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Renewable Energy as Means of Rural Livelihood Improvement in Bangladesh: an Experience of RDA

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Md. Nazrul Islam Khan²
Samir Kumar Sarkar³
Md. Ferdous Hossain Khan⁴

Abstract

When there is no use of anything considered as waste, may be converted to value or in use through proper initiatives or by transformation to make usable. Most of the rural people in Bangladesh face quality of life and livelihood challenges associated with sub-optimal sanitation because of existing improper waste management system.

The traditional practicing of using cow dung as fuel is deteriorating soil organic matter and environment through unmanaged wastes responsible for Green House Gas (GHG) emission. These challenges are manifested in health issues related to water-borne diseases, respiratory diseases from indoor smoke inhalation and declining agricultural livelihoods. RDA developed Community based biogas technology has been identified and accepted as a socially, economically and environmentally sustainable solution for addressing these issues. Total 106 Bio-gas plants are installed over the country for better solid waste management and livelihood improvement, Tearbond village is one of them where the study was conducted. The study reveals that earlier the farm owner of Tearbond was in breakeven point along with only milk business but incorporation of Bio-gas model profit margin noticed significant (Net income \$15000. Tearbond village community is managing 985 tons of waste per years. They converted waste to value and earned \$9350 by selling 433 tons of organic fertilizer in addition through providing service to the community people with biogas for cooking, generating electricity, safe water supply at domestic & farm levels; thus total net benefit stood at \$15000 during last year (2014). In changing of rural livelihood and waste management practice the community based bio-gas can be considered as unique model.

The viability of direct solar power irrigation study was conducted at RDA demonstration farm to make the rice base farming profitable one in multi-storied agriculture system, to ensure environment friendly energy sources and to reduce extra thrust on national electric grid and shrink electric bill. Bangladesh is the perfect location for direct solar power irrigation where sunshine hour in varies from 10 to 13 hours and solar radiation and intensity also fluctuates very little throughout the year. From the study, pump run maximum 10 hour by direct solar power where it

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gave full flow of water maximum 6 hour in a day. Average water discharge was 40710 liter per hour. Total water discharge per day was 310 m³ and by this water 0.53ha. of land was irrigated per day. By the system total 4.86ha of land was managed by irrigation. As in two storied cropping, production of rice (base crop) in experimental plot decrease up to 4.79% compare to the control plot but it produces secondary crop (127 Bottle Guard) as an extra production and also gave support for solar power for irrigation that cut the cost of electricity. Financial analysis indicated that NPV, BCR and IRR were BDT 4.675 million, 2.26 and 32% respectively. The values of NPV and BCR were > 0 and >1 so the model would be accepted and should be pursued.

The difficulty of community bio-gas was accumulation, handle and manage the degradable waste produced over the village. Overcome the difficulties and in addition to incorporate the success of using solar energy for lighting against load shedding period and using renewable energy (Bio-gas and Solar Power) for lifting and supply of water this cooperative based model house (Palli Janapad) would be a milestone for rural development. Total 288 HHs could be lived in a common tower with well facilities of rearing 500 cows and 16126 poultry birds. All degradable waste (Excreta, Cow dung, Kitchen waste and poultry drops) of 3.8512 million tons/yr could be managed by collecting them in a single point by gravity flow. Waste management becomes easier and produced bio-gas supplied to the individual flat with solar lighting facilities (50 kW) in load shedding period. Both the renewable energy (Bio-gas and Solar power) should be used for lifting water and supply. The recommended green housing model saves agricultural land of 7.81ha; erase the construction cost of 6.15 km overhead electric line. Yearly produced 145152 m³ of bio-gas and two tons of organic fertilizer daily which gross market value stands \$0.06 million per year. 50kW of electric power will be produced using solar energy and the flat owner will be enjoyed three light and one fan facilities. The piece of study is the success experience of using renewable energy in multi-dimensional sectors of rural development in efficient way.

The research findings support collaborative policy processes that include vertical and horizontal communication amongst government, NGO, private sector, and community stakeholders which might be the means of economically viable waste management system leading livelihood improvement in an environment friendly replicable model for Bangladesh.

Key words: renewable energy, bio-gas, solar power, means of livelihood, rural housing. palli janapad.

1. Introduction

Waste is a resource by its' nature of use, it may vary on the basis of location or on owner's decision; so there is nothing waste if it is transformed into usable ones. The waste particularly produced in livestock farms may be converted into biogas as a source of environment friendly renewable energy. Access to energy is crucial for the development of any country (Okello, *et al.*, 2013). While access to energy did not make the list of Millennium Development Goals, it has been cited by United Nations Secretary-General Ban Ki-moon as the very foundation for all the Millennium Development Goals (United Nations, 2010, September). Bangladesh has traditionally relied on biomass wood, charcoal, cow dung as a primary source of fuel for cooking. Inefficient use of wood is associated with pollution, deforestation and related issues such as undesirable change in biodiversity, wood scarcity, and degradation of land and water resources (Okello, *et al.*, 2013; Pandey *et al.*, 2007).

Bangladesh has major problems with energy shortage, persisting poverty and environmental degradation. Per capita energy use is only 180 kW-h (*Energypedia-2014*). With only 59.60% of Bangladesh's having access to electricity connection whereas the national grid could so far cover only 42 percent of 161 million of the total population, and only 06 percent people are enjoying piped gas supply major in urban areas as well as 90 percent of Bangladeshies cook with biomass such as rice straw, dried leaves, jute sticks, cow-dung or wood (*World Bank 2014*).

About 70 per cent people of Bangladeshies live in rural areas, where the energy situation is not satisfactory. As a result, rural to urban migration is high in Bangladesh. In the rural areas, the houses are scattered. Neither grid nor piped supply is suitable for those areas. Renewable energy systems like solar, biogas; wind, etc. have no alternative. About 90 percent of the electricity now produced in the country is based on natural gas, which has limited reserves and will be exhausted in the near future. Bangladesh has a wonderful condition for biogas production. The ideal temperature for biogas production is around 35°C. The temperature in Bangladesh usually varies from 6°C to 40°C. But the inside temperature of a biogas digester remains at 22°C-30°C, which is very near to the optimum requirement (*Gofran, 2007*).

Most of the supply is limited to urban areas; access to electricity in rural areas is less than 25%. Renewable Energy Technology (RET) can solve this problem by harnessing energy from country's free flowing renewable such as sunshine, wind, tidal waves, waterfalls or river current, sea waves or biomass. Use of renewable energy, increased energy efficiency and enhancement of energy security constitute a sustainable energy strategy approach (Sarkar *et.al.* 2014).

To minimize the energy problem, Rural Development Academy (RDA), Bogra, Bangladesh has been carrying out experiment since 2000. Initially two bio-gas plants having capacity of 130m³ each was constructed at RDA campus under the ADP funded project. At present, a total number of 63 households (4 storied building), Guest house, DG's Bungalow have been connected under biogas facilities. Moreover a 5 KVA generator is being operated using biogas and a portion of RDA demonstration farm premises has come under gas-electricity. The slurry (fermented cow dung & Kitchen waste) produced from biogas plant are processed as organic manure and sold at market through Advanced Chemical Industries Limited (ACI) with the branded name of "Palli Joibo Sar" (Rural Organic Manure) after mitigating local demand (Sarkar, *et.al.* 2013).

Rapid population growth, increasing food demand and urbanization are the main causes that create increasing pressure on scarce resources in Bangladesh to support food security of ever growing population. One of the lowest land-person ratios (0.12 ha) in the world (FAO