globalization in Bangladesh

Besides lots of negative impact of globalization, there are many prospects from where Bangladesh can reap benefits. The prospects of globalization in Bangladesh are following...

Prospect of industrial development

Firstly, there are prospects of globalization on industrialization of Bangladesh. As we know, Industrialization is must for a country to be developed country in the world. Bangladesh is a developing country where number of industry is increasing day by day. Globalization has a tremendous effect on establishing new industry across the country. World is now seen as a global village. Many foreign investors are investing the money to our industrial sector for which many new industries are being established. A number of Export Processing Zone (EPZ) has been established in the country. Many new EPZ and industrial park are going to establish. For last twenty years Industrial sector has an increasing share in the total Gross Domestic Product (GDP) of the country.

Table: Industrial Sector Share of GDP (%) at Constant Prices (Base Year: 1995-96)

Year	Percentage of GDP
2001-02	26.75
2002-03	27.23
2003-04	27.69
2004-05	28.32
2005-06	29.03
2006-07	29.45
2007-08	29.7
2008-09	29.86
2009-10	29.93
2010-11	30.37
2011-12	31.26
2012-13	31.98

(Source: Bangladesh Economic Review, 2013)

From the above table we can find that there is an increasing trend of share of the industrial sector in total GDP of Bangladesh. For the year 2001-02, it was 26.75% of total GDP and for last fiscal year 2012-2013, the total share of the industrial sector in total GDP was 31.98% . So globalization has a positive impact on our industrialization by which Bangladesh is aspiring to be a middle income country by 2021.

Prospect of high economic growth

Secondly, Bangladesh is gradually changing her condition by economic growth and development. Globalization has brought a new era in the economic growth of Bangladesh. Bangladesh is now participating in international trade and commerce and exporting readymade garment in the world market.

Figure: GDP growth rate of Bangladesh

(Source: Bangladesh Economic Review, 2013)

From the above figure we see that Bangladesh has over 5% GDP growth for last couple of year. And for the last four years Bangladesh has continues economic growth above 6 % per year. Bangladesh achieved 6.71 percent growth in FY 2010-11even after the global financial crisis. This growth performance was supported by strong rebound in exports and the expansion of manufacturing sector. However, the estimated growth rate slightly decelerated to 6.23 percent in FY 2011-12. For the last FY 2012-13, it was 6.03%.

Besides, Bangladesh earns a lot of remittance by the overseas employers. Readymade garments are now emerging tiger for the Bangladesh economy. Readymade garments bring 79.6% export earn for our country (Bangladesh Economic Review (BER), 2013). Bangladesh earns foreign remittance about 15 billion USD in 2013 (Bangladesh Bank, 2013). So our economic growth is increasing day by day. For this many kinds of development are occurred in our country. So it is really positive side for our economy that globalization is bringing a great change in our economic growth by increasing co-operation with other countries of the world.

Prospect of urbanization

Thirdly, due to globalization, urbanization is creasing day by day. For globalization people of Bangladesh are being individualistic and they become urban bias. So urbanization is gradually increasing within the country. For urban bias situation, people of the village area now are gathering within the Dhaka city and other big city of the country. The big industries and garments are located in city area. For this people need to stay within the city area. We find many developer societies who offer ready mate house and apartment to the people of city area. Real estate business is gradually becoming a large business sector in Bangladesh. This is the result of rapid urbanization within the country.

Prospect of digitalization

Fourthly, globalization has a positive impact on ICT development. It has facilitated connection and coordination among the people, corporation and non-governmental organization. Global exchange of ideas through internet and other means of communication such as mobile phone, telephone, fax, email, have made connection among the people around the world. Bangladesh has largely benefited by the ICT development within the country. ICT sectors of Bangladesh now much more developed than any other country of the world. We have different satellite TV channels, different mobile operating company; have brought a revolution in the ICT sector of the country. Now we can easily get connected with our friends and families through a mobile phone. We can share our views with other persons through internet. Internet has changed our life. ICT development is the consequence of Globalization. In this sector, globalization has brought a revolution and enhanced human advancement.

Prospect of education

Fifthly, globalization has positive impact on the education of Bangladesh. Bangladesh has introduced new form of education system which is similar to other developed countries of the world. In Bangladesh, there are three stage of education which is primary, secondary and tertiary. We follow the modern method of education in which we give emphasize on the English language. University level education is totally based on English. English is not our

language but we learn English to get communicated with other people of the world. Many university graduates from Bangladesh are going to take higher degree from the reputed universities of the world. They are doing exceedingly well and they are bringing recognition and fame for the country.

Like every other developing country of the world, Bangladesh has identified education as the key to prosperity and progress. But compared with about 90 percent for developing countries as a whole, there is about 57.9 % (BER, 2013) percent adult literacy rate in Bangladesh. Although the government was committed to education for all by the year 2000, and since the beginning of the 1980s total government expenditure for education has increased in real terms more than threefold, the gross enrollment in the primary school is not encouraging.

There also, the most dramatic response has been from the global organizations, like the various NGOs funded and aided by the foreign donors. There are about 52,000 nonformal schools run by NGOs. These schools also serve as springboards from which the children can jump into formal education. For example: BRAC has education program to give the light of education to the rural area of all over Bangladesh These models have proved so successful that since 1992, the government has supported more than 120 NGOs through its Integrated Non-formal Education Program (Islam, 2011). Education in Bangladesh could be on the threshold of a new era. What remains to be seen is if the country has the determination to carry out the reforms, her survival and prosperity would be a must.

Prospect of women empowerment

Sixthly, empowerment of women has been fostered because of globalization. Now women are largely engaged with job in industrial sector, garments sector, and all of profession where the men engaged. If we look at politics, we find many well known politicians who are women. Our prime minister and also the leader of the opposition are also women. In garments industry around 80% workers are women who are now contributing for their family and the improvement of the country. Globalization has brought a revolution to give the power to women to engage herself whatever she likes.

Prospect of good governance

Lastly, globalization has positive impact on the governance of Bangladesh. Although Bangladesh is a long way from having a fully globalized system of governance as well as the deficiencies in democratic accountability and public administration have left huge gaps but NGOs of Bangladesh, which have been largely funded by foreign-aid donors, have come forward to minimize the gap between elite and mass. In fact, the NGOs have become an effective and reliable means of reaching the poor, and the government is using them as a channel for more than 10 percent of the country's official development assistance. However, progress in recent years has been encouraging. The change is coming both from the top down and the bottom up. In the past the ordinary people of Bangladesh were poorly served by their existing political system. Now, due to the infusion of globalization into our political outlook, the national polity is in an increasingly stronger position to respond to their needs.

Conclusion

Globalization may ultimately prove a blessing, but the blessing may very well turn out to be quite mixed. To a country like Bangladesh, the impact of globalization at the national level is profoundly reflected in her national economics, politics, society, culture, and family etc as discussed above. Being a part of globalized world; Bangladesh has been changing her condition by taking the positive consequence of globalization and also are losing the traditional views, culture, belief, and norms. The size of the Bangladesh economy is increasing day by day and gradually marching toward growth and prosperity. In the name of globalization many industrially developed country and other international origination are trying to set up a new colonialism within the country. The politics of Bangladesh has faced lots of trouble since the independence. Bangladesh was under the dictatorship for many years. After the restoration of democracy in 1991, now Bangladesh is under the democratic government. Developed countries and many international organizations are influencing our politics which we have already discussed. Our traditional family bondage is declining day by day. People are now trying to live individually. They are being individualistic. Our traditional culture is now in a critical situation. People like western culture more than our traditional culture in the city area. Western culture is creating cultural hegemony over the traditional culture of Bangladesh. For example: imagine that 'in Dhaka' a 'band concert' is running and also a 'jatra pala' is running on the same day. Which will you choose? If we ask this question to the young person, obviously she/he will prefer the band concert (with some exception). Our environment is polluted because of the gradual industrialization without considering the damage of the environment. Though Bangladesh is benefitted by the industrial sector but in the mean time country is losing the environmental sustainability. For which we are facing different types of environmental problems such as flood, drought, strome, cyclone etc. Globalization has made our life modern but in the same time it snatches our sustainability of environment and sustainability of being on earth with comfort and safetyness. Finally, globalization is not without its opportunities and potential: the world can be knit together, cross-fertilization of cultures can take place, transfer of knowledge, which constitutes the only common wealth of mankind, can become a reality. Should poverty, ignorance, superstition, and lack of values still prevail in this borderless world? What is needed now, is not merely the effort to spread microelectronic chips but also the effort to see that people have access to potato chips, safe drinking water, minimum health care, and other basic needs. Globalization will be successful only when we are prepared to treat the world population as one single brotherhood and are ready to live in a spirit of sharing and cooperation rather than in the spirit of deprivation and competition.

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Fostering Community Based Waste Management Practice for Developing Sustainable Environment

Samir Kumar Sarkar[1]

Abstract

There is an increasing demand for livestock products for the growing and more affluent populations of many developing countries, particularly in Asia, which offers new market opportunities for poor farmers. Community based waste management approach is followed to reduce the major negative impact on environmental and health hazards created by improperly managed waste mainly focused on livestock production system of Bangladesh. The total waste amounted 4,78,220 kg annually managed by the community attributed to a significant role regarding livestock production and human health, sanitation, economic as well as environmental aspects. In terms of economic the Bamunia village community of Bogra district of Bangladesh could earned net benefit of Tk. 2,70,146/= last year in 2014 by selling waste by-products. Major earnings come from produced 95,644 kg of organic manure Tk. 1,37,546/= The global environmental perspective is to reduce livestock-induced pollution and environmental degradation. One of the major costs of running an agricultural farm can include buying nitrogen in the form of anhydrous ammonia to fertilize crops. But there are additional agricultural costs associated with nitrogen, especially when the nitrogen in livestock waste produces pungent and potentially harmful ammonia emissions. To get expected production and to capture optimum socio-economic benefit from livestock raising waste must be managed in proper ways through a community based biogas producing approach of waste management to have sustainable environment. During one year community could managed 4,78,220 kg of degradable mixed waste and twisted about 17,216 m3 of biogas and utilized that gas for cooking and electricity generation. The remarkable benefits come from women's saved time and money those who were involved in collecting cooking fuel before starting this project at Bamunia village under Shajanpur upazila of Bogra district situated in the northern region of Bangladesh. The 200 households at the community in one year have saved 15,881 working days through reduced time required for managing of fuel materials for cooking purposes. Most of the saved time is being used for household tasks and especially for education of the children. This can be considered as one of the greatest contributions to the nation.

Key words: Community, waste management, environment

1 Joint Director
Rural Development Academy (RDA), Bogra

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Introduction

Livestock contribute to the livelihoods of roughly 70% of the world's poor, supporting farmers, consumers, traders, and laborers throughout the developing world (Perry et.al. 2007). In decades past livestock waste management was not considered to be much of a problem. However, as milk and meat production need increased, herd size and waste production also increased. This has finely tuned the awareness for waste management. Any livestock operation, regardless of size, that is causing a pollution problem must need to follow the regulations.

Regarding waste management more than 14 years back in 2002, Rural Development Academy (RDA), Bogra conceived and implemented the waste management program in RDA campus, especial emphasis given on demonstration farm with the aim of putting the brakes on environmental pollution caused by livestock waste. RDA through action research project worked for five years to address these issues and will discus potential of replication to the other regions of Bangladesh.

Livestock is a significant global asset with a value of at least $1.4 trillion (Steinfeld et al. 2006). The livestock sector is increasingly organized in long market chains that employ at least 1.3 billion people globally and directly support the livelihoods of 600 million poor smallholder farmers in the developing world (Thornton et al. 2006). Keeping livestock is an important risk reduction strategy for vulnerable communities, and livestock are important providers of nutrients and toehold for growing crops in smallholder systems. Livestock products contribute 17 per cent to kilocalorie consumption and 33 per cent to protein consumption globally, but there are large differences between rich and poor countries (Rosegrant et al. 2009).

Livestock systems have both positive and negative effects on the natural resource base, public health, social equity and economic growth (World Bank 2009). Currently, livestock is one of the fastest growing agricultural subsectors in developing countries. Its share of agricultural GDP is already 33 per cent and is quickly increasing. This growth is driven by the rapidly increasing demand for livestock products, this demand being driven by population growth, urbanization and increasing incomes in developing countries (Delgado 1999).

The global livestock sector is characterized by a dichotomy between developing and developed countries. Total meat production in the developing world tripled between 1980 and 2002, from 45 to 134 million tons (World Bank 2009). Much of this growth was concentrated in countries that experienced rapid economic growth, particularly in East Asia. In developed countries, on the other hand, production and consumption of livestock products are now growing only slowly or stagnating, although at high levels. Even so, livestock production and merchandizing in industrialized countries account for 53 per cent of agricultural GDP (World Bank 2009). This combination of growing demand in the developing world and stagnant demand in developed countries represents a major opportunity for livestock keepers in developing countries, where most demand is met by local production, and this is likely to continue well into the foreseeable future. At the same time, the expansion of agricultural production needs to take place in a way that allows the less well-off to benefit from increased demand and that moderates its impact on the environment.

The family based approach for managing livestock waste (mainly dung) found to be less contributory and time consuming with higher cost involvement implemented by other GOs & NGOs in Bangladesh. Some 37,269 domestic biogas plants targeted to be installed by 2012 (Survey report-2010) across the country with the support of Netherlands Development Organization (SNV) through the partner organizations of IDCOL under the National Domestic Biogas and Manure Program (NDBMP). Considering the trends and situation of waste management initiatives particularly for rural areas the researcher felt to find out suitable and affordable alternatives of producing renewable energy, bio-fertilizer, sustainable livelihoods and friendly environment through biogas plant led by community based waste management approach in Bangladesh.

This paper attempts to provide present status of livestock waste management systems in relation to recent trends, coupled with a brief assessment of whether these trends are likely to continue into the future. Also indicates where potential remains, in relation to livestock waste management and livestock disease control under community initiatives. Study sketches of a number of factors that may modify both the production and the systems of livestock waste management in an efficient manner. The paper concludes with a summary outlook on community based waste management systems and utilization towards sustainable environment.

Objectives

The main objectives of the study is to determine the suitability of fostering community based biogas plant and its potentials for proper livestock waste management in Bangladesh.

Methodology

The overall methodological approach is focused on integration of quantitative and qualitative methods. Along with questionnaire, which is the main source of data, a number of qualitative tools have been used for data collection. The findings from the questionnaire survey and qualitative investigation are made complementary to each other throughout data collection to analysis phases.

The following methodologies were used to address the objective of the study:

Analyses of secondary data including project documents from Rural Development Academy (RDA), Bogra, Bangladesh.

Field visits to get an impression on the performance of biogas plant and to collect practical information on community biogas project implemented by RDA in Chandkarim village, Sadullahpur, Gaibandha.

A check-list was prepared for the collection of data during the field visits.

Interviews with key informants and potential stakeholders for community biogas users.

Determine of key conditions for dissemination of community based biogas plants in Bangladesh.

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Study location

The Rural Development Academy (RDA), Bogra, Bangladesh, runs a poverty alleviation project at Bamunia village under Bogra district in the northern part of Bangladesh. This study was conducted in Bamunia to identify suitability to fostering implementation of community based biogas plant for proper livestock waste management towards environmental sustainability. A participatory approach was used for both qualitative and quantitative data collection within January to March 2015. Interviewed respondents were engaged in community biogas plant management and allied income-generating activities such as livestock rearing, beef fattening, poultry rearing, biogas & electricity production and selling, organic fertilizer processing and selling etc.

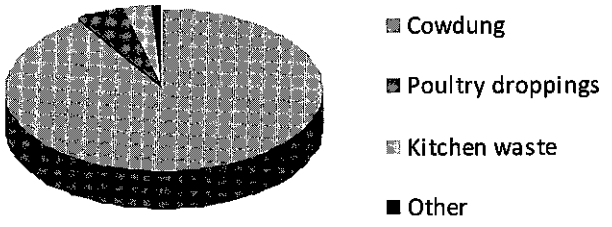
Respondents were selected randomly from the study area covering various categories according to the lands ownership.

Sources of waste

The Bamunia village community used crop field as the major source of fuel and biomass. The amount of contribution of biomass waste was not same for all farm categories. The biomass in the study area comes from different field crop residues mainly from maize stovers. Most of the villagers use their biomass as fuel from the crop residues (maize stover, bottom part of rice straw, husk, etc.), followed by dried cowdung cake, leaves and twigs, kitchen by product, etc.

As there is no availability of natural gas and electricity, most of the respondents depend on natural sources of biomass for cooking. For lack of community forests the farmers collect fuel wood from the homestead forestry. The main sources of biogas production materials are livestock waste (91%), poultry droppings (5%), kitchen waste (3%) and others (1%) etc. (Figure 1).

Figure 1:Raw materials used



Waste collection from livestock

Cowdung

The total number of cattle in the community present was recorded before and after project started 255 and 320 respectively. The quantity of cowdung (dry basis) was calculated by

multiplying the cowdung production per head per year and the number of cattle in the community. The cowdung (dry basis) quantity per head per year was found 0.51 ton in the study area which was almost similar to the cowdung (dry basis) quantity per head per year was estimated as 0.49 ton for Mymensingh area (Chowdhury *et al.* 1987).

Goat faeces

The dry biomass obtained from goat faeces per head in the study area was also estimated by same method used in cattle. The goat faeces quantity per head per year was found 18.94 kg in the study area which was almost similar to the finding (dry matter basis) per head per year was estimated at 19.25 kg (Shahjalal, *et al.* 1997).

Poultry droppings

According to Uddin (1991) average per head poultry dropping production was estimated at 10.95 kg on dry matter basis but in the study area it was 11.24 kg per bird per year.

Total dry matter (DM) from livestock used as input for the biogas plant was calculated by the following formula:

$$W_{cd} = \frac{\sum_{i=1}^{n} P_{cr}(i) x f_{cr}(i) + G_{dp}(i) x F_{dp}(i) + P_{dp} x F_{dp}}{\sum_{i=1}^{n} C_{dp} + G_{dp} + P_{dp}}$$

Where,

Wcd = Total cow dung used as input of biogas plant by the community, ton
Cdp = Production of dried cow dung of (i) family, ton
Gdp = Production of dried goat faeces of (i) family, ton
Pdp = Production of dried poultry droppings of (i) family, ton
Fdp (i) = Percentage of dry dung used as input by (i) family, ton
n = Number of family of a community.

Results and discussion

The concentration of livestock in factory farms leads to a buildup of animal waste in the areas where these livestock operations reside. Livestock plays an important role in human civilization. Economic uses of livestock sector are developed with the change of the nature of soil, air and sunlight associate with civilization. There are about 26.83 million cattle in Bangladesh, of which about 1.088 million are cross-bred cattle (4%). Community based biogas plant could be a solution as well as to capture the potential benefits of waste management.

The livestock development strategies in the fifth five-year plan of Bangladesh government are to increase people's participation through the development of entrepreneurial groups. Good dairy cattle nutrition is resulting in increased incomes for thousands of Rural Action

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Committee beneficiaries. The nutritional cycle doesn't end with the cattle. Nutrients in manure are building soil productivity and better crop production.

This sector can solve the unemployment problem of the rural people and can ensure the sustainable multipurpose use of our land. So this sector has the ability to ensure the certain mobility of the economy of Bangladesh through poverty reduction, nutrition supply and employment generation. To get optimum benefit from livestock, waste produced with proper management through community biogas plant can be one of the potential factors.

Community based biogas plant

Community based refers to the social unit shares common values. The findings showed per year net earning captured by the Chandkarim village community stood at Tk. 2, 70,146 (Table 3). Though, total efficiency of waste management incurred by the community biogas plant was near about 50% only.

Comparative statements of "Bamunia" village community & traditional family based biogas plant mentioned below:

Traditional Family Biogas Plant	Village Community Biogas Plant
Family based	Community based
Small unit (1.2-4.8 m^3)	Bigger in size (83-200 m^3)
Waste management in household level	Active participation in waste management
Individual family use	Common output sharing
Individual contribution with subsidy	Community investment without subsidy
Only Bio-gas plant	Package support for sustainability
Cost Tk. 0.35-0.60 Lakh	Total investment Tk. 14.5 Lakh
Family coverage: One family only	120-200 families
Waste management capacity- 30-60 kg/d	Waste management capacity- 2-3Ton/d
Improper decomposition	Proper decomposition
Daily gas output- 1.1-2 m^3	Daily gas output- 50-90 m^3
Manure output- 6-12 kg/day	Manure output- 400-500 kg/day
No water supply system	Safe water supply system
No generator for electricity generation	Biogas generator for electricity (5KVA)
Only biogas line connected to individual family	Main grid pipeline for supply of water & biogas to the community households
High cost	Average cost minimal
Least scope of benefit sharing	Maximum scope of benefit sharing

Experience of RDA on community based waste management

The plants based on Fixed Dome and community based waste management concept were developed by Rural Development Academy (RDA), Bogra in 2002. The design is based on principle of "Semi Batch-fed Digester". A combination of batch and semi-continuous digestion is known as semi-batch fed Digestion. It also called Fixed Dome Digester. Such

a digestion process is used where the dung/droppings from domestic farm animals is sufficient to operate a plant and the same time organic waste like crop residues, agricultural wastes, kitchen waste, weeds etc. are available during the season. But RDA's Fixed Dome CBP (Community Biogas Plant) use cow dung as the major substrates. This plant has an inlet pipe connected to BGP for daily feeding of cow dung directly from animal's shed. The semi-batch fed digester has much longer digestion cycle of much gas production as compared to the batch-fed digester. The batch-fed digester is ideally suitable for traditional family base small and medium farmers having 6-8 cattle's or 20-30 goats to meet the basic cooking requirement and at the end of the cycle it gives enriched organic manure in the form of digested slurry (Mamun, *et al.* 2009). Actually, RDA developed CBP offers a package system which mainly included e.g. a need based biogas plant (minimum vol. 130 m3) for managing waste; biogas generator to generate electricity, deep tube well to have safe water both for community and running biogas digester smoothly, pipeline both for water & biogas supply to the households level and a drying cum processing floor to manage organic fertilizer etc. with to some extent financial support of training match income generation activities (IGAs) towards sustainability.

Homestead energy use

Homestead energy use for a particular household was estimated through different daily activities performed by the family. The activities include for using energy were cooking, parboiling of rice, lighting, providing smoke to the cow shed and so on. The average homestead fuel energy requirement was estimated 83.86 GJ/Yr per household. (Rabbani, et al.2011).

Utilization pattern of biogas

Utilization pattern of biogas was observed in Bamunia village from community biogas digester supply of biogas to 17 families, for cooking and 1 cowshed for water boiling. On demand basis this biogas is also used for 5KVA biogas generator for production of electricity for households lighting.

Economic analysis of community biogas plant at Bamunia village

The average gas production of Bamunia bio-gas plant per day was estimated 60-110 m^3 at 210 millibar pressure. The expenditure of CBP (Community Biogas Plant) was Taka 762674 per year (2013). The gross return from this biogas plant was Taka 1032820 per year of which net return from biogas was Taka 54,600 and from bio-fertilizer ranked highest Taka 1, 37,546. Biogas plant produces slurry as byproduct, which produces bio-fertilizer. The return from bio-fertilizer was found much higher than the return from bio-gas. The overall benefit-cost ratio of the bio-gas plant was found 2.81, which was very promising (Table 3).

According to villager's opinion, the cost of supply of bio-gas per family per month at Bamunia was estimated as Taka 1400, whereas, the cost of supply of LP gas per family per month was Taka 1750. Therefore, the user of Bamunia village community is benefited by Taka 1250 per family per month by supplying bio-gas to its households. However, the Bamunia community is subsidizing Taka 900 per family per month by collecting Taka 500 from each household per month and allowing each household a benefit of Taka 1250 per month (Table 3). This finding is almost similar to Mamun *et al.*2009.

Cowdung as input for biogas production

Traditionally, cowdung, which in the forms of dried cowdung cakes and cowdung with sticks, is used to cook food, which rather could be used as feed source of biogas digester turn into biogas as renewable energy and organic manure for soil organic matter enrichment, enhanced water holding capacity and which ultimate would lower the need for chemical fertilizer and of course environment friendly.

A number of barriers hold back a small scale biogas plants as commercial entrepreneurship due to lack of active participation for collection and providing waste as feed materials to the biogas plants to make its' efficiently use. It is difficult to make biogas plants cost-effective with sale of energy as the only source of income. That is why; planners and decision-makers have to come forward instead of establishing small sized traditional family based biogas technology which is not feasible and cost-effective. Study reveals about 60% are inactive.

Price of inputs

Average price per (kg) of feed materials supplied as input to the biogas plant by waste category at Bamunia village, Shajanpur, Bogra was Taka 0.50 for cowdung; 0.55 for poultry droppings; 0.90 for kitchen waste & 0.50 for others respectively including sorting and carrying cost (Table 2).

Seasonal variation

As part of qualitative investigations, seasonality mapping was done in the study village. Substantial seasonal variations have been found in terms of availability of raw materials, biogas availability and quantity of bio-fertilizer produced. The following figures indicate the seasonality analysis for the community based biogas plant (Figure 2).

Figure 2: Seasonal variation of dung based Plants

Item	Month (January – December)											
	1	2	3	4	5	6	7	8	9	10	11	12
Availability of raw materials	⇩	⇩	⇧	⇧	~	⇧	~	⇩	⇩	⇩	⇩	~
Gas availability	⇩	⇩	⇧	⇧	~	~	⇩	⇩	~	~	~	⇩
Quantity of slurry produced	⇩	⇩	~	⇧	⇩	⇩	~	~	~	~	~	⇩

~ Normal | ⇧ More than normal | ⇩ Less than normal

Respondents opined that rainy season is the best time (month of April) for the availability of cowdung because of confinement of cattle in their shed. The cows produce more dung during the three months of rainy season (Figure 3). As a result biogas production increases as well. Moreover, the higher moisture content in the dung also helps generating more gas. Hence, availability of cowdung is more; bio-fertilizer also produced in more quantity during rainy season. However, the scenario get reverse for the cowdung based plants in winter.

Availability of cowdung reduces significantly and due to that biogas and slurry production quantity declined as shown in Figure 2 & 3.

It is to be noted here that, the fact is from traditional pit system of producing compost is less available as it is difficult to store and often gets washed away by rain almost 50-60%. The winter is bad for availability of both raw materials and biogas as well.

However, the rainy season is not particularly good for management of bio-slurry. The rain washes away the bio-slurry and the quality of it is affected by rain-water. Thus, although the rainy season is good for performance of the plants in terms of gas production but the slurry management is more complicated. In the last year, 2012 community managed 4,78,220 kg degradable waste and produced about 17,216 m^3 of biogas and utilized that gas for cooking and electricity generation. Through which on monthly charged basis community could able to supply 17 households (Tk. 400/m) & one dairy farm (Tk. 2000/m) for cooking purposes and connected 43 households (Tk. 100/m) with electricity.

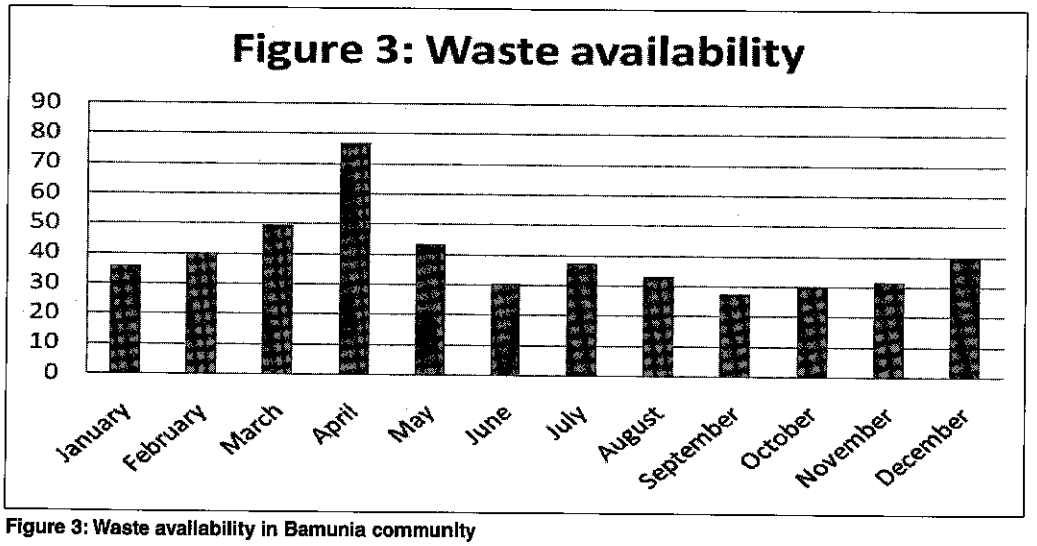

Figure 3: Waste availability in Bamunia community

Improves hygienic conditions

Managing of animal and other degradable wastes in biogas systems obviously improves hygienic conditions for the plant owners, their families and the entire village community. Biogas system eliminates the need for household's level waste dumping pits, thereby substantially improving the hygiene conditions in the village concerned. In addition, noxious odors are avoided, because the decomposed slurry stored in such pits is odorless.

Reduction of disease transmission

Since biogas slurry does not attract flies or other vermin, the vectors for contagious diseases, for humans and animals alike, are reduced. Furthermore, respiratory problems attributable to soot and smoke from the burning of dried cow dung and firewood, are mitigated.

Particularly in the rural areas of Bangladesh as long as inadequate sanitary and hygienic conditions prevail, the health of the rural people will remain threatened. The anaerobic

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digestion of animal and other organic wastes and effluents extensively detoxifies such material by killing most of the ova and pathogenic bacteria. It is not surprising, that the widespread popularization of biogas in Bangladesh has had immediate beneficial effects on the sanitary conditions of the areas concerned. As soon as the introduction of biogas technology fully covered an area, no more animal or organic wastes were deposited in the open pits. This would help to eliminate some of the main sources of infectious diseases e.g. tapeworm, schistosoma etc.

Economic aspect of disease reduction

With regards to the smoke reduction in the kitchen for the user of biogas technology, health effects are tangible. The reduction of diseases can only be felt if the numbers of biogas systems in an area reaches a critical threshold. Similarly, for a larger entity like village, district or nation, health impacts of biogas systems do not grow as a linear function of the numbers of biogas units installed. Analyses with caution was done to estimate the value of health benefits in a comparable region that is targeted for a biogas program.

Social acceptance and tradition

The women and children of poor families in rural areas traditionally expected that they collect fuel wood and cowdung, now have more free time and are more likely to attend school. Finding also shows that the use of biogas systems gives women more time to engage to the family affairs as well as caring of their children to boost up nations' development. The use of biogas for lighting can lead to remarkable changes in the way families integrate in the cultural and educational sectors. Biogas lighting makes it possible to engage in activities at night such as reading or attending evening schools.

Employment generation

During construction period of biogas plant creates an opportunity of short-term employment and income due to the need for excavation, metal-work, masonry and plumbing. Again, the subsequent operation and maintenance of the biogas systems can have long-term beneficial effects on regional employment and income. Community plants require a permanent/seasonal staff for plant management, raw material procurement, plant operation and maintenance, distribution of electricity, water and biogas and for disposal, processing & packaging of organic fertilizer for the marketing.

Conclusion

Fostering community based approach for managing waste is playing an important role for mitigating daily energy needs of rural households at Bamunia village. Community based biogas plants, may be considered as an efficient technology for managing all sorts of degradable waste to reduce diseases both for human and animal as a means of economic and sustainable environment.

In Bamunia village, neither grid nor piped supply gas is available for cooking. To make available required fuel decentralized supply systems like biogas, solar etc. may be considered

as better alternatives. To face this indispensable situation, finding alternative of renewable sources of energy is the only option. This area has a wonderful climate for biogas production. Community approach of managing and utilization of waste through biogas technology proved to be suitable and affordable one of those. They touched the success of producing biogas as a means of renewable energy source for cooking and electricity generation, bio-fertilizer, sustainable livelihoods and friendly environment through community led waste management approach instead of traditional family based biogas plant.

These technology need to be standardized and popularized for dissemination in rural Bangladesh. However, community may need motivational support for owning this technology to maintain all sorts of degradable waste especially for livestock and to have a sustainable environment. The Government along with NGOs and private sector institutions should initiate programs for extension and dissemination of this technology as a strategy of replicating this model by installing community led, "One Village One Biogas Plant".

Table 1: Daily average amount (kg) of raw materials supplied to the biogas plant by waste category

Month	Average amount (kg) of raw materials used /day				
	Cowdung	Poultry droppings	Kitchen waste	Others	Total
January	1080	30	41	13	1164
February	1337	30	48	14	1429
March	1521	32	46	11	1610
April	2438	42	60	32	2572
May	1315	39	39	20	1413
June	928	47	35	16	1026
July	1114	54	29	16	1213
August	973	58	33	13	1077
September	792	66	48	12	918
October	837	62	53	15	967
November	915	68	63	17	1063
December	1145	69	58	20	1292
Average	**1200**	**50**	**46**	**16**	**1312**

Table 2: Raw materials supplied to the biogas plant by percentage, ratio & price per (kg) at Bamunia community, Shajanpur, Bogra.

Item	Category of raw materials				
	Cowdung	Poultry droppings	Kitchen waste	Other	Comment
Feeding to biogas plant (%)	91	5	3	1	Depends on availability
Feeding to biogas plant (water : material)	1:1	1:2	1:0.5	1:1	Depends on raw materials
Average price Tk. per (kg)	**0.60**	**0.55**	**0.90**	**0.50**	**Including carrying cost**

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Table 3: Source wise yearly income & expenditure of chandkarim community biogas plant system

Item	Yearly expenditure (Tk.)				Yearly income (Tk.)			
	Input	Labor	Other	Total	House-hold	Farm	Total	Net income
Deep tube well	24000	12000 (1)	6000	42000	20400 (17)	48000 (2)	68400	26400
Biogas generator	12000	24000 (1)	5000	41000	51600 (43)	24000 (2)	75600	34600
Biogas supply	12000	24000 (1)	3000	39000	81600 (17)	12000 (1)	93600	54600
Organic fertilizer (Waste@0.52/kg× 478220kg)	248674	87000 (76)	5000	340674	-	-	478220	137546

N.B. Figures in the parenthesis indicate number of users.

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Methane Emissions from the Dams: Environment-friendliness of Hydropower

Dr. Mahfuzul Haque[1]

Abstract

This article is an attempt to relook at the hydropower energy based on the new findings and argues that popular understanding of hydropower as environment-friendly with no emission should be questioned against the backdrop of allegations of methane emissions from the submerged reservoir. As climate change is taking place due to increased presence of greenhouse gases in the atmosphere, the scientists and climatologists are putting emphasis on promotion of renewable energy, like hydropower energy. The article questions validity of the statement and unearth the issue of methane emission both upstream and downstream of the reservoir- a fact based on recent scientific findings. The paper suggests that promotion of hydropower by Clean Development Mechanism (CDM) under Kyoto Protocol 1997 and subsequently by Intergovernmental Panel on Climate Change (IPCC) as an alternative to non-renewable energy should be immediately halted and further investigations needed to be carried out on the probable adverse impacts of hydropower energy on the environment.

1 former Secretary, currently Adjunct
Faculty Development Studies, University of Dhaka.

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Introduction

In order to meet growing demands for energy, manage flood waters, provide irrigation and to supply water for drinking and industrial use, hydro-dams have been built since time immemorial. As population increased and national economies grew, more dams are being commissioned. By mid-twentieth century, at least 45,000 large dams have been built as a response to energy or water need (Rasheed, 2011). Out of them around 45% dams (22,000) are in China alone (World Commission on Dams, 2000). Dam construction started much before the 19th century and there many sayings of the world leaders on the utility of hydropower. US President Herbert Hoover (Hoover Dam was commissioned in 1936) proclaimed that "every drop of water that runs to the sea without yielding its full commercial returns to the nation is an economic waste" (Rasheed 2011). It was a significant moment in the history of dam building in the US. The Indian Prime Minister Nehru compared dam project to "the new temple of resurgent India". Egyptian President Nasser compared Aswan Dam to a "pyramid" (Rasheed, 2011).

Recently, many critical views on hydropower energy are surfacing based on new scientific findings. World Commission on Dams (WCD) in its report *Dams and Development: A New Framework for Decision-Making* (November 2000) said that while "dams have made an important and significant contribution to human development in too many cases an unacceptable and often unnecessary price has been paid to secure those benefits, especially in social and environmental terms, by people displaced, by communities downstream, by taxpayers and by the natural environment."So far, some 40-50 million people (other reports say as many as 80 million) displaced so far worldwide due to dam construction (WCD, 2000; Nusser, 2014). Millions living downstream also suffered due to loss of livelihood, not restored so far. Impacts on downstream people not accounted for compensation or relocation. Many displaced persons not resettled or compensated. Vulnerable ethnic communities suffer disproportionately. Gender gaps widened, poor and women suffer the most. Novelist like Arundhati Roy wrote in her book *The Cost of Living*, in protest of the *Narmada Dam* Project that "Big dams are to a nation's 'development' what nuclear bombs are to its military arsenal. They are both weapons of mass destruction. They're both malignant indications of civilisation. They represent the severing of the link between human beings and the planet they live on. They scramble the intelligence that connects eggs to hens, milk to cows, food to forests, water to rivers, air to life and the earth to human existence" (Roy, 1999). Medha Patkar, firebrand leader of the *Narmada Banchao Andolon* (Struggle to Save the *Narmada* River) said, "Development? What sort of development is this? Development with destruction?" (Khagram, 2004). There are myths surrounding hydropower energy by commissioning of dams that hydropower is cheap; hydropower is clean; hydropower is a renewable energy; hydropower is environment-friendly; it has no GHGs emission etc. Perhaps it's high time that we revisit commissioning of the dams and generation of electricity by creation of a permanent reservoir and its impacts on the environment.

Objectives

The objectives of the study are to: (1) explore the adverse impact of dams on environment pollution through emission of methane gas, a greenhouse gas and (2) suggest alternative mechanism to minimize the adverse impact of renewable energy sources of electricity generation.

Methodology

The study was carried out based on secondary sources of scientific information of recent time. Coated many critical views on hydropower energy generation based on new scientific findings. Descriptive analytical methods were used for explanation and interpretation of results based on relevant references.

Results and discussion

Pollution of hydropower

There is a common belief that hydropower is environment-friendly and does not cause emission polluting the environment. Hydropower's reputation for low emissions, however, has come under scientific scrutiny in recent years. Reservoirs behind dams flood vegetation, which decays, releasing methane and soil carbon. A study concluded that "emissions from tropical hydropower are often underestimated and can exceed those of fossil fuel for decades."(*Journal Nature Climate Change*, 2012). The study emphasized that the effect is more pronounced in tropical ecosystems. Yet hydropower is typically presumed to be emission-free. There is no mechanism within dam sanctioning processes, or any of the funding models that methane emissions are monitored in dam projects, even carbon market instruments such as the Clean Development Mechanism (CDM) help to fund large dams without considering their carbon foot prints. Intergovernmental Panel on Climate Change (IPCC) 2007 remained silent on the allegation of methane emission from hydro-dams. IPCC in a 2011 report, supported promotion of hydropower in order to slowing down of climate change, calling it a "proven, mature, predictable technology" (*The New York Times*, 19 November, 2014).

Question arises, whether hydropower is environment-friendly? Apparently, raw materials used for production of electricity are water, and the technology is very simple. Water stored in the reservoir is forced to pass through a penstock and the turbine rotates forced by onrush of water that generates electricity. In a study, it is found that hydro dams emit methane (CH4), which has the 24 times more global warming potential than that of CO2 (Haque, 2015). While some dams in the United States and Europe are being decommissioned, a dam-building boom is underway in developing countries. It is a shift from the 1990s, when amid concerns about environmental impacts and displacement of people, multilateral lenders like the World Bank backed away from large hydroelectric power projects. Later, according to International Energy Agency in Paris it is reported that world hydropower production will grow from 4,000 terawatt hours to 4,670 terawatt hours in 2020 (Erica, 2014). The IPCC

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predicted that hydropower generation will be double in China between 2008 and 2035, and triple in India and Africa (IPCC, 2007).

Methane emission

A small-scale study published in 2015 offers some clues. Researchers from the EPA's National Risk Management Research Laboratory in Cincinnati and the University of Cincinnati studied methane emissions from Harsha Lake near Cincinnati during a 13-month period spanning 2012. They found that Harsha Lake emitted more methane than had ever been recorded at any reservoir in the US. One of the study authors suggested that proportion of methane emission is more, perhaps of its location in an agricultural area. They are of the view that emissions from agricultural reservoirs could be a significant component of anthropogenic emissions.

The source of the methane is bacteria feeding on carbon-based organic plant material and breathing out methane. Agricultural runoff, such as that found in Harsha Lake, contains nutrients that allow algae to thrive, providing a wealth of food for microbes. And there's little information yet about how the amount of methane generated by reservoirs varies in different parts of a reservoir. Precisely how much they contribute to methane pollution is a mystery though. It was estimated for a long time that 20 percent of all manmade methane emissions were generated from the surface of reservoirs. But now scientists think it may be even higher than that, although few studies have been done so there's not enough data to attach a number to it. "Reservoirs are a globally significant source of methane, although most measurements have been made in tropical and boreal systems draining undeveloped watersheds," said the study's summary. Extrapolating from the methane they found at Harsha Lake, the researchers estimated that worldwide, all large reservoirs could emit as much as 104 teragrams of methane each year, compared to estimates of 80-120 teragrams of methane from fossil fuels (*The Daily Climate*, 11 September 2014).

Tropical hydroelectric dams, such as those in Amazonia, emit significant amounts of greenhouse gases, especially, methane. These emissions have been underestimated or ignored in many global and national greenhouse-gas accounts. Dam emissions are of two types: reservoir surface or upstream emissions and those from the water that passes through the turbines and spill ways (degassing or downstream emissions). Where dam emissions are counted, they often include only the upstream emissions. The recent Intergovernmental Panel on Climate Change (IPCC) special report (2011) on renewable energy ranks hydro as having half the impact or less compared with any other source including solar, wind and ocean energy. Carbon that is emitted as carbon dioxide comes from two types of source. First, there are fixed sources that produce a one-time emission, such as the trees inundated by flooding the reservoir and the stocks of carbon in the soil. Second, there are renewable sources such as the carbon that is removed from the atmosphere through photosynthesis by aquatic plants, phytoplankton or algae in the reservoir, trees in the watershed that produce litter that is washed into the reservoir by rainwater, or vegetation in the drawdown zone (the area that is temporarily exposed each time the water level is lowered in the reservoir).

Fixed sources of carbon dioxide should be counted as contributions to global warming, especially the decay of dead trees that are left projecting out of the water in a reservoir, but are often omitted. By contrast, carbon dioxide from renewable sources is not a net emission,

as this is exactly balanced by the carbon removed from the atmosphere when the biomass is formed. All of the methane emissions, however, make a net contribution to global warming. The reservoir's function in transforming renewable carbon into methane gives it the role of a methane factory, continuously removing carbon from the atmosphere as carbon dioxide and returning it as methane, with a much greater impact on global warming. Methane is formed where organic matter decays under anoxic conditions, such as in the sediments at the bottom of a reservoir. The soft vegetation that grows when the drawdown zone is exposed will decay under anoxic conditions at the bottom of the reservoir, releasing methane.

Philip M. Fearnside and Salvador Pueyo in a study (2012) observed that the water in a tropical reservoir stratifies thermally, with a warm layer (epilimnion) in the upper 2–10 m where the water is in contact with the air and contains oxygen, and a colder layer (hypolimnion) at the bottom where any oxygen is quickly exhausted and virtually all decay produces methane rather than carbon dioxide. Water passing through the turbines and spillways is drawn from the lower layer. Downstream gas emissions occur as the water is released under pressure below the dam. Just as bubbles emerge on opening a bottle of soft drink, the release of pressure reduces the solubility of gases, causing bubbles to form. Later, warming of water in the river below the dam causes further gas to be released. Downstream emissions have been omitted in a number of global compilations of estimates of dam impacts. The proportion of upstream and downstream methane emissions depends on the area of the reservoir and the magnitude of the river's flow: upstream emissions are proportional to the reservoir area but downstream emissions are proportional to the stream flow.

When downstream emissions have been included, they have often been underestimated by methods that miss a major portion of the release. Because much of the methane is released immediately as the water emerges from the turbines, and even inside the turbines themselves, estimates based on flux measurements by samplers floating on the water surface in the river some distance downstream will inevitably miss much of this emission. The only practical means of avoiding this bias is to calculate the immediate degassing emissions from the difference in methane concentration in the reservoir water at the turbine intake depth and in the water below the dam. Tropical dams emit more greenhouse gases than do dams in other zones.

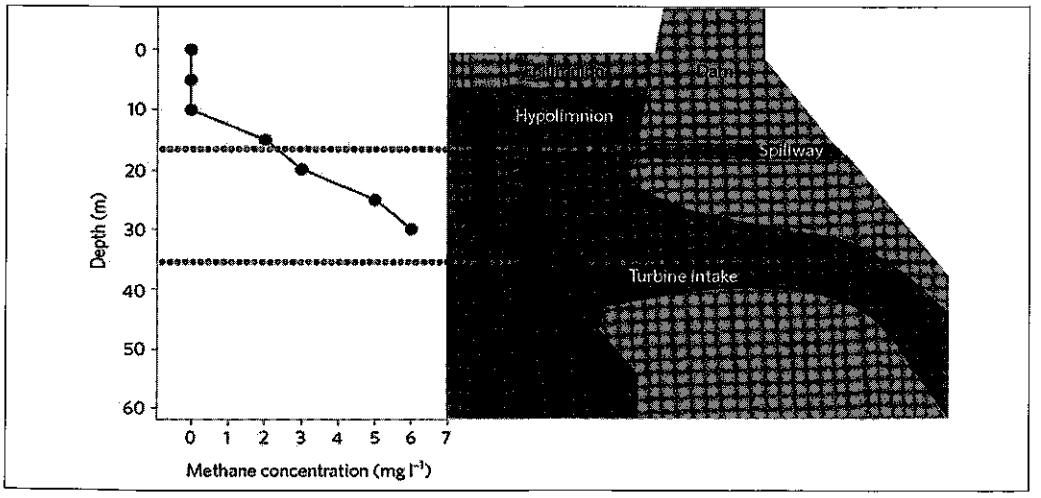

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Figure 1: Methane-rich water is drawn from below the thermo cline that divides the water column into a surface layer (epilimnion) and an anoxic bottom layer (hypolimnion). The thermo cline prevents cold water at the bottom of the reservoir from reaching the surface. The raise of water level releases of pressure and emerges allows the methane to degas to the atmosphere (Fearnside, P.M. and Pueyo, S., *Nature Climate Change*, June, 2012).

Unknowingly, dams are being promoted, on the basis of a supposed benefit in mitigating global warming, including the intention of capturing mitigation funds on a large scale under the Kyoto Protocol's Clean Development Mechanism (CDM). Unfortunately, these dams can be expected to have cumulative emissions that exceed those of fossil-fuel generation for periods that can extend for several decades, making them indefensible on the basis of global warming mitigation. In the case of Brazil, much of the country's Amazon forest is under risk from the consequences of global warming on this timescale. The time frame is critical in dealing with global warming: dams produce large emissions in the first few years followed by lower emissions that are sustained indefinitely, whereas generation from fossil fuels produces emissions at a constant rate. The greenhouse-gas debt created by the dam in the first years when emissions are much higher than those from fossil-fuel generation can take decades to pay off after the dam emissions stabilize at a level below those of fossil fuels. The consequences of waiting decades to begin effective reduction of global emissions are grave.

Controlling global warming will require mitigation measures that are sufficient to keep the atmospheric concentration of greenhouse gases below a level defined as dangerous. All emissions must be mitigated, whether or not they are the result of deliberate human actions such as building dams, or their reporting is mandatory at present under UNFCCC guidelines. If any of these emissions are ignored or understated, then the national quotas (assigned amounts) negotiated to reduce emissions will be insufficient and global temperatures will continue to increase, along with all of the impacts that this implies. Among the issues to be faced is that of counting all emissions from dams and including them in national inventories. The emissions from tropical hydropower mean that this is not clean energy and that countries need to commit to making deeper cuts in their anthropogenic greenhouse-gas emissions than they have been willing to consider so far.

Most important greenhouse gases with respect to reservoir emissions and their basic properties in the atmosphere are given in the following table (Olli V. *et al*, 2012):

Table 1: Greenhouse gases and their basic properties

			Global Warming Potentials relative to CO2		
Gas	**Symbols**	**Lifetime (Years)**	**20-Year**	**100-Year**	**500-Year**
Carbon dioxide	CO_2	-	1	1	1
Methane	CH_4	12	72	25	7.6
Nitrous oxide	N_2O	114	289	298	153

The Fourth IPCC Report, 2007 lists several dozen GHGs but the others have a minor relevance in this context. The greenhouse warming potential of gases is typically expressed as CO_2 equivalents, which are different in different time perspectives since gases such as methane or nitrous oxide degrade in the atmosphere. For instance, a unit of methane has

72 times the warming potential as the same unit of CO_2 in the timescale of 20 years, but this goes down to 25 in the time perspective of 100 years. The analysis was made using the 20-year equivalents (IPCC Fourth Assessment Report, 2007).

Greenhouse gases from reservoirs

It has been known for at least a century that natural lakes and wetlands have an active exchange of gases with the atmosphere. The process of photosynthesis consumes CO_2 and releases O_2 while the degradation of organic material does the opposite. The sediment is important in this process, acting on one hand as a sink of carbon since sediment material is often rich in organic carbon, while on the other hand, the degradation processes release carbon from the sediments. The dominant form of this released carbon is CO_2 if the sediment surface is rich with oxygen and methane (CH_4) if the sediment and deeper water layers are anoxic (Olli *et al,* 2012).

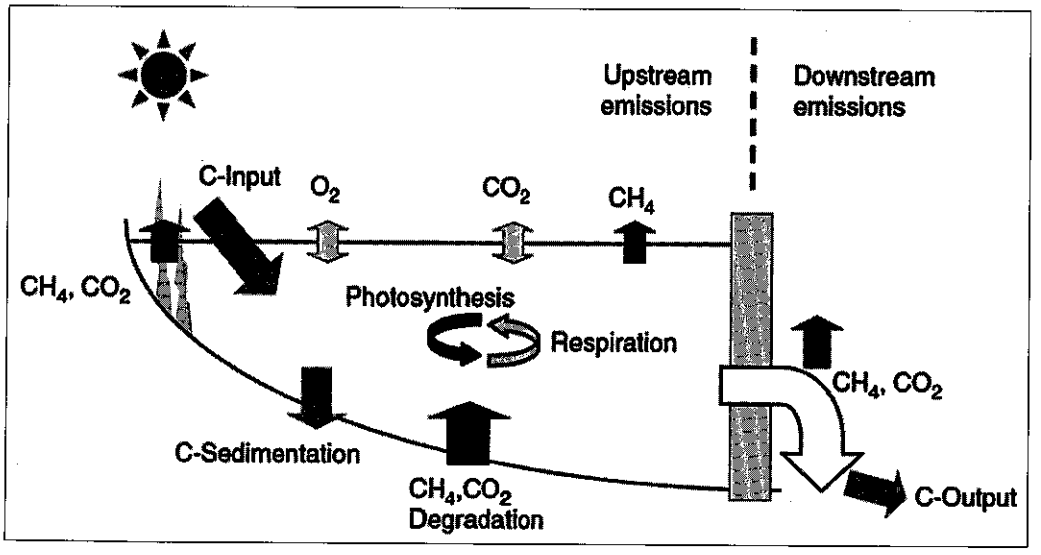

Fig 2: Major gas fluxes in a reservoir. The relative role of these fluxes is highly specific

An important player is the alkalinity of the water. If the water contains high concentrations of lime and other earth metals, the p^H is high and the lake or reservoir tends to act as a carbon sink. This is because the lime precipitates to the sediment with CO_2 and forms very stable compounds. In contrast, if the water is acidic and the earth-alkaline metals are in short supply, the water body tends to emit carbon to the atmosphere. In acidic water bodies with high humic acid concentration such as the peat land reservoirs of northern Europe and Canada, the humic acids arable to precipitate to the sediments in certain amounts and thus remove carbon from circulation.

If the lake or reservoir is eutrophic, i.e. it contains plenty of nutrients and its primary production level is high, it fixes high amounts of atmospheric CO_2 and releases much of it back to the atmosphere. But a part of this carbon is sedimented, and is stored in the bottom layers. Consequently, the lakes and reservoirs act as asink for this carbon, but in the case of allochthonous carbon (the carbon compounds that come with the inflow and are degraded in the lake), lakes act as a source of carbon for the atmosphere. Depending on the

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balance between these two processes, the lakes act as either sources or sinks of carbon for the atmosphere. In eutrophic conditions, the amount of settled, easily degradable organic material tends to be large enough to consume all available oxygen from the bottom layers of the water body, and the sediments release methane, phosphorus, sulphides etc., that accelerate the eutrophication process. This is usually seen as a major water quality problem in lakes and reservoirs.

The main difference between lakes and reservoirs in this regard is the following. Most reservoir bottoms, once inundated with water, contain large amounts of organic material such as wooden material, peat, other plant material and the like. This material is rich in carbon, and when it comes in contact with minerals, the carbon is released into the water body and the atmosphere. Much of this material is relatively easily degradable and leads to oxygen deficiency and methane formation, which is a common problem in the case of reservoirs. The greenhouse gas emissions of reservoirs have there for been estimated to be in many cases far larger (as calculated per unit area) as those of natural lakes or wetlands. The estimates available vary substantially, but as a global average, the reservoirs may release 3-5 times the amount of GHGs as compared to natural lakes (Haque, 2013). There is enormous variation in estimates due to differences in the locations where reservoirs are being constructed, as well as due to the time that has elapsed since reservoir inundation. The factual impact of reservoir construction on GHG emissions is the net emission, i.e. emissions in the pre-damming conditions subtracted from actual emissions. Such impact analyses are available for very few cases; they are there for subject to rough and varying estimates and also too much argumentation.

Another major difference between natural lakes and man-made reservoirs is the following. If a reservoir has a dam and the water is released from deeper water layers, the released water might contain pressurized gases including greenhouse gases. Once the pressure drops as soon as the water exits the reservoir, large quantities of gases might be released into the atmosphere. This phenomenon, called degassing, and its contribution to total emissions of reservoirs are under heavy debate, although the phenomenon is well known in theory.

Conclusion

It is suggested that more scientific studies are to be conducted on GHG emissions from the reservoirs before we come to a conclusion on their environment-friendliness. Attention should be paid to both CO_2 and particularly CH4emissions and N_2O should not be neglected. Prior to construction of a reservoir, the GHG balances should be investigated and monitored systematically after inundation so that the net emission rates can be ascertained. The evolution of emissions over time would also be an important issue to study. While emissions from the reservoir itself are an issue, an additional emission source is the water discharged from the reservoir. These downstream emissions are very scarcely investigated and there is an urgent need to track them carefully, particularly in cases in which the water is discharged from deeper water layers where the pressure is much higher than in the atmosphere and where anoxic conditions prevail.

A systematic analysis should be made of the types of reservoirs (in terms of depth, vegetation, water quality, dam type etc.) that are most risky for high greenhouse gas emissions. Equally important is a systematic analysis of the influence of water quality factors such as eutrophication level, alkalinity and concentration of humic substances to GHG balance. Special care and attention should be paid to planned reservoirs with such properties. This alert is particularly important in tropical conditions. Therefore, the assessment of emissions from such reservoirs is of prime importance. Based on the findings of these studies, the policy makers could develop further policy options on undertaking hydro projects. Against the backdrop of global proliferation of dams for generation of hydro power, the scientists are to seriously ponder on the environment-friendliness of the hydro power, when there serious allegations of methane emissions from the reservoirs.

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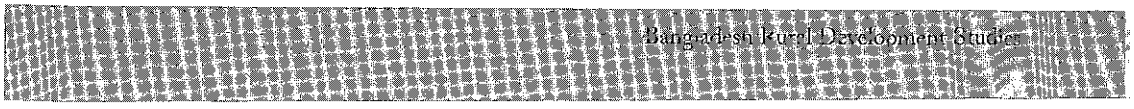
Bangladesh Rural Development Studies

Role of Homestead Agroforestry on Livelihood Improvement of Rural Women in Dinajpur District, Bangladesh

Rebeka Sultana[1]

Abstract

The study was conducted in five upazillas of Dinajpur District . Total 100 women respondents were selected randomly for the study 20 from each upazilla. The study was undertaken to determine the level of acceptability of homestead agroforestry practices by the women and its impact on their livelihood. It also explored the relationships among the selected characteristics of the women namely age, education, family size, homestead area, knowledge of homestead agroforestry, annual income from homestead area, problem confrontation with homestead agroforestry practices and opinion regarding changes of livelihood. A structured interview schedule was used to collect data and correlation test was conducted to ascertain the relationship between concerned dependent and independent variables of the study. The majority (67%) of the women had medium attitude regarding changes in livelihood while; 23% had low attitude and 10% had high attitude towards traditional homestead agroforestry practices. Education, knowledge of agroforestry, homestead area, knowledge on homestead agroforestry had significant positive relationship with their attitude regarding changes in livelihood; while age, family size, annual income from homestead area and problem confrontation had no significant relationship. Therefore, there is a great scope to improve the existing homestead agroforestry practices with suitable agroforestry approaches for maximizing income of the women.

Keywords: Homestead Agroforestry, Rural Women, Women's opinion

1 Assistant Director
Rural Development Academy (RDA), Bogra

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Introduction

Homestead agroforestry is the subsistence system and potential production area in Bangladesh, especially for the rural poor people. Homestead production system, which is popularly called homestead agroforestry or home gardening (the integrated production of crops, trees, and/or livestock in the household's residence and its surrounding areas), has been playing an important role in the rural economy of Bangladesh since time immemorial, and providing various essential products and services to millions of rural households. About 85 per cent of population lives in the rural areas in 15.4 million households spreading over 85000 villages (FAO, 1986; BBS, 2000). Bangladesh holds a total of 399585 hectares of homestead land with 0.03 ha per household, with marginal, small, medium and large household having an average 0.01, 0.02, 0.04 and 0.07 ha of total cultivated land respectively (BBS, 2006). Bangladesh possesses a glorious tradition of agroforestry systems practiced by the farming communities. Well planned interacted land use system combining woody perennials and other production enterprises in accordance with the farmers' need, goals and resources base can only lead to viable farming system towards sustainable livelihood in the coming future. The homestead of rural people is a unique feature of combination of trees, shrubs, vegetables, livestock, ducks, poultry, and pigeon from ancient time. In Bangladesh 68% of the forest products is fuel wood but they met only 10% of the demand to national fuel energy (ADB, 1993. Byron,1984) observed that 90% of the fuel wood and 70% of timber requirement of the country were met from the homestead plantation. The major portion of the rural household has homestead and cropland areas, and thus can contribute to the economy of the country to a large extent (Rahman, 1995). All of these are planted and maintained by household member's especially female members with the view to household consumption; they have considerable ornamental value and provide shade to people and animals. In Northern part Bangladesh, innovative women have spontaneously developed agroforestry systems in their homesteads and croplands. They provides benefits to the rural community because trees offer facility such as shade, shelter, recreation, agro-ecological balance and so on (Roy *et al.,* 1996). Homestead agro-production has special significance in the context of Bangladesh where about 50% of rural households are landless (Januzi and Peach, 1977). Homestead farming is getting importance as the way of investing minimum capital but earning maximum income with increased participation of women in economic activities. Homestead agroforestry may contribute to uplift the socio-economic condition of the women, supply fuel wood, give protection from hazards, provide food and other benefits etc. Thus the study was carried out to determine the role of homestead agroforestry on the livelihood improvement of rural women in Dinajpur district of Bangladesh.

Methodology

Location

The study was conducted in Dinajpur district. The district consists of 13 upazila. Each upazila consist of several unions, each comprising different villages. Among the 13 upazilas, 5 upazilla namely Dinajpur Sadar Upazilla, Chirirbandar, Khanshama, Birgong and Kaharol was selected randomly.

Preparation of questionnaire: The survey schedule was carefully designed in the light of the objectives to the study. The draft schedule was pre-tested by interviewing some sample women and necessary modifications were made accordingly.

Period of data collection: To achieve the objectives of the study and to minimize errors, several repeated visits were made to collect data properly. A stratified random sampling technique was followed to select the sample women. Rapport was established with the respondents through informal discussion regarding objectives of the interview. Data were collected from 25 January to 14 June 2013.

Variables of the study: Independent variables of the study were age, education, family size, homestead area, annual income from homestead area, knowledge on homestead agroforestry and problem confrontation. The dependent variables were adoption of homestead agroforestry practices and opinion regarding changes in livelihood of rural women.

Measurement of independent variables: Age of the respondents was measured by counting the period of time from her birth to the time of interview and was expressed in terms of years. Education was measure in terms of classes passed by her and score was given according to the class passed while a respondent who did not know reading or writing had education score of zero (0). Family size of a respondent was determined in terms of the total number of members of a family. The family member included respondent herself, spouse, sons, daughters and other dependents. Homestead was measured by the area of the raised land in which the household has its entire living room, livestock and poultry shed, yard under vegetable, home garden, fruit and timber trees, backyard, bushes, bamboo bunches, pond etc. expressed in hectare. Annual income from homestead area refers to the total earnings of all family members of women from trees species, vegetables, livestock, fisheries and other sources and express in taka. Knowledge on homestead agroforestry refers to the knowledge gained by the women from different sources and also through their experiences of homestead agroforestry and farming. Finally problem confrontation was measured using of closed form of questions and the respondents were asked to give their opinion in 25 selected problems, which were identified during designing of the questionnaire along with their extent of confrontation in use of homestead agroforestry practices.

Measurement of dependent variable: A four point scale was used for computing the extent of adoption to homestead agroforestry practices. Weights of responses against the applicable ones of the 25 practices were assigned in the following way. A score of 3, 2, 1 and 0 was assigned for high use, medium use, low use and no use respectively. The weights of responses of all homestead agroforestry practices were added together to obtain the extent

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of use homestead agroforestry practice and the score of the respondents could range from 0 to 75 where 0 indicating no use and 75 indicating high use of agroforestry practices.

Opinion regarding changes in livelihood is another dependent variable which was measured by the changes in socio-economic aspects of the women. It referred to the improvement of social as well as economic status of the women respondent. The women were asked to give their opinion regarding the improvement in socio-economic aspects of' their livelihood due to the contribution of homestead agroforestry. It was measured on the basis of opinion obtained from the women in 15 statements containing information on the improvement of socio-economic aspects of their livelihood.

After completion of field survey data were coded, compiled, tabulated and analyzed in accordance with the objectives of the study. In the process, all the responses in the interview schedule were given numerical coded values. Local units were converted into standard units and qualitative data were converted into quantitative ones by means of suitable scoring techniques whenever necessary. Descriptive analysis such as range, number and percentage, mean, standard deviation and rank order were used whenever possible. Pearson's product moment co-efficient of correlation (r) was used in order to explore the relationship between the concerned variables.

The weights of responses of all homestead agroforestry practices were added together to obtain the extent of use homestead agroforestry practice and the score of the respondents could range from 0 to 75 where 0 indicating no use and 75 indicating high use of agroforestry practices.

Pearson's product moment co-efficient of correlation (r) was used in order to explore the relationship between the concerned variables.

Results and discussion

Characteristics of the women

Age of the respondents ranged from 16 to 69 years with an average of 39.43 years and standard deviation of 9.11. On the basis of their age, the respondents were classified into three categories as presented in Table 1. The highest proportion (54.8%) of the women was in the middle age, 11.3% old and only 33.9% was in young category. The major proportions of the household members are middle aged and they have the working ability to change their livelihood. The educational level of the women ranged from 0-14 with an average of 7.06 and standard deviation of 4.17. The data stated that good number of household members are educated and they are well motivated to change their socio-economic status by using modern agroforestry approaches. The family size of the women ranged from 3-8 with an average of 5.43 and standard deviation 2.14. Most of the women (52%) had medium families compared to 30% small and 18% large families (Table 1). The homestead of the women ranged from 0.01-0.24 hectare with an average of 0.16 hectare and standard deviation of 0.24. Among the women 21.1% were marginal, 41.6% small, 28.39% medium had medium and only 9% had large homesteads. With the lack of homestead area the women had no scope to practices

modern homestead agroforestry approaches and it is one of the major constraints to uphold their socio-economic conditions.

Annual income of the women ranged from Tk. 2073.00 to 95175.00 with an average value of Tk. 15817.3 and standard deviation of Tk. 13849.62. The study indicates that most of the women (30%) were small category, (average annual income Tk. up to 15000.00) 45% of the women were medium category (average annual income Tk. 15000.00 to 25000.00), 25% of the women were large (average annual income above Tk. 25000.00) (Table 1).

The computed knowledge on homestead agroforestry scores ranged from 15-44. The mean and standard deviation were 23.18 and 6.017 respectively. The highest proportion of (44%) women had medium homestead agroforestry knowledge, 35% had low and 21% had high level of knowledge on homestead agroforestry, respectively (Table 1). The problem confrontation scores of all respondents ranged from 9-41. The mean and standard deviation were 26.08 and 7.328 respectively.

Table-1: Description of women characteristics treated as independent variables of the study (N=100)

Characteristics	Category	Respondent %	Measuring Units	Observed Range	Average	Standard Deviation
Age	Young age (up to 35)	33.9	Years	16-69	39.43	9.11
	Middle age (36-50)	54.8				
	Older age (above 50)	13.3				
Education	Illiterate (0)	43.5	Level of Schooling	0-14	7.06	4.17
	Primary level (1-5)	24.3				
	Secondary level (6-10)	17.7				
	Higher level (above 10)	14.5				
Farm Size	Marginal (<0.05 ha)	1.6	Hectare	0.04-3.54	099	0.72
	Small (0.05-1 ha)	61.3				
	Medium (1-1.5 ha)	19.4				
	Large (>1.5 ha)	17.7				
Family Size	Small (up to 5)	30	Number	3-8	5.43	2.14
	Medium (6-9)	52				
	Large (above 9)	18				
Homestead Area	Marginal (0.02-0.08 ha)	16.1	Hectare	0.01-0.24	0.16	0.24
	Small (0.08-0.14 ha)	45.2				
	Medium (0.14-0.20 ha)	6.5				
	Large (above 0.20 ha)	32.3				
Knowledge of Homestead Agroforestry	Low	35	Scale score	15-44	23.18	6.017
	Medium	44				
	High (above)	21				

Characteristics	Category	Respondent %	Measuring Units	Observed Range	Average	Standard Deviation
Annual income from homestead Agroforestry	Small (Tk. up to 15000)	30	Taka	2073-95175	15817.3	13849.62
	Medium (Tk.15000 to 25000)	45				
	High (above Tk. 25000)	25				
Problem confrontation	Low (up to 15 score)	25	Scale Score	8-43	26.08	7.328
	Medium (16 to 30 score)	55				
	High (above 30 score)	20				

Adoption of traditional homestead agroforestry practices: The adoption of traditional homestead agroforestry practice score to the women ranged from 18 to 59 with the mean value to 28.27 and standard deviation 7.72. Based on the adoption scores, the respondents were classified into 3 categories (Table 2). The overwhelming majority of the women (53%) were medium category who was found to have high adoption of traditional homestead agroforestry practices.

Table 2: Distribution of women according to their adoption of homestead agroforestry practices and attitude regarding the impact of traditional homestead agroforestry practices

Characteristics	Category	Respondent %	Measuring system	Average	Standard Deviation
Adoption of traditional homestead Agroforestry practices	Low (up to 30)	29	Scale Score	28.27	7.72
	Medium (30 to 50)	53			
	High (above 50)	18			
Attitude regarding changes in livelihood	Negative (up to 35)	13	Scale Score	39.81	15.23
	Medium (36 to 55)	61			
	Positive (above 55)	26			

Opinion regarding changes in livelihood: Scores of women opinion regarding changes in livelihood through traditional homestead agroforestry practice ranged from 21 to 68 with a mean value to 39.81 and standard deviation 15.23. Based on the scores, the respondents were classified into 3 categories (Table 2). The overwhelming majority of the women (61%) were medium category who was found to have medium opinion on livelihood of traditional homestead agroforestry practices, where 13% had low and 26% of them had high adoption.

Relationship between the selected characteristics of the respondents and adoption of traditional homestead agroforestry practices on livelihood: To explore the relationship between the selected characteristics and their adoption and impact of their livelihood observed in traditional homestead agroforestry system, Pearson's product moment co-efficient of correlation (r) has been used (Table 3) with description of the meaning of 'r' (Cohen and Holiday, 1982).

All the characteristics of the women and situational factor to the women except age and problem confrontation had significant positive relationship with the adoption to traditional

agroforestry practices. Problem confrontation to the women faces had significant negative relationship with their adjusted behavior to agroforestry practices. While the education, family size, homestead area, annual income from homestead and knowledge of homestead agroforestry had shown the significant positive relationship with the adoption towards the traditional homestead agroforestry. In case of age Sultana (2003) found the similar type of findings for adoption of traditional homestead agroforestry. Women characteristics like age, family size, and annual income from homestead had no significant relationship with the opinion regarding changes in livelihood in homesteads while problem confrontation showed the negative non-significant relationship. On the other hand education, homestead area and knowledge of homestead agroforestry had positive relationship to the attitude regarding changes in livelihood in homestead.

Table-3: Computed co-efficient of correlation (r) among dependent variables and selected characteristics (N=100).

Women Characteristics	Values of 'r' with df 98 for adoption of traditional agroforestry	Values of 'r' with df 98 for attitude regarding changes in livelihood in homestead
Age	-0.073^{NS}	0.007^{NS}
Education	0.463**	0.489**
Family size	0.258**	0.095^{NS}
Homestead area	0.253**	0.267**
Annual income from homestead	0.252*	0.091^{NS}
Knowledge of homestead agroforestry	0.554**	0.443**
Problem conformation	-0.291**	-0.187^{NS}

Note: NS= Non significant, *-significant at p≤ 0.005 and ** = significant at p≤ 0.001

Meaning of correlation co-efficient (r)

r value	Meaning
± 0.009- 0.19	Very low correlation
±0.20-0.39	low correlation
±0.40-0.69	Medium correlation
±0.70-0.89	High correlation
±0.90-1.00	Very high correlation

Conclusion

Women are used to practicing traditional homestead agroforestry systems from time immemorial. Homestead size was a factor for the increase of production. Some areas of the homestead were found to be unutilized that could be used for growing more trees and vegetable crops. The selected women thought that the traditional homestead agroforestry systems had significant role in improving socio-economic status and up gradation of environmental condition in the area. Therefore, there is a great scope to improve the prevailing homestead agroforestry practices with the modern agroforestry technology for maximization of income of the women. From the study it was also found that the highest percentage of the

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respondents had medium level of adoption to the traditional homestead agroforestry that might have ultimate reflection in their adoption of homestead agroforestry practices. The extent of knowledge regarding changes in attitude in livelihood encouraged them to adopt the traditional homestead agroforestry system which is not sufficient enough to adopt a well planed and highly manageable system aiming higher profit and uplift of economic condition. Thus it is necessary to strengthen knowledge on homestead agroforestry for effective utilization of homestead areas with suitable sophistical agroforestry approach to maximize homestead productivity and family income.

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Salinity Intrusion in the Coastal Areas of Bangladesh: A New Challenge to Agricultural Sustainability

Fahmida Sultana[1]

Rayhan Miah[2]

Abstract

Salinity intrusion is an increasing problem in the coastal areas around the world. Climate Change and its associated hazards like sea level rise, cyclone and storm surge had been increasing the salinity problem in many folds. The purpose of the study was to identify how salinity intuition was putting challenge to agricultural sustainability and its possible remedy measures for coastal areas. The study was mainly qualitative and the data was collected from secondary sources. Data revealed that climatic and anthropogenic factors were mainly responsible for salinity and sea level raise. That was found as main cause for saline intuition in coastal regions and reason for increasing salinity in surface water, ground water, soil degradation and loss of agricultural production. Besides cyclone, storm surge, back water effect, precipitation also enhance also enhance salinity. Salinity causes unfavorable environment and hydrological situation and hampered crop production and livelihood improvement of farmers. Therefore, to prevent current loss and to reduce future loss this paper recommended some adaptive techniques and strategies that was protection of embankment, establishment of sluice gate, leveling of land, rain water harvesting, saline tolerant treatment, verities and adaptive measures and irrigation management system etc.

Key words: Climate change, Salinity intrusion, See level rise, Crop production

1 Associate Professor
Department of Development Studies, University of Dhaka.

2 Program Officer
Centre for Entrepreneurship Development, BRAC University.

Introduction

Salinity intrusion is a growing problem in the coastal areas around the globe. The problem becomes exacerbated especially in the dry season when rainfall is inadequate and incapable of lowering the concentration of salinity on surface water and leaching out salt from soil. Climate change associated hazards like sea level rise, cyclone and storm surge have been contributing to the problem in many folds. Inter Governmental Panel on Climate Change (IPCC) Article Four(2007) predicted that the sea level rise is likely to persist for centuries, resulting from the process and feedback of climate, even though the concentration of Green House Gases (GHG) are to become steady. The sea level rise is likely to put gravest threat by land desertification through salinity intrusion. Irrigated water demand is highly affected by salinity intrusion in surface water (Shahid, 2010) and salt accumulation in the root zone of soil affects plant growth in coastal soil (Yadav, et al. 2009). Besides constraining agricultural production, salinity limits the fresh water availability for drinking purpose and industrial production. Bangladesh, a low-lying deltaic land, is particularly vulnerable to sea level rise and its associated hazards.

Being an agrarian country, 60% people of Bangladesh are directly or indirectly dependent on agriculture for their livelihood with the contribution of 20% of its Gross Domestic Product (GDP) (BCCSAP, 2009). The dominant land use in coastal Bangladesh is also for agriculture. The gross and the net-cropped area in the coastal zone of Bangladesh is 144,085 and 83,416 hector respectively (Islam, 2004).

However, the net-cropped area of coastal zone in Bangladesh has been decreasing over the years due to the land inundation and salinity intrusion by tidal water. It is estimated that a net reduction of 0.5 million metric tons of rice production will take place due to a 0.3 meter sea level rise in coastal areas of Bangladesh (World bank, 2000). In general, soil salinity is believed to be mainly responsible for low land use as well as cropping intensity in the area (Rahman & Ahsan, 2001). World Bank (2000) also predicted a 1 meter sea level rise at the end of the century which would affect 17.5% of total land mass of the country. It implies that the future sea level rise will bring further land under inundation and therefore, salinity will intrude to more inlands.

This paper shows how salinity intrusion is putting new challenge to agricultural sustainability in the coastal area of Bangladesh.

Objectives

The overall objective of this study is to identify how salinity intrusion is putting new challenge to agricultural sustainability in the coastal area of Bangladesh. This study also sees the root causes of the salinity intrusion and the possible remedy measure for this salinity problem in the coastal area of Bangladesh.

Methodology

The study is mainly qualitative in nature. It is based on the data mainly from secondary sources. Data are collected from various sources. The secondary data sources are books, articles, reports, websites, journals, and the publications from the concerned organization.

Discussion

The coastal saline area lies about 1.5 to 11.8 meters above the mean sea level. The Ganges river meander floodplain systems are standing higher than the adjoining tidal lands. The tidal floodplain has a distinctive, almost level landscape crossed by innumerable interconnecting tidal rivers and creeks. The estuarine islands are constantly changing shape and position as a result of river erosion and new alluvial deposition. Peat basins are located in some of the low lying areas between the Ganges river floodplains and tidal floodplains occurring in the western part of Khulna (Karim *et al.*, 1982). These areas are subject to flooding in the monsoon season and water logging in parts of the basin areas in the dry season. Tidal flooding through a network of tidal creeks and drainage channels connected to the main river system inundates the soil and impregnates them with soluble salts thereby rendering both the top and subsoil saline. The most significant feature of hydrology in relation to agricultural development is the seasonal shallow flooding (up to 90 cm) which affects about 64% of the total area. In these areas flood water recedes from October to late December. Depending on topographical position and drainage facilities, water recedes from about 24% area within October, from about 53% area in November and mid December and from about 23% area in late December.

Causes of salinity intrusion in the coastal area of Bangladesh

Water circulation in the coastal zone and in the Meghna estuary in Bangladesh is largely dependent on the factors like fresh water flow from the river, penetration of tide from the Bay of Bengal and the meteorological conditions like low pressure systems, cyclones, and storms surge and wind (MoWR, 2003). Both climatic and anthropogenic factors are responsible for causing salinity in the river water. However, climate induced factors such as sea level rise is the most pressing cause of salinity in coastal areas. Figure 1 illustrates causes of salinity intrusion.

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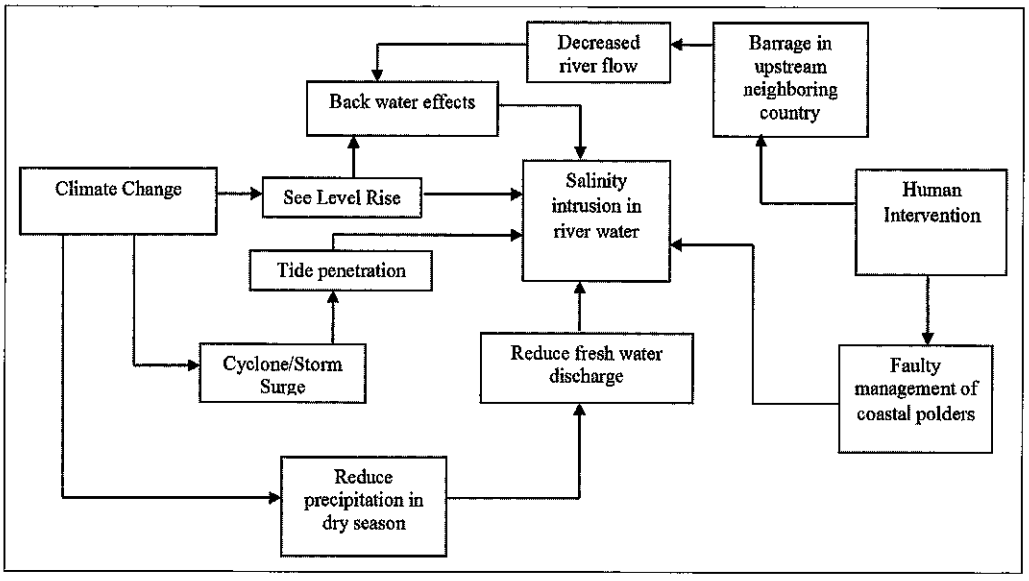
Figure 1: Causal diagram of salinity intrusion



(Source: Seal and Baten, 2012)

Climate change induced factors

Rising temperature and fluctuation in precipitation are considered as the signs of climate change which are likely to have multiple impacts on the coastal zone of Bangladesh. World Bank (2000) predicted that the sea level might rise to 30 and 50 cm respectively with changing temperature and precipitation in 2030 and 2050 (table 1).

Table 1: The scenario of climate change in Bangladesh

Year	Sea level rise (cm)	Temperature increase (°c)	Precipitation Fluctuation compared to 1990 (%)
2030	30	+ 0.7 in monsoon; + 1.3 in winter	- 3 in winter; + 11 in monsoon
2050	50	+ 1.1 in monsoon; + 1.8 in winter	- 37 in winter; + 28 in monsoon

Source: World Bank, 2000.

In the scenario, World Bank (2000) showed that the increase in temperature in winter would be higher than that of summer and therefore, may cause higher rate of evaporation from the surface of the river in winter in the upcoming days. Moreover, fluctuating precipitation would likely to reduce precipitation in the dry season in the near future. The cumulative impact results in a low flow condition in the river. Again, sea level rise will likely to create backwater effect in the mouth of the river and exacerbate salinity in the river water.

Sea level rise

Bangladesh, having a densely populated coastal area, is highly vulnerable to sea level rise. United Nation Environmental Program (UNEP) (1989) predicted a 1.5 m sea level rise by 2030 which will inundate 16% of total land mass and effect 15 million people, whereas world Bank (2000) predicted a rise of 10 cm, 25 cm and 1 m by the year 2020, 2050 and 2100 respectively which will likely to inundate 2%, 4% and 17.5% of total land mass respectively. Based on 22 historical data, SAARC Meteorological Research council (SMRC) has developed a trend of sea level rise in three tidal stations in the coastal Bangladesh and the trend depicts a worrying picture where on an average coastal areas experience 5.9 mm sea level rise every year.

Table 2: Trend of tide in the three coastal stations

Tidai Station	Region	Latitude (N)	Longitude (E)	Datum (m)	Trend (mm/year)
Hiron Point	Western	21°48′	89°28′	3.784	4.0
Char Changa	Central	22°08′	91°06′	4.996	6.0
Cox's Bazar	Eastern	21°26′	91°59′	4.836	7.8

Source: SMRC; cited in Rahman and Alam, 2003.

Sea level rise has direct influence on salinity intrusion in coastal area. The anticipated sea level rise would produce salinity impacts in three fronts: surface water, groundwater and soil. Increased soil salinity due to climate change would significantly reduce food grain production. Even at present, some parts of coastal lands are not being utilized for crop production, mostly due to soil salinity; and this situation would aggravate further under a climate change scenario. A modeling exercise has indicated that, under the changed climate conditions, the index of aridity would increase in winter (Huq, et al. eds.1999). Consequently, higher rates of capillary action from an increased rate of topsoil desiccation would accentuate the salinity problem.

Cyclone and storm surge

The coastal zone and off shore island in Bangladesh is very flat with height less than 3 m above the mean sea level. The astronomical tide is very prominent in coastal Bangladesh with higher range and therefore cyclone induced sea level rise and storm surge is likely to be very frequent. Khan, *et al.* (2010) predicted that climate change would increase the frequency of tropical cyclone with larger peak wind speeds and with heavier rainfall.

Back water effect

Backwater effect is a special type of saline water movement which takes place at the mouth of the river when fresh water is not sufficient enough to counterpart tide water moving towards river from sea. Ali (1999) identified different causes of backwater effect, among them i) South west monsoon wind ii) astronomical tides iii) storm surge are responsible for backwater effect at the mouth of the Meghna estuary . He further argued that sea level rise is the non-dynamic and long term cause of backwater effect.

Precipitation

Precipitation pattern is likely to be changed in south Asia due to higher temperature that results in stronger monsoon circulation (MoWR, 2003). Such fluctuation in precipitation causes flood with higher magnitude in wet season and reduces the availability of fresh water in dry season. Using Global Circulation Model (GCM), Agarwala *et al.* (2003) showed that winter temperature is in a rising trend due to climate change. On the other hand, the precipitation is likely to be increased throughout the summer monsoon. They argued that during summer air over the land gets warmer than the air over oceans which will create a further low pressure system in the land and exacerbate the monsoon. However, the winter with a small decrease in precipitation and higher evaporation will create drier condition. The combined effect of less precipitation and higher evaporation will cause a low flow situation in the river water.

Constraints for agricultural development

The agricultural development in the coastal saline belt is constrained by various physical, chemical and social factors. In general, the major agricultural constraint identified that impedes development has been found the increasing intensity of salinity. Soil salinity is the most dominant limiting factor in the region, especially during the dry season. It affects certain crops at different levels of soil salinity and at critical stages of growth, which reduces yield and in severe cases total yield is lost. A substantial area of land is tidally affected by saline water. Appropriate management practice for crop production in this area is not available. Fertility status of most saline soils range from low to very low in respect to organic matter content, nitrogen, phosphorus and micronutrients like zinc and copper. The crop yields obtained in these soils are also low.

How salinity threaten agricultural productivity?

The effect of saline water intrusion in the estuaries and into the groundwater would be enhanced by low river flow, sea level rise and subsidence. Agriculture is a major sector of Bangladesh's economy and the coastal area of Bangladesh is very fertile for growing rice. Increase in salinity intrusion and increase in soil salinity will have serious negative impacts on agriculture. The presently practiced rice varieties may not be able to withstand increased salinity. The food production does not seem to have a better future in the event of a climate change. In Bangladesh, rice production may fall by 10 % and wheat by 30 % by 2050 (Climate change in Asia 'too alarming to contemplate'-report, IPCC, 2007).

Impact on crop production

Salinity intrusion due to sea level rise will decrease crop production by unavailability of fresh water and soil degradation. Salinity also decreases the terminative energy and germination rate of some plants (Rashid et al., 2004; Ashraf et al., 2002). Several studies have been conducted to see the impact of salinity intrusion on crop production. And these studies found that crop production is declining due to salinity in the coastal area of Bangladesh. A field study conducted by Unnayan Onneshan in Gosairhat Upazila under Shariatpur district in 2011 found that the impact of salinity on crop production is already visible in that study area. Most of the respondents in the study area already experienced yield reduction. Moreover, some of the

respondents added decline in crop size as the impact of salinity. Some respondents reported the impacts like burning leaf tip or early yellowing of leaf. A small number of respondents reported that they have changed the crop variety to cope up with increasing salinity. The most pressing problem faced by the farmers in the study area is yield loss. However, the yield loss is not uniform for all food crops. Different crops respond to salinity differently even at a same level. Food and Agricultural Organisation (FAO) (201)1 sets the threshold value for different crops in response to salinity and their yield potentiality. Threshold value is the value of soil salinity level at which plants start experiencing the impact of salinity in terms of yield loss. Based on the salt tolerance limit, different crops have different threshold value. The higher the threshold value, the more a crop is tolerant to salt and the lower threshold value indicates less tolerant to soil salinity. Table 8 presents threshold value of different winter vegetables and the corresponding percent yield loss.

Table 3: The threshold value and percent reduction of some winter crops on different soil salinity

Crop	% in yield reduction based on different soil salinity (EC in ds/m)		
	0%	10 %	25 %
Onion	1.2	1.8	2.8
Beans	1.0	1.5	2.3
Potato	1.7	2.5	3.8
Sweet potato	1.5	2.4	3.8
Carrot	1.0	1.7	2.8
Radish	1.2	2.0	3.1
Pepper	1.5	2.2	3.3

Source: FAO, 2011.

The yield potentiality of crops is calculated on the basis of per unit increase of soil salinity (EC in dS/m) from their threshold value. Ali (2005) investigated the loss of rice production in a village of Satkhira district and found that rice production in 2003 was 1,151 metric tons less than the year 1985, corresponding to a loss of 69 per cent. Out of the total decreased production, 77 per cent was due to conversion of rice field into shrimp pond and 23 per cent was because of yield loss. Practicing shrimp cultivation in saline water has a drawback, and that is a decrease in rice production due to degraded soil quality. The decrease rate is very high and the scene is common for almost all rice fields in Khulna, Satkhira and Bagerhat districts. A World Bank (2000) study suggests that increased salinity alone from a 0.3 metre sea level rise will cause a net reduction of 0.5 million metric tons of rice production. When the rice fields are converted into shrimp ponds, total rice production decreases because of decreased rice field areas. In the fiscal year (FY) 1997-1998, rice production area was decreased by one per cent compared to the FY 1993-1994, whereas the total rice production was decreased by 26 per cent during the same period (Islam, 2004, p.190). Farmers couldn't produce two rice crops during the year, as one vegetation cycle was used for shrimp cultivation instead. For that reason, the decrease in production is seemingly too high compared to the decrease in area.

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Rice is the staple food of the people of Bangladesh. It was estimated earlier that farmers of the country have 10,000 rice varieties in their collection (Brammer et al., 1993). These varieties include Aus, Aman, Boro and seasons. Most of the varieties are in the Aman season. Sea level rise will increase flood frequency and flooding duration, affecting Aman production. Due to sea level rise, salinity of water and soil will increase, and this will damage Aman cultivable land. Because of the shortage of fresh water, Boro rice production will be decreased. Boro rice and wheat production will also be affected by salinity increase. A study by Bangladesh Agricultural Research Council (BARC) (1999; cited in Islam, 2004) concluded that salinization will cause a reduction of wheat production equivalent to US$ 586.75 million. Miller (2004) stated that high projected rise in sea level of about 88 cm (35 inches) would flood agricultural lowlands and deltas in parts of Bangladesh. Agricultural lands in the coastal area will be affected by salinity; soil quality will be degraded and flooding event will loss the agricultural production of the coastal land of Bangladesh. Thus salinity intrusion will have an impact on crop production, especially on food production, leading Bangladesh to fail, obtaining food security. As Bangladesh is a dense populated country, there is no specific grazing field for cattle. Farmers get grass from their rice field. Hey is another source of fodder. Decreased rice production is decreasing fodder production resulting in fodder shortage. Ali (2005) noticed that fodder shortage is the cause for a declining livestock population from 630 in 1985 to 168 in 2003 in a small village in S atkhira district. If we try to find out the big picture of salinity intrusion impacts on agriculture of Bangladesh, we will find that decreased agriculture will cause decreased GDP. If crop production is decreased, food and cash crop production will be decreased too. Decreased food production will cause food shortage leading to health hazards or even famine. The ultimate result of reduced crop production is high poverty that will force Bangladesh to seek aid from other countries.

Strategy for Management of Coastal Saline Soils for Agricultural Development

Protective embankment

Land may be protected from inundation of saline water through establishment of embankment of suitable size. The recommended size should be 1 meter high above the high tide level.

Provision of sluice gate on the embankment

There should be provision of sluice gate in the embankment system to remove excess water and also to prevent ingress of saline water during high tide

Leveling of land

Slight variations in the micro-relief lead to salt accumulation in the raised spots. Land should be properly leveled to prevent accumulation of water in the low-lying patches with shallow ground water tables and to facilitate uniform drainage of excess water. It will help to apply irrigation water uniformly in the field in rabi season, facilitate uniform germination of seeds and better growth of crops.

Storing of excess rainwater for irrigation

A part of the excess water stored in pond and cannel.

Selection of kharif rice variety

Even though the coastal area is relatively flat, there exist elevation differences in areas, where depths of standing water ranges from 1590 cm. Selection of rice varieties (BRRI dhan 23, 30, 40, 41, 47, BINA8 and BINA 10), available in the country on the basis of standing water and extent of salinity in the field can overcome the situation to a great extent.

Keeping land covered in winter and summer months

Ground water is saline and present at a shallow depth (about 1.0 meter). Keeping lands fallow leads to high salinity in soil due to evaporation of excessive soil moisture. Therefore, it is recommended to avoid fallowing of lands during rabi season. Salt tolerant crops should be chosen and grown. This will lower the profile salinity.

Technological adaptation

Sustainability of the crop production in the coastal area will not be ensured without adaptation strategies. Technological adaptation should be a continuous process for sustainability of crop production in coastal region.

Provision of sub-surface drainage

In many parts of the coastal area, salinity is very high. To grow crops successfully in those areas, it is necessary to bring down the salinity by leaching the salts. It is also necessary to lower down the water table and maintain it blow the critical depth to prevent salt effect on crops grown. To achieve the objective, a proper sub-surface drainage has to be installed to keep the ground water at least 1 meter below the soil surface. This technology is effective but somewhat expensive.

Conclusion

Salinity problem becomes acute in hot and dry season than that of wet season. Saline intuition both in soil and water would increase into many folds along with some permanent water logged areas. Present salinity concentration had already put a threat to the crop production and a significant yield loss has already been observed in the dry season. In the changing scenario of the sea level rise, it has been predicted that the increasing concentration of salinity will create more pressure to the farmer by reducing yield on one hand and threatening livelihood, income generation and food security on the other hand. Agricultural land use in these areas is very poor. Declining land productivity with shift towards negative nutrient balance is among the main concerns with food security problem in the country. Thus combating land salinity problem is vital for food security in the country through adoption of long-term land management strategy. Poor farmers are severely affected by salinity intrusion in rice fields. Farmers and communities are trying to adapt to changing climate conditions in different ways.

It is now important to rethink long-term planning for rice cultivation in the coastal zone, not only in areas currently affected by saline intrusion but also in areas that could potentially be affected, according to predicted climate scenarios. Low-lying agricultural land needs to be securely protected, while at the same time innovative and context specific practices, including climate-resilient rice cultivation (seeds and methods), must be researched and implemented.

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Effects of Gibberellic Acid (GA_3) on Table Grape Production *(Vitis vinifera L.)*

Dr. Ranajit Chandra Adhikary[1]

Abdullah Al Mamun[2]

Md. Asaduss Zaman[3]

Abstract

Gibberellic acid (GA_3), a plant growth regulator commonly used in vineyard of RDA demonstration farm to enhance berry size, early and uniform ripening and seedless bunch which was sprayed on grape (Vitis vinifera) cultivars 'Jakkaw' and 'Thompson'. GA_3 treatments at 10 ppm, 20 ppm, 30 ppm and40 ppm were sprayed on the leaves and fruit clusters before and after anthesis. The first spray was at pre-blooming stage followed by a second spray two weeks later at the prebloom dip stage; third spray after berry set and finally when berry was 6-7 mm in diameter the fourth spray was applied. Effect of GA_3 on fruit and seed development were observed in those sprayed vines: 1) increased berry size and weight;2) observed early and uniform ripening; 3) noticed the presence of seedless berries and 4) thickness of pulp of the berries. But no differences were observed between the experimental cultivars compared with the control one. The results indicated that there was no significant effect of GA_3 but there is opportunity for further experiment with higher doses.

Key words: Gibberellic acid (GA_3), Anthesis, *Vitis vinifera* L.

1 Director (PRL)
Rural Development Academy (RDA), Bogra

2 Director (In-charge)
Rural Development Academy (RDA), Bogra

3 Assistant Director
Rural Development Academy (RDA), Bogra

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Introduction

Table grapes are those grapes which are meant for consumption while they are fresh. They should have attractive appearance, bold and elongated size, and crisp pulp (mesocarp) with thin and soft skin (epicarp). Seedlessness is another desirable character for these grapes. Seedless grapes (*Vitis vinifera* L.) are of interest because they reach good prices and thus increase grower's GA_3 application. Bangladesh meets the demand of table grapes by import only. Commercial cultivation of grape would save foreign currency and further is receiving importance in creating jobs on and off the farm and other related sectors, thus improving economic status of farmers, farm laborers and others. Though the environment and soil condition of the country is suitable for grape cultivation but no commercial farming has been developed yet. Farmers are not interested to cultivate grape due to its sour taste and smaller berry size.

Berry size is affected by both endogenous (*e.g.* nutritional and hormonal factors) and exogenous factors (*e.g.* temperature, light and water availability) (Ojeda *et al.*, 2001; Ollat *et al.*, 2002). Seeds have been related to endogenous growth promoters (Coombe, 1960; May, 2000). Further, number of seeds per berry has been significantly correlated with endogenous gibberellins concentration (Lavee and Nir, 1986; Göktürk and Harmankaya, 2005), and growth retardants, such as 2-chloroethyl trimethylammonium chloride (CTC), increase fruit set but reduce berry size and sugar accumulation by inhibiting gibberellins synthesis (Coombe and Hale, 1973; Looney, 1981). The necessity of gibberellins in berry development was first described by Coombe (1960). Seeded berry has a high gibberellins concentration at fruit set that persists for at least three weeks then falling to a very low values and re-increasing after giving rise to a second peak two weeks later; finally concentration diminishes and remains low during fruit ripening (Scienza *et al.*, 1978). Unexpectedly, similar pattern is found in seedless grapes (Iwahori *et al.*, 1968 and Pérez *et al.*, 2000).

Although, there are reporting the effects of GA_3, the role of gibberellins on berry growth has not been completely elucidated in many studies but it would be possible to increase berry size by means of GA_3 application. In this research project the authors are going to study the effect of GA_3 applied to both seedless and seeded berries on the pattern of sugar levels, in order to achieve a better understanding of the role of gibberellins in developing grapes.

Objectives

The major objectives of this study were:

To examine the effect of GA_3 on grape production (berry size, berry weight, fruit ripening, seed development) and

To determine the appropriate doses of GA_3 for optimum production.

Materials and method

Two cultivars, 'Jakkaw' and 'Thompson', were used for this study. Gibberellic acid was obtained formulated as the commercially available ProGibb 4% (Abbott Laboratories, North Chicago, IL). GA_3 at 10 ppm, 20 ppm, 30 ppm and 40 ppm, was sprayed on the leaves and fruit clusters of the grapevine (National Research Centre for Grapes, Pune, India). Only Water (without GA_3) was sprayed to serve as a control. Hydrogen cyanamide 50 SL was applied after pruning for uniform bud break.

The first spray was at the pre-blooming stage, followed by a second spray two week later at the pre-bloom dip stage, third spray after berry set and finally when berry was 6-7 mm in diameter. Two mature vines (4-6 years old) were used for each treatment in 2014 and 2015 at RDA Demonstration Farm. Ten clusters were randomly selected from each vine for measuring berry weight, berry size, number of seeds and seed weight. Percentage and uniformity of ripened berries were estimated in the field based on the observation of 20 fruit clusters.

Table-1: Application of Gibberellic Acid (GA_3) at different stages of fruit thinning

Sl. No.	Days after thinning	Growth stage	Chemical	Concentration/dose
1.	1 – 2	After thinning	Hydrogen cyanamide 50 SL	40 ml/L
2.	21 – 24	Parrot green (Pre-bloom) spray	GA_3 technical	10 ppm/L
3.	23 – 27	2nd Pre-bloom dip	GA_3 technical	pm/L
4.	48 – 50	After berry set (3-4 mm berry diameter)	GA_3 technical	pm/L
5.	60 – 62	After berry set (6-7 mm berry diameter)	GA_3 technical	40 ppm/L

Results and discussion

Effects of gibberellic acid on berry development

No significant changes were found for berry weight in GA_3-treated vines (Table-2). Generally, the average weight per berry in GA_3-sprayed vines was 4.50g to 4.60g similar to those of untreated ones. For example, the average berry weight of cultivar 'Jakkaw' treated with10 ppm GA_3 was 4.56g compared to 4.55g in the untreated ones. A little increase was found in 'Thompson' treated with 30 and 40 ppm GA_3 which had an average berry weight of 4.65g. This is about 1.08% greater than the control (4.60g). No significant difference was observed among the 10, 20, 30and 40 ppm treatments for the same cultivars.

Table-2: Effects of GA_3 Treatments on berry weight (gram/berry) in 2014 and 2015

Cultivars	Control			10 ppm GA_3			20 ppm GA_3			30 ppm GA_3			40 ppm GA_3		
	2014	2015	Mean	2014	2015	Mean	2014	2015	Mean	2014	2015	Mean	2014	2015	Mean
Jakkaw (g/berry)	4.53	4.57	4.55	4.54	4.58	4.56	4.52	4.60	4.56	4.55	4.59	4.57	4.52	4.58	4.55
Thompson (g/berry)	4.56	4.64	4.60	4.54	4.66	4.60	4.58	4.62	4.60	4.63	4.67	4.65	4.63	4.67	4.65

Effects of gibberellic acid on fruit ripening

The cultivar 'Jakkaw' did not respond on earlier ripening and no effect was observed on the ripening time for 'Thompson' cultivar as well. In the 'Jakkaw', the 40 ppm sprayed vines ripened at the same time as the controlled vines. The 10 ppm GA_3 treated berries seemed to have no effect, as indicated by the fact that the ripening time was not shortened as the GA_3 concentration increased from 10 to 40 ppm. 'Thompson' is a typical uneven-ripening cultivar and berries from GA_3-treated vines ripened with same uniformly as those from the controlled vines.

Effects of gibberellic acid on seed development

Indian literature (National Research Centre for Grapes, Pune, India) showed that GA_3 clearly increased the percentage of seedless berries in some cultivars but no effect was found in the tested cultivars 'Jakkaw', and 'Thompson'. The percentage of the seedlessness, however, unchanged when 30 and 40 ppm GA_3 was applied. The size and the number of seeds were similar in both untreated and treated vines with GA_3.

Conclusion

Mostly, the literature showed that GA_3 had several positive effects on grape production in general genotypic variation among cultivars is obvious. GA_3 significantly increased not only the berry size but also enhanced earlier ripening and seedlessness in most of the cultivars but RDA study did not find any significance improvement regarding the change of berry size, seedlessness and early ripening in tested cultivars 'Jakkaw' and 'Thompson'. Results from the study indicated that the concentration of 10, 20, 30 and 40 ppm GA_3 had not reached the optimum effects for berry weight, ripening time and seedlessness. Further investigation maybe carried out with higher concentration but spraying date and number of applications should remain same that may bring out significant result.

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Usage Pattern of Mobile Banking Services in Rural Areas: A Study at Sherpur Upazila of Bogra District

Asim Kumar Sarker[1]

Abstract

Mobile Banking (M-Banking) was defined as one of the new dimensions to reach the mass people with the modern baking services by using the mobile network coverage. In the rural areas of Bangladesh where the branch banking services were unable to reach, m-banking services could fill the gap efficiently to ensure the appropriate access to finance to that people. This study was an attempt to find out the demographic status and the attitude towards the adoption of m-banking services in the rural areas of Bangladesh. Data was collected following both the qualitative and quantities method. A total of 100 respondents were surveyed in the Shepur Upazila of Bogra District. The study found that about nine (09) percent women were using m-banking services and they usually depend on the male members of their family. The usage practices were more in the age group of 26-35 years. In aspect of consumers' attitude on comfort level, trustworthiness and time saving towards using m-banking services were also addressed. Regarding comfort level, about 76 percent respondents feel comfort to make their transactions with the help of m-banking agents; about 100 percent respondents though that the transaction cost was very high that of traditional baking; only 16 percent respondents have the trustworthy on m-banking transactions and about 92 percent respondents thought that m-banking transactions make their time saved. Though this concept of m-banking was relatively new in Bangladesh but it's highly potential. So the stakeholders could adopt effective action plan to expand its operations throughout the country especially in rural areas.

1 Assistant Director
Rural Development Academy (RDA), Bogra

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Introduction

Financial inclusion refers to the process of ensuring the access to appropriate financial goods and services needed by the low-income generating groups and rural area people at an affordable cost in a transparent and fair manner by the mainstream institutional players (Rao et al, 2009). Financial inclusion has been considered one of the main aspects in terms of inclusive economic development and growth. A broad vision has been developed for financial inclusion, where financial transactions can be made easily through a mobile or an electronic device. This technology is used to bridge distances, contain settlement risks, close information gaps and reduce the transaction costs. Mobile banking (m-banking) has a great potential to extend the financial services distribution to poor people as it lowers the delivery cost, encompassing costs both to banks for maintaining, building channels, for delivery and to users who access services (Alam et al, 2010).

Lyman et al (2008) and Yu (2009) point out that financial inclusion refers to the delivery of financial services at an affordable cost to the most sections of the society. The customers can perform the financial transactions through mobile banking. M-banking as the channel of branch banking will be more helpful to rural customers in saving the time and money to visit the distant branches for money transaction and it is an appropriate delivery door-step banking model. Thus it is considered that m-banking helps to achieve the financial inclusion.

The m-banking in rural areas of Bangladesh facilitates financial service delivery such as withdrawals, saving mobilization, remittances, credit disbursements and repayments, bill payments, fund transfers and so on through banking facilitators or banking correspondents.

In Bangladesh, only 55 percent financial inclusion rate among those only 16 percent are fully banked, meaning they are able to take advantage of a full range of financial services (including savings, insurance, credits and others); and 39 percent are underbanked, with only basic access, such as a savings account (BCG, 2011).

Objectives

The objectives of the study are:

- To know demographic status of using m-banking services in rural areas; and
- To identify the consumers' attitude towards using m-banking services.

Methodology

Sources of data

Data used in this study were collected from the primary and secondary sources. Primary data were collected through interview method with a structured questionnaire. For qualitative data collection, three FGDs and informal discussion were conducted. Interview conducted to the persons who were using the mobile banking services in any manner. The secondary data sources were-journal, books, internet etc.

Sample size

The random sampling procedures were followed for the data collection. Among the m-banking users, 100 respondents were interviewed in different villages of Sherpur Upazila in Bogra District.

Data analysis

Advance applications of MS Excel were used to analyze and summarize the quantitative data. Thematic analysis was followed for the qualitative data.

Limitations of the study

This study covered only one upazila of Bangladesh with a small number of respondents. The respondents were interviewed only those who were currently using m-banking directly or indirectly. The perceptions and views of non-users of m-banking were not addressed in this study. So, the overall scenario of current users as well as potential users of m-banking could not be reflected in this study. Findings of this study could not represent the overall scenario of Bangladesh.

Conceptual clarification

Mobile banking (M-Banking) can be defined as the systems that has the ability to conduct bank transactions via mobile devices or more broadly- to conduct the financial transactions via mobile terminal (Drexelius & Herzig, 2001). It includes the basic services of banking transactions like bank account statement; fund transfer; electronic payment and other information based financial services. M-Banking is also referred to the "ability to bank virtually anytime, anywhere" (Kiesnoski, 2000). Though the mobile banking applications are becoming popular in some countries and regions, it is not widely used (Yu. S., 2009). In developing countries, millions of people depend on the informal economic activities and they do not have the basic access to finance as it is costly and very limited (Sultana, 2009). In addition, the services offered by the traditional retail bank branches are out of reach for the rural people from both an economic and geographical perspective (Bångens. L & Söderberg. B, 2008). The M-Banking is the key element to bring those unbanked people under the umbrella of banking services (Akram. S, 2014) for economic development of a country (Bruhn. M., & Love. I., 2009). Recently, in Bangladesh, the central bank has taken initiative to offer banking services to the unbanked population with the implementation of m-banking by some commercial banks. However, the personal security; inconvenience in using mobile handsets; and information technology literacy (Saif. A. N. M, 2013) were the main challenges for the users of m-banking in Bangladesh especially in rural areas. This study will focus to explore the usage pattern and the attitude towards using the m-banking services in rural areas and to recommend how to make this services effective in rural areas in Bangladesh.

Overall scenario of m-banking in Bangladesh

Dutch-Bangla Bank Limited (DBBL) had firstly introduced its m-banking service for expanding the banking services from urban to rural areas since March 2011. Bangladesh

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Bank Governor Atiur Rahman inaugurated the service by depositing Tk. 2,000.00 and withdrawing Tk. 1,500.00. Bangladesh Bank had already approved 28 scheduled commercial banks for operating m-banking services in Bangladesh (Table-1).

Bangladesh Bank, permited the delivery of the following broad categories of financial services by scheduled commercial bank-led Mobile phone based Financial Service (MFS) platforms in Bangladesh:

1. Disbursement of inward foreign remittances,
2. Cash in/cash out into Mobile Accounts through agents/bank branches/ATMs/ Mobile Network Operator (MNO) outlets.
3. Person to Business payments - e.g. Utility bill payments, merchant payments, deposits into savings accounts/schemes with banks, loan repayments to banks/ Nonbank Financial Institutions(NBFIs)/ Micro-Finance Institutions (MFIs), insurance premium payments to insurance companies, and so forth.
4. Business to Person payments e.g. salary disbursements, dividend/refund warrant payments,
5. Loan disbursements to borrowers, vendor payments, etc.
6. Government to Person payments e.g. pension payments, old age allowances, freedom-fighter allowances, input subsidy payments to farmers, and so forth.
7. Person to Government payments e.g. tax, fee, levy payments etc.
8. Person to Person payments (from one Mobile Account to another Mobile Account).

The Central Bank has fixed the transaction limits for the account holders of m-banking services at maximum Tk. 10,000 daily and a total of Tk. 25,000 on monthly basis.

Source: Regulatory Guidelines for Mobile Financial Services (MFS) in Bangladesh, Bangladesh Bank

Table- 1: M-Banking comparative summary statement of May- June, 2015

Sl. no.	Description	Amount (in May, 2015)	Amount (in June, 2015)	% Change (May, 2015 to June, 2015)
1	No. of approved Banks	28	28	
2	No. of Banks started to convey the service	20	20	
3	No. of agents	530,699	538,170	1.41%
4	No. of registered clients in Lac	272.89	286.46	4.97%
5	No. of active accounts in Lac	111.82	122.34	9.41%
6	No. of total transaction	95,412,146	96,159,303	0.78%
7	Total transaction in taka (in crore BDT)	12,601.78	12,969.51	2.92%
8	No. of daily average transaction	3,180,405	3,205,310	0.78%
9	Average daily transaction (in crore BDT)	420.05	432.31	2.92%
10	Additional information	Amount (in crore BDT)	Amount (in crore BDT)	
a.	Inward Remittance	2.75	4.09	48.73%
b.	Cash In transaction	5,309.19	5,461.53	2.87%

Sl. no.	Description	Amount (in May, 2015)	Amount (in June, 2015)	% Change (May, 2015 to June, 2015)
c.	Cash Out Transaction	4,568.48	4,776.09	4.54%
d.	P2P transaction	2,277.88	2,287.22	0.41%
e.	Salary Disbursement (B2P)	83.41	101.40	21.57%
f.	Utility Bill Payment (P2B)	151.96	120.40	-20.77%
g.	Others	208.08	218.79	5.15%

Source: Bangladesh Bank

Banking services in Sherpur upazila

Among the 12 upazilas under Bogra District, Sherpur was one of them. A total of 10 banks with 17 branches were operating their banking services covering a total of 332,825 populations and 278,743 populations in rural areas in Sherpur Upazila (BBS, 2012. Furthermore; most of the m-banking services have established their operation in Sherpur Upazila among them bKash was in leading position having 93 percent market share, Dutch Bangla Bank mobile banking was in succeeding position having five (05) percent market share and other companies were in growing stage having the market share on two (02) percent (Source: Field Survey).

Table-2: Number of bank branches at Sherpur upazila

Sl. No.	Name of Banks	No. of Branches
1.	Rajshahi Krishi Unnayan Bank	01
2.	Janata Bank Limited	03
3.	Sonali Bank Limited	02
4.	Agrani Bank Limited	04
5.	The City Bank Limited	01
6.	Jamuna Bank Limited	02
7.	Rupali Bank Limited	01
8.	Islami Bank Bangladesh Limited	01
9.	Prime Bank Limited	01
10.	BRAC Bank Limited	01
	Total	**17**

Source: All Banks Website

Results and discussions

A) Demographic status of using m-banking services

A total of 100 respondents were surveyed those who are using the m-banking services in any manner under the Sherpur upazila. It was found in this study that the female respondents are more reluctant to use m-banking services that of male respondents. The female respondent usually depended on the male member of their family in this regard. It was found that 91 percent male and only nine (09) percent female respondents are using m-banking services (Figure-1).

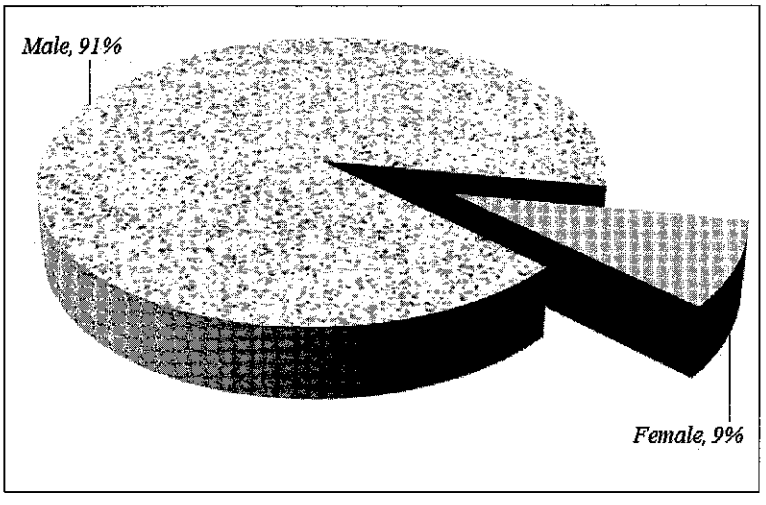

Figure 1: Category of respondents according to sex

The respondents of 26-35 years age group with different level of education were about 46 percent. The education level of below secondary was possessed by more respondents which was 26 percent that of graduation level, which was 21 percent. It was also remarkable that five (05) percent users of m-banking were found in the age group of below 18 years (Table-3).

Table-3: Category of Users according to different age with different educational qualification

Age Group	Frequency of the Respondents (%)						
	Primary	Below Secondary	Secondary	Higher Secondary	Graduation	Post Graduation	Grand Total
Below 18	0	0	2	3	0	0	5
19 to 25	2	4	3	2	7	0	18
26 to 35	4	14	8	4	9	7	46
36 to 45	1	5	3	1	5	1	16
Above 45	3	3	1	2	0	6	15
Grand Total	**10**	**26**	**17**	**12**	**21**	**14**	**100**

An attempt was made to know the user's occupational status regarding the usage of m-banking

services. According the respondents, 81 percent respondents performed their financial transaction with the help of m-banking agents among them 28 percent respondents were farmer, 23 percent respondents were service holders and 18 percent were students. It was also found that 14 percent respondents were using m-banking services through self registered m-banking account. Furthermore, only five (05) percent respondent answered that they made their financial transactions through other person's m-banking account (Table-4).

Table-4: Category of m-banking services users according to occupation

Occupation	Frequency of the Respondents (%)			
	Transaction through Self Account	Transaction through Agent	Transaction through Other's Account	Grand Total
Farmer	1	28	3	32
Businessmen	1	8	0	9
Day Labor	1	0	0	1
Driver	0	1	0	1
House Wife	0	3	1	4
Service Holder	3	23	0	26
Student	7	18	1	26
Unemployed	1	0	0	1
Grand Total	**14**	**81**	**5**	**100**

Majority (51 percent) of the respondents have been using personal mobile phones during 7-10 years among them 25 percent of the respondents are using m-banking during last one year and 16 percent are using during last two years. It shows that the usage of m-banking was being increased during last couple of years. It was also found that all (100 percent) the respondents have been using personal mobile phones for five years and above (Table-5).

Table-5: Experience on using m-banking services compared to using personal mobile phone

Duration of Personal Mobile Phone Usage	Frequency of the Respondents (%) on using m-banking Services				
	01 Year	02 Years	03 Years	04 Years	Grand Total
3 to 4 Years	0	0	0	0	0
5 to 6 Year	15	1	1	0	17
7 to 10 Years	25	16	7	3	51
Above 10 Years	7	8	8	9	32
Grand Total	**47**	**25**	**16**	**12**	**100**

A) Consumers' attitude towards using m-banking services

In this study, it was surveyed to identify the consumers' attitude towards using m-banking services in the aspects of purposes of usage, comfort level, trustworthiness, time saving and the satisfaction level.

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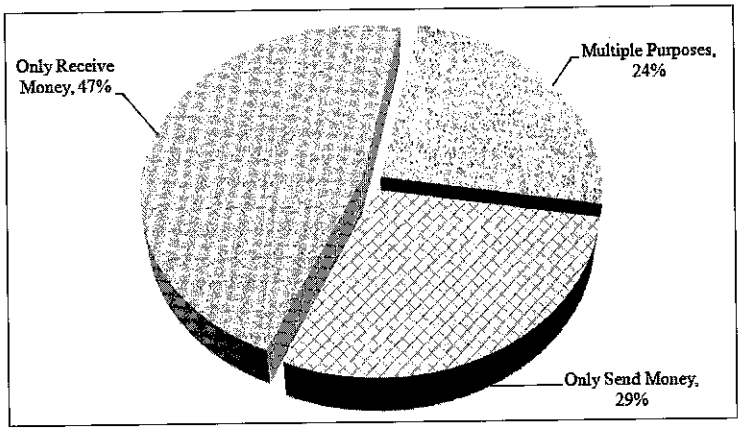

Figure 2: Purpose of usage m-banking services by the respondents

Among the respondents, about 47 percent used the m-banking services only for receiving money from other sources, 29 percent used it only for sending money and the rest (24 percent) used this services for multiple purposes including send money, receive money, bill payments and mobile account recharge etc (Figure-2).

This study addressed that the status of using traditional bank account by the respondents. This study showed that about 61 percent respondents have no bank account whereas about 39 percent respondents have their own bank accounts in nearest banks mainly with the government owned banks. Out of 39 percent bank account holders, 24 percent respondents have their bank account in Sonali Bank Limited (Figure-3).

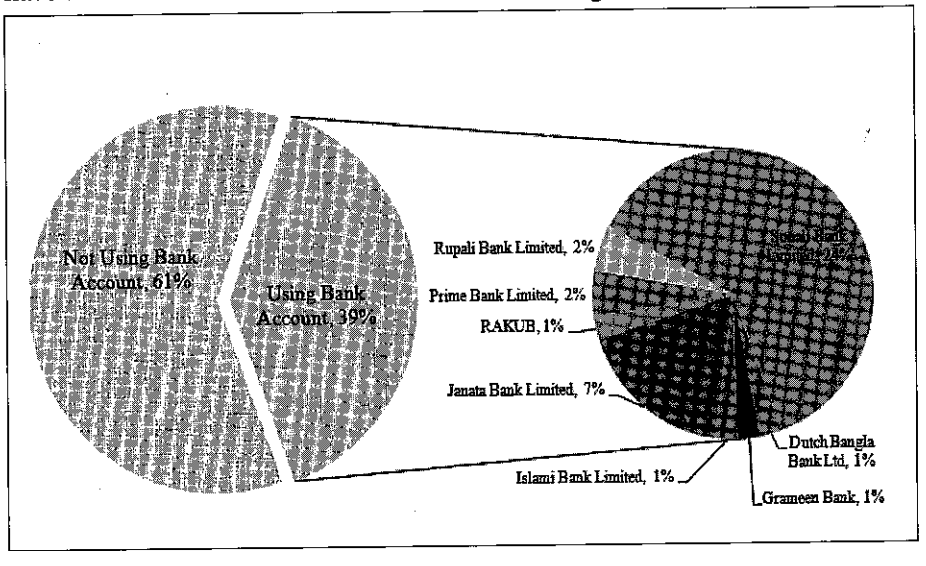

Figure 3: Percentage of bank account users of the respondents

It was asked to the respondents to know their perceptions regarding comfortable medium for their regular financial transactions. The result showed that about 76 percent respondents used to feel comfort to make their financial transactions with the help of m-banking

agents, about 17 percent comfortable with self m-baking account and only seven (07) percent respondents answered to make their transaction via bank is comfortable (Figure-4).

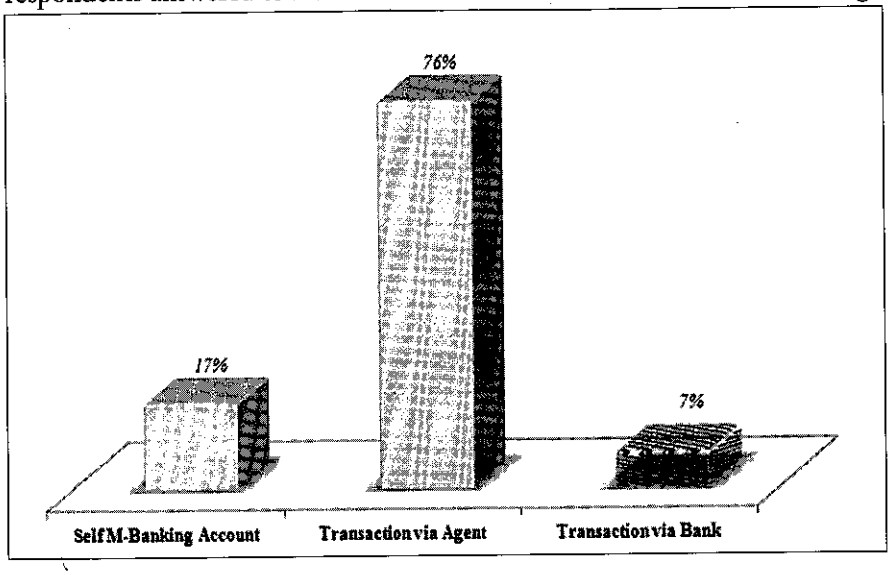

Figure 4: Comfort level to make financial transaction by the respondents

Though most of the respondents were comfortable in using m-banking services, they were concern about the transaction cost for m-banking services. According to the respondents, all the respondents (100 percent) replied that the transaction performed through m-banking is highly expensive that of Banks (Figure-5).

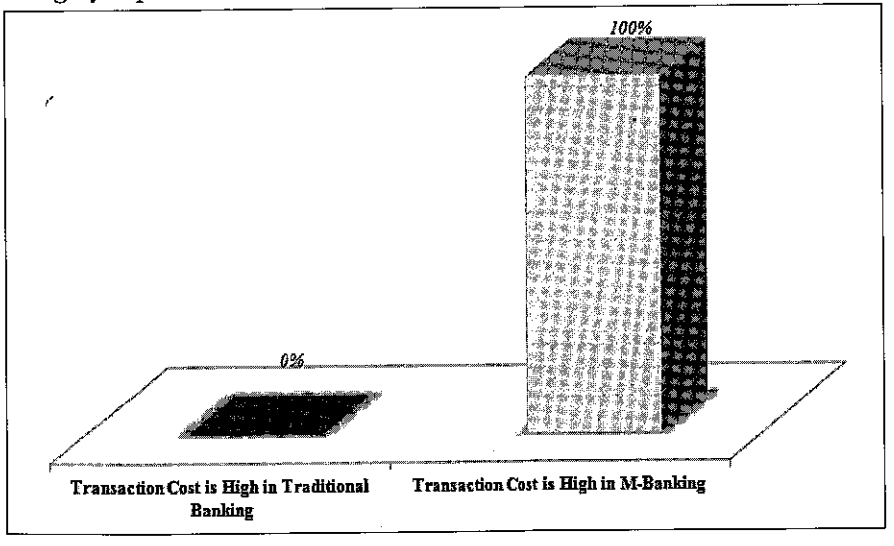

Figure 5: Perception towards the transaction cost of m-banking than traditional banking

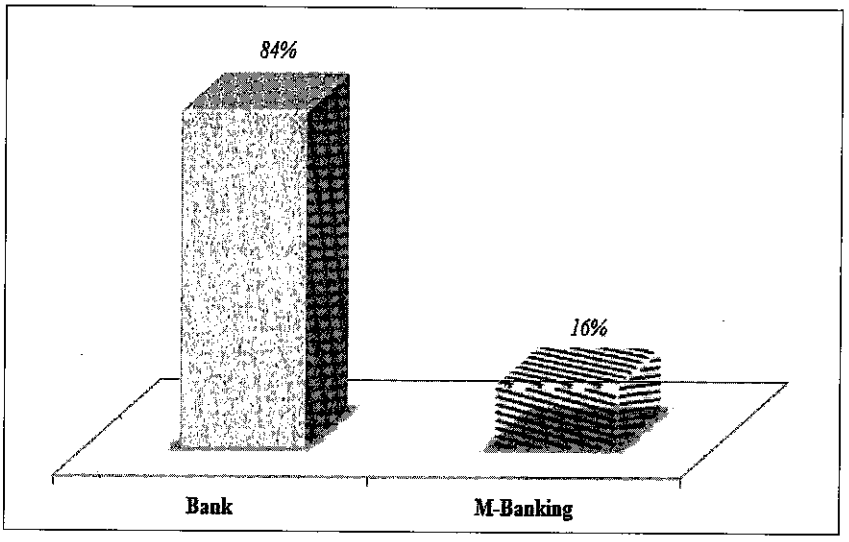

Figure 6: Perception towards trustworthiness for financial transaction by the respondents

Any kind of financial transactions should be safe, secured as well as trustworthy. In this study, it was addressed to the respondents to understand their views on trustworthiness on using m-banking and traditional banking. About 84 percent respondents thought that transaction made through bank account was more secured and trustworthy rather than the transaction through m-banking (Figure-6).

On the contrary, about 92 percent respondents replied that the transactions performed through m-banking were more efficient in the aspect of time-saving (Figure-7).

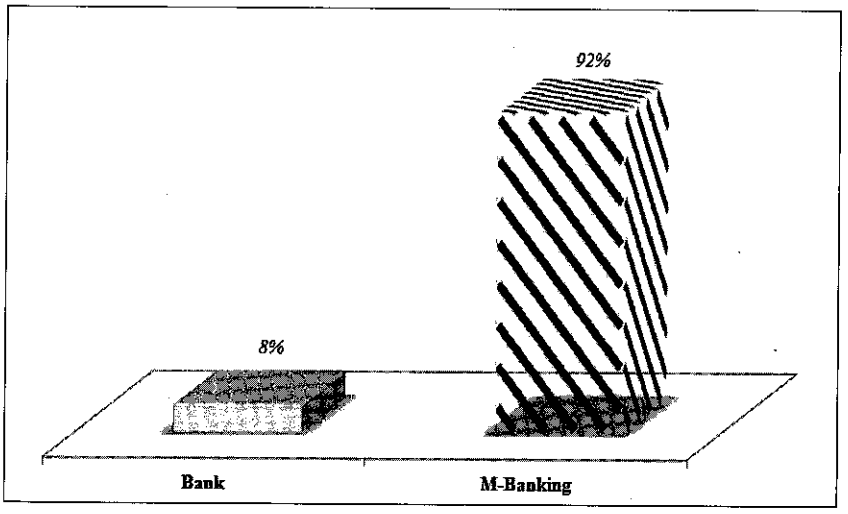

Figure 7: Perception towards time-saving for financial transactions by the respondents

In the view point of consumers' satisfaction in using m-banking services among the respondents, it was found that about 67 percent respondents were moderate satisfied whereas only two (02) percent respondents were highly satisfied and 31 percent were satisfied on enjoying the m-banking services (Figure-8).

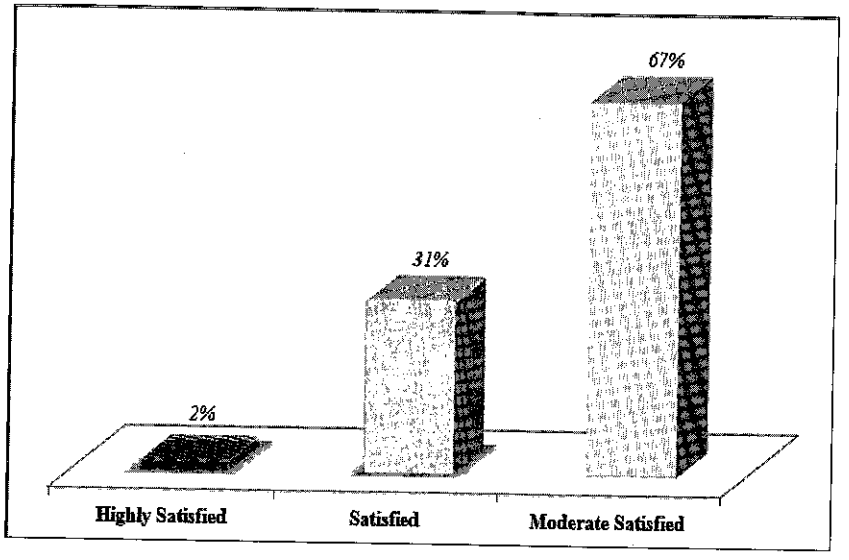

Figure 8: Level of satisfaction in using m-banking services by the respondents

Form the qualitative data analysis some major problems regarding m-banking transactions were found that the respondents were facing:

- The consumers were facing the network disturbance in several times during the transactions
- They had to wait for a long time while transferring money through m-banking agents as the agents would busy with other businesses
- It would very difficult to return the money if the transaction was made in any wrong number
- The agents could not pay the cash amount instantly during the "Cash-Out" transaction due to shortage of liquid money.

Conclusions

M-banking technology is one of the latest technologies in the banking sector in Bangladesh as well as in the study area. Where the branch banking has the limitation to provide the doorstep banking services, m-banking can be the solution to make it happen. The m-banking technologies can reduce the gap between the urban and rural people in the aspect of access to finance opportunities. In the study area, m-banking could enrich the access to finance opportunities collaborating with the traditional banking. In addition, the banking facilities through this technology will make the life easy-going and flexible. Therefore, it needs the proper policies and strategies in aspect of regulatory and legal issues for better penetration in Bangladesh.

Recommendations

On the basis of the above analyses, some recommendations are given for better penetration of m-banking services in rural areas through which the unbanked sections of the rural areas could make their contribution to the national economy.

- Programmes would be taken by the Govt. and/or the concerned institutions to encourage the rural people especially for women to use the m-banking services having own account as well as to achieve the trustworthiness.
- Some awareness campaigns might be arranged for building positive perception on security, safety and trustworthiness to use the m-banking services in rural areas in Bangladesh.
- The m-banking service provider companies should focus to expand their service network to the rural areas.
- The service quality like network availability, effective customer relationship management, product availability should be improved.
- Strategies should be taken to reduce the transaction cost for ensuring the access to finance for the rural areas users.

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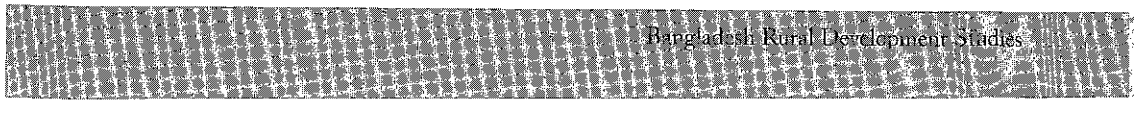
Bangladesh Rural Development Studies

Local Environmental Exposure and Community Vulnerability to Climatic Hazards in Bangladesh

Shaikh Mehdee Mohammad[1]

Abstract

Bangladesh is one of the most disaster prone countries of the world and it is predicted that its current climate variability will be made worse by future climate change. Apart from a well-known disaster management system and inherited coping mechanisms of residents in high risk locations of Bangladesh, vulnerability to environmental disasters and climate change remains high. To better understand the meaning of environmental vulnerability in local context, the present study was carried out amongst both flood and cyclone survivors in focal regions of Bangladesh using qualitative and quantitative approaches. Despite regional disparities, the respondents overall claimed that geographical location and the morphological formation of their land were the major aspects of environment al vulnerability to disasters and climate change. They were concerned about localised seasonality and natural resources due to their agriculture based livelihoods. Moreover, the study found that the char-dwellers from the Jamuna river basin were regularly displaced from river islands to the mainland due to floods and river bank erosions whereas the Cyclone Sidr survivors who lived closer to the coast were severely affected by the cyclonic event in terms of house damages. However, the respondents from the Jamuna river basin had their houses on higher plinth and had not been affected by floods or river erosions since 2005. The people who lived in the villages situated behind the 'Sunderbans' were not exposed to cyclone Sidr. The results show how initiatives such as home plinth raising, coastal afforestation, resilient settlement design and sustainable livelihoods decrease environmental vulnerability to climate induced disasters in Bangladesh.

Key words: environmental vulnerability, hazard exposure, climate change, disaster survivors, Bangladesh.

1 Joint Director
Rural Development Academy (RDA), Bogra

Introduction

Natural hazards and risks of disaster are considered to be the highest in contexts of poverty in the developing world (Dilley et al., 2005; UNISDR, 2009a) where resulting losses can also be a major obstacle to development (UN, 2000; Collins, 2009). Evidence shows that climate change can affect disaster risks in two ways; firstly through increased climatic hazards, and secondly through the vulnerability of communities to natural hazards, particularly resulting from ecosystem degradation, reductions in water and food availability, and changes to livelihoods (O'Brien et al., 2008; UNISDR, 2009a). Apart from projected extreme climatic events of the future, many changes are already being observed due to climate variability (UNISDR, 2008, 2009b).

In these circumstances, the double bind of climate change impacts may increases in localised environmental vulnerability. However, most vulnerability studies concentrate on either 'environmental disasters' (O'Keefe et al., 1976; Burton et al., 1993; Cannon, 2000; Lewis, 1999; Wisner et al., 2004; Hewitt, 2007) or 'climate change' (Adger, 1999; IPCC, 2007; O'Brien et al., 2007; Gaillard, 2010) rather than interpreting the underpinning relationship between these and how one approach impacts on other, despite a tacit knowledge that climate change influences changing patterns, magnitudes and effects of environmental disasters (Schipper and Pelling, 2006; Thomalla et al., 2006; Mercer, 2010; IPCC, 2012). Further, in the context of disaster management and climate change, vulnerability studies often focus on social factors (Adger, 1999; Bohle, 2001; Cutter and Finch, 2008). Despite the obvious criticality of these, ecological influences often remain less examined in terms of their great influence on how vulnerability is exacerbated in people's lives and livelihoods (Briguglio, 1995).

In Bangladesh, poverty and over population are considered as the root causes of disaster vulnerability (Bhuiyan and Dutta, 2010). Wisner et al. (2004) points to several dynamic pressures such as breakdown of rural economy, population pressure, inaccessibility to land for poor, inadequate alternate livelihoods, absence of social insurance in relation to vulnerability to floods of 1987 and 1988. Brouwer et al. (2007) argue that families with lower income and poor access to resources are more likely to be exposed to flood risk. They also claim that 'disparity in income and asset distribution at community level' makes those families vulnerable at higher risk exposure collectively (ibid: 313). Besides, the whole coast of the country is exposed to tropical cyclones over time, particularly in 1970 and 1991. The west part was least affected in terms of death tolls in 2007 and 2009 due to the natural barrier formed by the 'Sunderbans' (Shamsuddoha and Chowdhury, 2007; Blake, 2008; Hossain et al., 2008). However, Paul (2009) argues that physical characteristics of cyclone Sidr such as the duration of storm and storm surge, and landfall time at site also facilitated a decrease in the death tolls. They point out how cyclone Sidr was costly in terms of economic losses which accelerated post-disaster vulnerability. In addition, Mallick et al. (2011) indicated that cyclone Aila also damaged physical infrastructure (road networks), obstructed post disaster activities and sources of drinking water (pond sand filter, rainwater harvesting system) putting a huge amount of coastal populations into water crisis for a long period of time. Moreover, the discourses of climate change and sea level rise has made the potential scenarios complex

in terms of environmental change threats to coastal infrastructures including polders and cyclone shelters, and local livelihoods (Dasgupta et al., 2011).

The study from which this paper is derived critically examines the relationship of disasters, climate change and people's vulnerability at community level for a disaster prone country context with particular attention to the oft overlooked factors relating to local environmental exposure. An underlying objective of the paper is to understand the existing condition of environmental exposure and community vulnerability in interpreting the disaster – climate change nexus.

Research methods

Study area

Two distinct geographical locations were selected so as to provide opportunity to investigate local knowledge and practices in zones of contrasting socio-cultural contexts and differences between flood and cyclone prone areas of Bangladesh. A further, two villages were selected from each area (Figure 1). This is because there are differences in the types of flooding event in relation to local communities for the river islands in Sirajganj district to those in the mainland adjacent to the Jamuna River in Bogra district. Impacts of cyclones Sidr and Aila on coastal communities are varied due to local socio-economic conditions. Two cyclone affected villages were selected from Barguna and Satkhira district respectively. During selection of the study villages, some further issues such as easy accessibility, local logistics and personal safety had to also be taken into consideration.

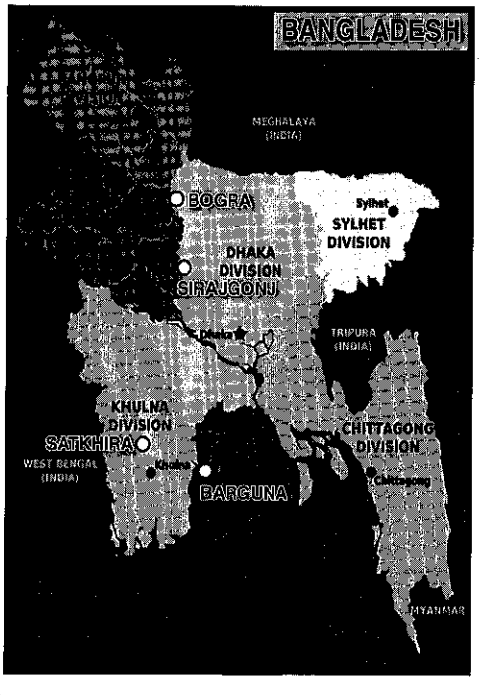

Figure 1 : Four study areas

Methods of the study

The study was designed using a qualitative data collection approach implemented through active community participation. Primarily this used in-depth interview and focus group discussion (FGD). Four in-depth interviews and four focus group discussions conducted in four study villages are used for this paper. Seasonality mapping, a participatory tool, was conducted during the FGD session at Bonna village at Sirajgonj district. Local level government and NGO officials were also interviewed. The study was supplemented by the researcher's observations and notes throughout.

Selection of respondents

Before selection of respondents, the researcher visited the selected villages intensively and discussed the aims of this research with local people. Based on his personal observation and local people's recommendations, respondents were selected for in-depth interviews from four distinct social groups comprising fishermen, migrant workers, homeless people and women. The basic principle of selection of respondents was how their daily life environmental vulnerability related to disaster risk and climate change. As environmental vulnerability or exposure is a vital phenomenon for agriculture, the FGD session primarily focused on seasonality impacts on local agriculture. Thus, eight out of 13 participants of that session had agriculture based livelihoods including two farmers, two sharecroppers and four agricultural wage workers including one woman worker. In all instances, engagements with respondents observed the norms of ethical practice including consent in advance of an interview and confidentiality regards participant identity within the context of the data collection.

Data analysis

Data analysis was initiated during the data collection phase through the researcher's everyday observation and written notes based on informal discussion with local people. In this way the researcher explored those issues that helped him select respondents purposively and the outline of in-depth interviews. After coming back from the field study, all recordings were transcribed and coded. Finally, the statements and accounts made in the paper have been constructed based on the respondents' own voices and local context.

Results and discussion

Environmental vulnerability is often referred to as ecological vulnerability because of its focus on exploration of ecological/ecosystem change (Holling, 1973). In the context of hazard/disaster and climate change studies, environmental/ecological vulnerability is often thought of as being how ecosystem and human-ecosystem interrelationship are exposed to hazards/disasters and climate change (IPCC, 2012). In the context of this study environmental vulnerability to disasters and climate change is considered as being how the local people of the study areas are exposed due to their existence in places easily affected by natural hazards and seasonality, and their dependency on nature for a means of living and survival in an emergency setting.

Exposure through geographical location

In Bangladesh, historically many ports and townships were built along the coast and major rivers. At present the normal migration pattern in the country is to Dhaka, the capital city with more 12 million people living within 500 km^2 followed by Chittagong, the principal seaport with around five million people (BBS, 2012). Though the Chittagong coast including the city offers new jobs to outsiders, other part of the Bangladeshi coast, particularly from Satkhira to Noakhali is still underdeveloped. Thus, many people from the study areas (Sidr and Aila villages) migrate out, particularly to Dhaka city. The study areas of Jamuna river basin (Bonna and Borsha villages) are regularly exposed to floods and river bank erosion due to the influence of the mighty Jamuna and soil formation processes. Forced migration is a common livelihood strategy for these river char-dwellers (CLP, 2013). The participants of FGD sessions at four study villages claimed that geographically remote areas like their villages are often neglected from national services and facilities. Apart from some special package programmes implemented by the government and NGO, it has been understood from the FGD sessions that those areas get overlooked in emergencies.

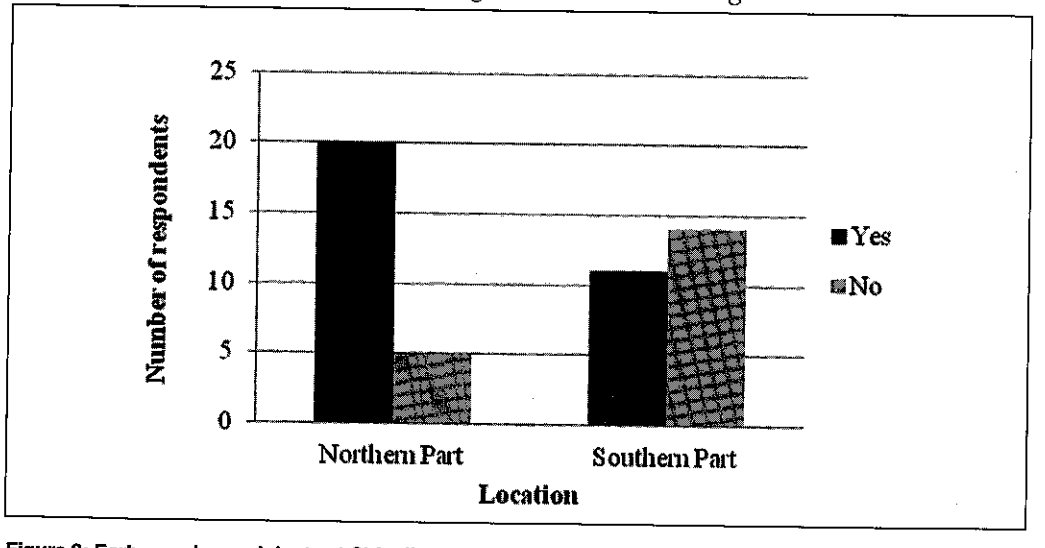

Figure 2: Early warning recipients at Sidr village, Barguna before Cyclone Sidr hit

Figure 2 shows that 80% of the respondents who lived in the northern part of Sidr village received an early warning before cyclone Sidr hit their area which is well-connected to the nearest town centre whereas less than half of the respondents (44%) who lived in the southern part of the village received such warnings before the event occurred. The southern part of the village is not well-connected to the nearest town and easily exposed to disasters including cyclone and river bank erosions. It was observed that there was a local office-cum-cyclone shelter of Grameen Bank in the northern part. Thus, the micro-credit recipients of the bank knew about the cyclonic event from the bank staff. Conversely, the respondents of southern part claimed that the local Cyclone Preparedness Programme (CPP) volunteers did not disseminate early warning properly especially at the remote corners of those villages. However, this allegation was refused by the local CPP volunteers and NGO staff.

Impact of seasonality

To identify the impact of seasonality, first it is important to define 'season'. In Bangladesh, seasons are often divided in terms of crop calendar, namely *Kharif-1* (summer), *Kharif-2* (wet season) and *Rabi* (winter) (Khan and Obaidullah, 1999). Besides, farmers of the country commonly call these seasons by the main rice varieties grown in each season such as *Aush*, *Aman* and *Boro* seasons respectively.

In vulnerability context, the respondents used a Bangla term *Auvab* which closer to English literally means scarcity. They defined scarcity as such a condition when most char-dwellers have not enough food to survive and they are nearly dependent on external relief and loans. *Shukher Somoi* (time of happiness/ felicity) is another term they used to describe the opposite condition of scarcity. The literal meaning of 'felicity' in English varies from how the char-dwellers defined it. The understanding of felicity by the people of other regions of Bangladesh may also differ. The respondents of the study identified felicity as such a situation when most people have sufficient food at their home for the next few months and they can survive without external assistance. However, the seasonality of this condition fluctuates over the year depending on the flood situations of any given year (Figure 3).

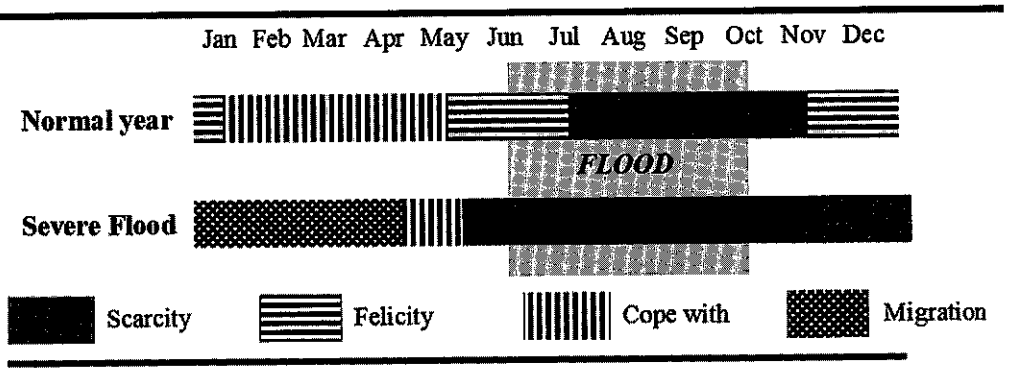

Figure 3: Interaction between seasonality, flood and food scarcity for the char-dwellers of Bonna Village, Sirajgonj

In a normal flood year, scarcity is experienced for a maximum of four months (mid-June to mid-November). As they can harvest Kharif crops including Aman rice and plant their desired winter crops in time, the next couple of months (mid-November to mid-January) are considered as 'felicitous months'. After mid-January the household food storage of many respondents are gradually being shrunk and the time of survival starts. Thus, the next four months (mid-January to mid-May) are considered as the months of survival. However, the well-off families still have sufficient food to live in a modest way. Conversely, the poor often start loans from relatives and neighbours from February with the hope of standard yield of pre-Kharif crops including Aus rice. The second felicitous period begins in mid-May in a normal flood year and continues until mid-July. If a severe flood occurs during June to October, the period of scarcity is for a longer period and sustains until mid-February because of losses and damages of standing crops and delays in winter crop plantation. For the next three months (mid-February to mid-May), most of the respondents survive primarily on the basis of external assistance and internal loans.

Figure 4 illustrates how char-dwellers' vulnerability to flood impact fluctuates due to seasonality. The respondents used jute sticks on a brown paper to measure and compare their monthly vulnerability both in a normal flood year and a severe flood year. They used the Bangla calendar that starts from 14 April and they included farmers following in their day-to-day life. Firstly, they chose the month (Ashwin – from 16 September to 15 October) when they experience highest vulnerability in a normal year and then determined other months. After that they measured and drew lines for a year of severe flood.

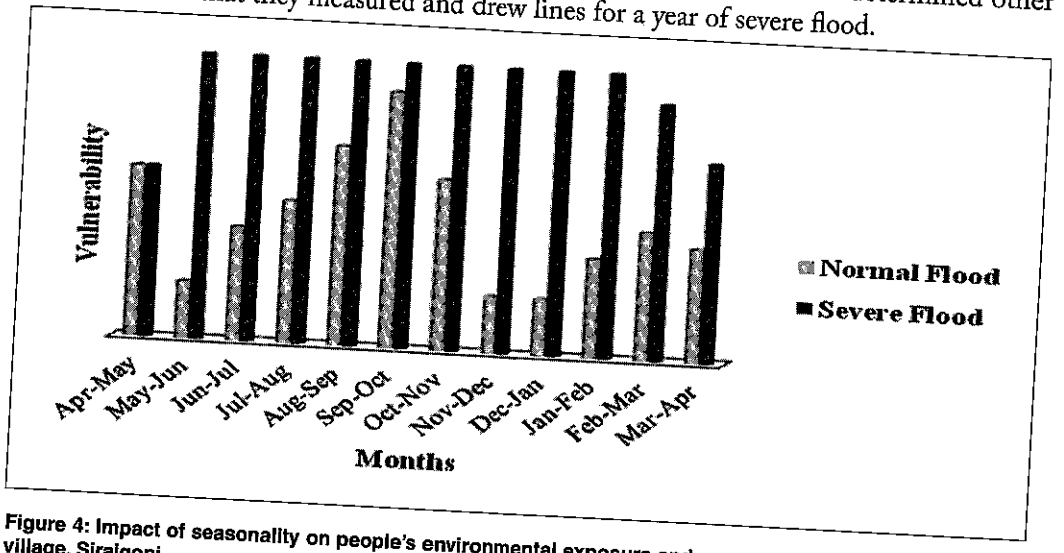

Figure 4: Impact of seasonality on people's environmental exposure and community vulnerability at Bonna village, Sirajgonj

Figure 4 demonstrates that vulnerability continues rigorously over the year except two months (mid-March to mid-May) if a severe flood occurs. This is due to losses and damages of standing crop and lack of local jobs. However, in a normal year, char-dwellers' vulnerability fluctuates regularly over the year. They face severe problems for three months (mid-August to mid-November) of a normal year due to the reductions in their storage rice and livelihood opportunities. As farmers plant Kharif-1 crops including Aman rice and need to wait until *Agrahayon* (mid-November to mid-December), agricultural wage workers are not offered any jobs in crop fields. The respondents pointed out the situation as *Akal* (extreme scarcity) and Auvab commonly in a severe flood year and a normal flood year, respectively. However, in a normal year, they may face Akal situation if they experienced a severe flood the previous year. Though they claimed Ashwin is the month of the highest vulnerability/ scarcity, the season is also called *Mora Kartik* (deadly Kartik – from mid-October to mid-November). That is why, now-a-days the government and NGOs take initiatives such as creating seasonal local employment to reduce people's vulnerability. Besides, many char-dwellers manage jobs at nearer towns as daily commuters or migrate seasonally to Dhaka and Chittagong for 2-3 months. This special period of hunger and starvation is also termed *Monga*[1], particularly in the development field, though the term originated in north-western Bangladesh as a local colloquial word (Elahi and Ara, 2008).

From the month of Agrahayon vulnerability gradually decreases as the char-dwellers can harvest their field crop. This is the month of *Nobanno* (Bengali harvest celebration) when

1 Monga is popular in northern Bangladesh, we can use the term Akal or Auvab for southern delta of Bangladesh.

farmers have sufficient rice for the next one year or few months, and wage workers can earn cash for harvesting Aman rice and planting winter crop. The second Monga period starts from the beginning of April because of a lack of agriculture based job opportunity. However, the duration of this period is around one month due to high migration trend to Dhaka and earth digging employment opportunities during that period. Though introduction of irrigation and HYV Boro rice create new jobs in some northern districts, Bonna village in Sirajgonj district is not well irrigated due to its geographical isolation from mainland.

Natural resource dependency related issues

Natural resource based communities can often be exposed to natural hazards/ disasters due to the distinctive interface between environment and society they experience (Flint and Luloff, 2005). These natural resources include agriculture, forests, wetlands, and others. In Bangladesh, though the contribution of the agriculture sector to GDP is just less than one-fifth (19.3 percent), around half of the whole population of the country (47.5 percent) are involved in this sector (BBS, 2012). In Bonna village, the respondents claimed that at least 60 percent of them are directly involved in the agriculture sector. They further added that they are easily exposed to floods and river bank erosions due to their dependency on natural resources. The respondents of Borsha village argued that many of them lost their agricultural lands to river erosions and were displaced on this embankment for the last 10-11 years. In Sidr village, the farmers lost their standing crops to Sidr and Aila. Besides, the local fishermen community claimed that the amount of fish caught in their nets were gradually decreasing. The respondents of Aila village stated that all rice fields in their area were converted into shrimp farms within the last few decades. Such natural resource dependency has already generated livelihood related vulnerability in the study areas.

"I was a sharecropper before these lands were converted from rice fields to shrimp farms. I just know how to plough land and cultivate rice. However, now I work at a brick field near Dhaka as I don't want to work at shrimp farms." (A migrant worker aged 50, Aila village, Satkhira, July 2012)

The statement of the above respondent indicates how natural resource dependency may create a threat to people's skills and knowledge. The sharecropper has not been performing his rice production related knowledge, experiences and skills since the lands were converted into shrimp farms in his area. As he did not have his own cultivable land and wishes to work at shrimp farms, he had to migrate to Dhaka to search for a job and left his family behind. Natural resource dependency may accelerate livelihood vulnerability through the human induced damage and loss to someone's environmental asset. The statement of the fisherman given below indicates that people who are dependent on natural resources and vulnerable to natural hazards, want to continue their livelihoods options recovering the losses directly related to their livelihoods. Thus, they may increase other vulnerabilities like living with food insecurity and poor housing conditions for longer or through migration to overcrowded urban areas. Local environmental exposure and community vulnerability to climatic hazard for those that remain is meanwhile increased due to the break-up of long established seasonal adaptations to loss and exposure.

"... After Sidr, I had to repair my boat but that was a new one." (A fisherman aged 45, Sidr village, Barguna, June 2012)

"We are depended on nature for different purposes. We also collect fodder and domestic fuel. But it is difficult to collect fodder and fuel during floods. Men do nothing; we women and our children do it." (A housewife aged 32, Bonna village, Sirajgonj, March 2012)

The housewife belonged to a male-headed family described such dependency on nature prompts gender sensitive vulnerability to disasters. The char-dwellers of Jamuna river basin are fully depended on their natural resource management for collecting livestock fodder and domestic fuel. The division of labour driven by male dominated rural social system in Bangladesh put women and children to collect fodder and fuel over the year and further solitary dependency on nature for fodder and fuel constructs extra vulnerability on these members of the community. However, it was observed that many char dwellers were included in many development projects/ programmes in terms of involving environmental and disaster awareness, cattle rearing, home gardening, seasonal jobs. Nevertheless, still many other disaster victims are behind these projects/programmes. It was found that two out of 10 poor flood survivors in Bonna village and seven out of 32 Sidr survivors in Sidr village had not been enlisted in any major reconstruction and rehabilitation projects/programs excluding relief activities.

Homelessness owing to environmental disasters

Displacement is a common feature of the people who live in flood and river bank erosion prone areas (Baqee, 1998). Natural phenomena like geographical location and seasonality are vital factors for determining the level of exposing by disasters and the trend of displacement. Most respondents of Borsha village (5 out of 6) who earlier lived in different chars of Jamuna river migrated there in last one decade. Though their present houses are situated above regular flood level, the housing condition of the poor and extreme poor are fragile and unhealthy which is supported by the words of the homeless people. He was not only forcedly to migrate to an unhealthy housing condition on a river embankment but also lost his inherited land and livelihood strategies.

"I lost my home and land in the river. Now I live in this embankment. The houses in a line you see of the landless people like me. Look where you now see the water of the river, I had my own lands. I was a farmer; now pulling a rented van." (A homeless people aged 38, Borsha village, Bogra, April 2012)

Besides, 10 respondents out of 13 at the FGD session in Bonna village claimed that their houses were flooded and fully damaged in the flood of 2004. After that the plinth of the houses of eight respondents were raised under a development programme. Thus, their houses have not been affected since then whereas the other two respondents who were not included in the programme were affected regularly, particularly by the flood of 2007.

Rapid onset events such as cyclones also primarily damage houses situated closer to the coast where the events first hit. Cyclone Sidr fully destroyed 64% of the respondents' houses of Sidr village in Barguna district whereas data from another study shows that the same cyclonic event damaged around one-third of the respondents of Lakurtola village in Bagerhat district (36%) which was also severely affected by cyclone Sidr (Mohammad, 2014). The previous study claims that the natural barrier 'Sunderbans' protected many villages of Bagherhat and Khulna district like Laturtola. Conversely, the present study observed that Sidr village is one of the few villages of Barguna district severely affected by cyclone Sidr in 2007

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including house damages due to their location nearer the mouth of river Boleshwer where the cyclone hit at first. However, it was observed that 24 out of the 32 Sidr survivors were enlisted in different post-Sidr reconstruction projects/programs and their houses were rebuilt.

Conclusion

Where different international, national and local factors of vulnerability are interlinked, it can be difficult to explore localised environmental vulnerability in disasters in a climate change context. However, all respondents of this study agreed that their geographical location in terms of remoteness and morphology is the major environmental vulnerability. Besides, seasonality regularly impacts on their daily life and agriculture based livelihoods, particularly in the years of severe floods and for those who live on different char-lands in the Jamuna River. Furthermore, the high dependency on natural resources in these areas is another vital factor that increases their vulnerability to disasters and climate change. Nonetheless, many respondents who live in chars are regularly displaced by floods and river bank erosions and finally move to the mainland as do many Sidr survivors who lost their houses due to being severely exposed by the cyclonic event. Variations can be due to not only environmental factors but also the political and social influences involved in boosting their disaster vulnerability. This paper found that the life and livelihoods of the respondents are primarily environmentally determined. However, many initiatives were found in the study villages that assist to reduce localised vulnerability, particularly to nature and including through changes in people's behaviour and practices over seasonal, short term or longer periods. These noble initiatives include house plinth raising in flood prone area, coastal afforestation and resilient settlement schemes in cyclone prone coastal belt. Besides, sustainable livelihoods such as cattle rearing, home gardening and seasonal earth digging jobs are successful initiatives. However, for building resilient communities, it was apparent that the focus is on a whole community rather than selective approach which had been known to increase societal imbalance and disparity.

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Mass Media, the Rights of Disabled People of Bangladesh: A Critical Overview

Dr. Mustak Ahmed[1]

Nusrat Jahan[2]

Abstract

The aim of this article is to explore how representations of disabled people rights and policies in mass media can be used to increase awareness of society members in Bangladesh. At the same, this article set some prospective research models for studying of mass media representation of disability rights and policies related issues that use different critical perspectives in order to better understand the problems of access, equal opportunity, rights, policy and employment as they affect persons with disabilities. This unfolds the inter-relationship among mass media, society and persons with disabilities. It also discussed the critical framework for studying media representations of persons with disabilities. Finally, the article discovered a participatory conceptual model for portraying rights and policies of disabled people of mass media of Bangladesh.

Key Words: Mass Media, Disability, Representation, Rights, Policy, Development.

1 Associate Professor
Department of Mass Communication and Journalism, University of Rajshahi, Bangladesh

2 Assistant Director
Rural Development Academy (RDA), Bogra

Introduction

In Bangladesh, there is an urgent need to raise awareness in society of the rights of disabled people in order to facilitate policy activities aimed towards integration of people with disabilities into society. The trend towards the isolation of disabled members of society still strongly dominates in Bangladesh. Health care practices violate the human rights of disabled despite the fact that persons with disabilities in Bangladesh have all civic, political, economic and social rights. As almost 10% of the total population is disabled and this segment of population have a very limited opportunity and access to participate in mainstream development process. The nation would not be able to achieve desired development goal without including the disabled population in the process.

Over the past 30 years, a substantial amount of research has been conducted to determine the effect of the mass media on the public's belief all over the world. Those studies have concluded that the media's power to influence public perception and the degree to which people are exposed to media representations combine to make the mass media one of the most significant influences in developed and developing societies. But sufficient evidence exists to indicate that if the public considers people with disabilities to be violent and or unable to care for themselves, government policies and resulting legislation will look more toward containment and control than toward recovery and community living. If public perception of physically challenged is based on negative and false images perpetuated by the media, there is a danger that government responses to systems and people with disabilities field will also be based on these false realities, rather than on the true needs and issues of people suffering from such illness (Cutcliffe and Hannigan, 2001).

There is a common perception that the media's depiction of disability is overwhelmingly negative and inaccurate. Media portrayal is also viewed as an important element in forming and influencing community attitudes towards disabilities issues. The media can also affect public belief in relation to health information. It does seem likely that people make up their minds on health care by using their own experiences and the experiences of friends and relatives in the light of other information, from the media and their prior political and social views.

Define disabled people

Disability is a complex phenomenon. It is not just health problem. Disability reflects the interaction between features of a person's body and features of the society in which he or she lives. According to World Health Organization (WHO), Disabilities is an umbrella term, covering impairments, activity limitations, and participation restrictions. Impairment is a problem in body function or structure; an activity limitation is a difficulty encountered by an individual in executing a task or action; while a participation restriction is a problem experienced by an individual in involvement in life situations.

Rights of disabled people: Bangladesh perspective

Bangladesh has a population density of 867 people per square kilometer and a total population of 125 million people spread over 144,000 square kilometers. It has one of the highest densities of population in the world, with 80% of people living in rural areas. It has a Human Development Index ranking of 146 out of 174 countries, Gender Empowerment Ranking of 67 out of 70 countries and Human Poverty Index ranking of 70 out of 85 developing countries. The per capita income is US$ 350, life expectancy is 58.6 years, infant mortality is 79 per 1000 live births and adult literacy is 51.1% for males and 28.6% for females. It is a fertile country prone to frequent a flood that causes economic damage and loss of human life. Muslims constitute 86% of the population with all people sharing the same Bengali culture and language. About half of the population is below 15 years of age due to a 2.1% growth in population. It has an unequal distribution of wealth with 10% of the population holding 60% of land. The country has a high rate of corruption, frequent political upheavals and is highly dependent on external debt (37% of the GNP).

The prevalence of disability is believed to be high for reasons relating to overpopulation, extreme poverty, illiteracy, lack of awareness, and above all, lack of medical care and services. Although disability is a major social and economic phenomenon in Bangladesh, there is very little reliable data available on this issue, especially in the absence of a comprehensive national survey on persons with disabilities. The Government of Bangladesh (GOB) surveys in 1982, 1986 and 1998 estimated a national prevalence rate of disability at 0.64%, 0.5% and 1.60% respectively. Action Aid-Bangladesh and Social Assistance and Rehabilitation for the Physically Vulnerable (SARPV) put the disabled population at 8.8% of the total population. Bangladesh Protibandi Kalayan Samiti records 7.8%. Most of the estimates generally appear to be underrated, sometimes excessively. The WHO's global estimate predicts approximately 10% of all people have a disability of one kind or another. This also considered true in Bangladesh with some sources quoting a higher disability rate in rural Bangladesh (VHSS, 2000).

The number of people with disabilities in Bangladesh is high enough to merit special attention. Based on an assessment of the available figures and estimates by WHO and World Bank for developing countries, an overall disability prevalence of about 10% of the population remains a valid working estimate. The prevalence of disabilities in children below 18 years can be estimated to 6% and for the age group above 18 years the prevalence to about 14% or corresponding to 3.4 million children with disabilities and 10.2 million adults with disabilities (VHSS, 2000).

In recent years, there have been some improvements and positive trends as a result of the efforts at both government and non-government levels; however the overall situation of Persons with Disabilities is still far from satisfactory. In fact, they are still granted lowest priority in service provision in Bangladesh. The following explains the current situation of each issue associated with handicaps, impairment and disability in Bangladesh. Throughout history, persons with disabilities have usually been considered 'fearful and superstitious beings'. The direct result of these beliefs has been their 'neglect'. This neglect bars persons with disabilities from normal economic, social and political activities in their families, communities, essential services and education, etc. There are no systemic interventions to raise awareness of persons with disabilities at the community level.

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Though many persons with disabilities are able to live and lead productive lives, they are neglected by society as a whole. Many people in the Bangladesh view persons with disabilities as a curse and a cause of embarrassment to the family. They are unsympathetic to the situation of persons with disabilities. Women with disabilities are particularly vulnerable to social discrimination and neglect. According to the little available data, about 70% of the disabled population has special needs for medical rehabilitation and social integration. In Bangladesh, the health care service delivery system and approaches do not include medical rehabilitation for persons with disabilities. Persons with disabilities in need depend largely on traditional healers. A minimum level of medical rehabilitation is available through NGOs, which are concentrated in urban areas.

Persons with disabilities are usually excluded from existing governmental and non-governmental development programs. Despite national policies that protect the rights of persons with disabilities (for example, a 10% job quota for Persons with Disabilities), in reality they face unfair competition or neglect. According to available estimates, the actual number of employed persons with disabilities may be less than 1% (VHSS, 2000). With the exception of a few initiatives by some organizations, there are very few job opportunities for persons with disabilities. Service facilities for rehabilitation therapy and medical care assistance for persons with disabilities are inadequate. Extra care and cost are required as the types and severities of disability are diverse, but many persons with disabilities and their families cannot afford such services.

The WHO figure of 10% prevalence is quoted in most reports on disability in Bangladesh. Surveys by different agencies however, yield figures from 0.5% to 14% due to differences in definition of disability used in methodology. Major causes of disability are communicable diseases and malnutrition. Unsafe birth practices and nutritional deficiencies also contribute to the incidence of disability. Accidents and old age related disabilities are now on the rise. People with speech and hearing problems constitute the major proportion of disabled people in the country, followed by physical disabilities.

The Bangladesh Constitution states that `no citizens shall, on grounds only of religion, race, caste, or place of birth be subjected to any disability, liability, restriction or condition with regard to access to any place of public entertainment, or resort, or admission, or to any educational institution'. In 1995 the first National Policy for the Disabled was approved by the government the policy mainstreamed disability into the country's development agenda. An action plan to operational this policy was approved in 1996. In 2001, comprehensive disability legislation entitled `The Bangladesh Persons with Disability Welfare Act' was adopted by parliament. This document includes revised definitions of various disabilities, the formation, roles and responsibilities of legislative bodies at national and district levels, as well as the coordination between them. The Act lists ten specific priority areas: 1. Disability prevention, 2. Identification, 3. Curative treatment, 4. Education, 5. Health care, 6. Rehabilitation and employment, 7. Transport and communication, 8. Culture, 9. Social security, and 10. Self-health organizations.

Mass media, society and persons with disabilities

In a democratic society, equal opportunity to participate in all facets of that society should be a goal of government, private and public institutions, and the majority rule and one of

the duties of the majority is to recognize the rights of those who are not in the majority. A smaller more diverse minority still struggles for recognition of their problems and acceptance in society all over the world. The group, known variously as disabled, handicapped, physically challenged or handicappers (all are persons with disabilities) includes those with visual handicaps (including the blind and partially sighted), hearing disabilities (deaf and partially hearing) and mobility characteristics. Because of economic, physical, architectural and attitudinal barriers, inclusion of these individuals has lagged behind that of minorities.

Mass media influence the visibility of minorities and can have some impact on the broad social recognition of the problems of the groups. The problems of acceptance, equal opportunity, access and employment for persons with disabilities in the 1980s are no less pressing than the situation of disabilities in the 1960s (Stroman, 1982). These individuals remain ignored or at least misunderstood, partly because of the lack of accurate portrayal in the media (Liebert, 1975; Hespenheide, 1988). Much has been written about how the public views individuals with disabilities. The social psychology and rehabilitation literature are rich with such studies. However, the mass communication literature has virtually ignored this issue.

Models of disability studies: medical, social, pathology and civil perspectives

Researchers in the field of special education have developed a theoretical paradigm, which springs from two approaches to individuals with handicaps. Gliedman and Roth (1980) outlined three theoretical models of ways society views people with disabilities. One model, based on medical criteria, emphasizes an individual's physical functioning and may be the most common conception. Another perspective, the social pathology viewpoint, is the basis for many government assistance programs and emphasizes the perceived inability of persons with disabilities to support them economically in society. The third model rejects the assumptions of the first two- that person with limitations cannot unction physically, mentally or economically. This minority/civil rights perspective view the person with a handicap as a member of a group, which is oppressed by the physical or attitudinal barriers of a society, which is prejudiced in favor of the needs of the non-disabled majority.

Probably the most prevalent conception society has of those with disabilities is the medical model. This stems from what Parson has called the 'sick role' as a form of deviant behavior (Parsons, 1951). Parsons noted that this role entails the individual's exemption from normal social obligations and from responsibility for his or her condition.

The medical model views disability as an aberration from the 'healthy' norm. The focus is on prescription and treatment of the individual, who is expected to give up autonomy to a health professional and to a medical support network. This model puts the focus of the problem on the individual's disability as a sickness that must either be cured or contained. No blame is put on any aspect of society. The consequences of this mode of thinking for the individual with a disability can be passivity, gains limited to individual physical recovery or maintenance, and severe limits on if not outright suspension of social activities.

The second model is based many of the assumptions present in the medical outlook. Whereas in the medical model the disability is thought of as a disease and the individual become the patient under the care of medical expert; in the social pathology model, the role of the individual with handicap is that of a stigmatized individual or deviant who is considered out of step with the rest of society. Again, the individual is labeled as inferior,

this time as a disadvantaged client who must look to society for economic support. Unlike the medical model, blame for the disabling aspect of the individual is apportioned between the person with handicap, who cannot perform many types of jobs and activities in society and the social environment itself, whose free market economy is unable to accommodate the individual's employment and other needs.

The ramifications of this model, however, are only slightly different from those of the medical model. Specifically, Bogdan and Biklen (1977:23) noted that a cornerstone of the support system for persons with disabilities is that the service provided is a gift or privilege, not a right. Such support 'demeans its recipients by supporting the prejudice that the handicapped are inferior people'. They also postulated that the other major source of social services to the handicapped, governmental agencies, tend, in the interest of bureaucratic efficiency, to held, label, and further stigmatize those individuals with various disabilities.

Both the medical and social pathology attitudes result in what Bogdan and Biklen (1977) refer to as 'handicapism' promotion of differential or unequal treatment of individuals because of physical, mental or behavioral differences. They add that at the societal level, these individuals are portrayed stereotypically by the media, are held back by physical as well as attitudinal barriers and are encouraged to be docile in order to receive support services from the government. The third model, the minority/civil rights perspective, is explicitly politically-based. It puts the blame for disabling aspects of a handicap not on the individual who cannot walk, see or hear, but on the inability of society to adjust to the specific needs of these individuals.

The idea of person with disabilities as a minority group was advanced by Tenny (1953) when he proposed focusing on 'the limitations imposed by society upon handicapped individuals and groups.' Bowe (1978) noted that disabled have suffered more economically than other minority groups, with the highest rates of unemployment, poverty and welfare dependency in the world. They have also been segregated from the rest of society in housing, education, transportation and public accommodation. Gliedman and Roth (1980) assert the able-bodied people blame these economic and social problems on the physical limitations of disabled persons, not on social oppression.

A consequence of the minority or civil rights model is that those with disabilities expect and demand that society view them as equals and respect their opinions and input in all areas of society. The ultimate goal is to achieve a physical and societal environment useable by and accommodating to all. The goals of the minority/civil rights model are similar to the focus of minority group theory. Both concentrate on the need of society in general to accommodate members of different groups. The medical and social pathology models, like deviance theory, focus on the differences between individuals and society. The traditional definition of the deviant as being a flawed individual coincides with medical model. The social pathology model also concentrates on the individual's differentness and seeks to solve problems caused by this differentness by funneling resources (charity, government aid etc.) to allow persons with disabilities to survive in an arena separate from (and most likely unequal to) the rest of society.

Critical framework for studying media representations of persons with disabilities

While Mass Communication researchers have studied media representations of minorities, little research has been done on media treatment of persons with disabilities. So to develop

theoretical framework of this research, deviance theories, and minority group theory, three models of disability and some models for studying media representations of persons with disabilities are discussed.

In a democratic society, equal opportunity to participate in all facets of that society should be a goal of government, private and public institutions, and the majority rule and one of the duties of the majority is to recognize the rights of those who are not in the majority. Mass media influence the visibility of minorities and can have some impact on the broad social recognition of the problems of the groups. There were some modern models of media representations of person with disabilities developed by J. S. Clogston, Beth Haller. J. S. Clogston (1991) developed Supercrip model, Cultural Pluralism model, and Haller developed Legal model and consumer model of media representations of persons with disabilities.

In Supercrip model, the person with a disability is portrayed as deviant because of 'superhuman' feats or as 'special' because they live regular lives 'in spite of' disability. This role reinforces the idea that disabled people are deviant that the person's accomplishments are amazing for someone who is less than complete. In cultural Pluralism model, person with disabilities are seen as multifaceted person and their disabilities do not receive undue attention. They are portrayed as non-disabled person would be (Clogston, 1990). In the business model, the person with disabilities and their issue are presented as costly to society and business especially. Making society accessible for people with disabilities is not really worth the cost and overburdens businesses. It is not good value for society or business. Accessibility is not profitable (Haller, 1995). Another is Legal model (Haller, 1995). It is illegal to treat person with disabilities in certain ways. They have legal rights and may need to sue to guarantee those rights. Various national and international laws presented as legal to halt discrimination (Haller, 1995). Haller developed another model for studying media representation of people with disabilities. It is called consumer model. In consumer model, people with disabilities are shown to represent an untapped consumer group. Making society accessible could be profitable to businesses and society in general. If disabled people have access to jobs, they will have more disposable income. If disabled people have jobs, they will no longer need government assistance, (Haller, 1995). These models have been used in both quantitative and qualitative studies of media representations of person with disabilities.

Prospective models for studying mass media and disabled people rights

Discussing above models, it is clear to us that the critical study of media representations of persons with disabilities is an area thus far largely untouched by mass communication researchers. Still the theoretical perspectives reviewed above provide the basis for theoretically grounded inquiries into media representations of persons with disabilities. These theories: normative deviance, labeling and stigma, the medical and social pathology models of disability, minority group theory and minority/civil rights model of disability; will now be briefly summarized for applications to mass media studies.

Normative deviance theory holds that persons with non-behavioral characteristics (e.g. a physical or mental disability) which violate social norms will be stigmatized by society. Mass media researchers might then ask if representations of handicapped individual in news and entertainment fare are consistent with this perspective. For example, does news coverage focus on the triumphs of an individual who overcomes an explicitly emphasized disability

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to perform some feat while implying that those with disabilities who do not perform such feats are less than fully human? Do newspapers portray persons with disabilities as unable to function in ways not related to their disability? The above studies based on normative deviance and stigma theory would predict that if predominant social attitudes determine media portrayals, individuals with disabilities would be portrayed in ways tied to their disability, or would be covered primarily as human-interest feature subjects.

Labeling theorists hold that an individual is stigmatized when he or she is called deviant. In this instance, researchers could view mass media representation of persons with disabilities as an independent variable (the labeler) or as a dependent variable (reflecting society's designation of a person with a disability as a deviant). For example, does news copy refer to persons with disabilities using terms that emphasize their difference from normal members of society? Do visual portrayals in news, television entertainment and advertising do the same? Do advertisers avoid portrayal of persons with disabilities because of the negative and deviant ramifications of their 'sicknesses'? The medical model would predict that these individuals would appear most often in some variation of sick role in both news coverage and entertainment programming, and would be invisible in advertisements.

The social pathology model of disability, also drawn from deviance concepts, views the disabled individual as a disadvantaged client, dependent on society for economic support. In social pathology model, people with disabilities presented as disadvantaged and must look to the state or to society for economic support, which is considered a gift, not right (Clogston, 1990). Researchers could look at whether news coverage of persons with disabilities focuses on government welfare or private charity programs to help them. Do telethons and fundraising programs portray these individuals as objects of pity, who need help from monetary donations? Do disabled characters reflect this role of the recipient of help, or of the economically needy individual who is in that state because of his or her disability? The social pathology model would predict that disabled individuals would be portrayed as economically disadvantaged and in need of help and would be more likely to appear in the news as the subject of political debates over social welfare programs.

Minority group theory holds that persons with handicaps is identifiable, have less political power, receive differential pejorative treatment and have group awareness. Researchers cold ask if this identifiable group receives pejorative treatment from the media by being excluded from news stories, entertainment programs and advertising, or by portrayal in stereotypical (possibly reflecting the medical or social pathology models) ways. Does news coverage of persons with disabilities concentrate on the differential power of these individuals as well as their political demands for societal changes that would allow them to take part in everyday life? Minority group theory would predict that news coverage and portrayals of these individuals would reflect these political aspects of disability.

The minority or civil rights model of disability, a further specification of minority group theory, holds that persons with handicaps held back primarily by society's unwillingness to open up physically and attitudinally to this minority group. Clogston (1990) noted that in minority/Civil rights model, people with disabilities seen as members of the disability community, which has legitimate political grievances. They have civil rights that they may fight for, just like other groups. Accessibility to society is a civil right. Media researchers might

ask whether news coverage focuses on debates over social changes called for by disability rights activists.

Proposed model for studying rights of disabled people of Bangladesh in mass media

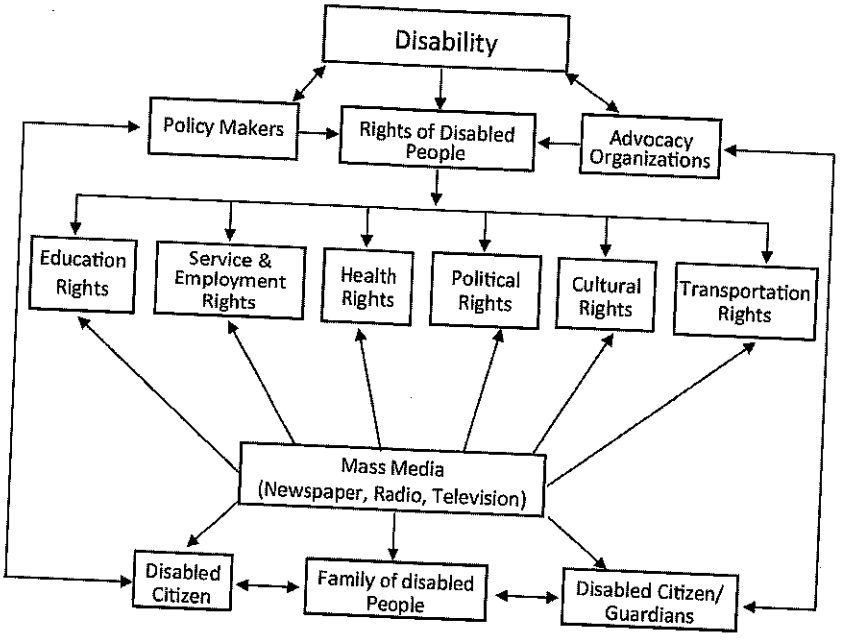

Figure: The participatory conceptual model of portraying rights and policies of disabled people of media of Bangladesh.

The figure shows that the position of mass media is central point. In addition, top of figure shows disability. According to figure policy, makers and advocacy organizations take ideas about rights (education, service, employment, health, political) of disability and formulate policy. Mass Media will reflect the rights and disseminate information about disabled people, family of disabled people and their parents.

Conclusion

Mass media has been widely recognized as an important factor that facilitates both negative and positive attitude towards people with disabilities problems, rights, policy and society attitudes towards people with disabilities and illnesses have been studied or discussed in Bangladesh so far. In Bangladesh, there is an urgent need to raise awareness in society of the rights of disabled people in order to facilitate policy activities aimed towards integration of people with disabilities into society. The trend towards the isolation of disabled members of society still strongly dominates in Bangladesh. The nation would not be able to achieve desired development goal without including the disabled population in the process.

Persons with disabilities in Bangladesh are socially isolated in specialized hospitals and social care homes that usually are established far away from community. Moreover, 'because of the shortage in health care funding, people with disabilities care hospitals and social care houses often receive inappropriate care and live in substandard conditions' (Leimana, 2000). Others spent the majority of their time at their homes because of the lack of community-based services. As a result, disabled people in Bangladesh who constitute around 10% of the whole population are excluded from society; most of them are rural, they represent an 'invisible population'- a population whose rights are not widely recognized and respected. Moreover, even if some limited actions towards inclusion of people with disabilities into do exist, public in Bangladesh is rather uninformed about them. Rural people of Bangladesh still have an opportunity to use mass media to strengthen public awareness of rights of people with disabilities and prepare general public for community based health care policies in advance to policy activities.

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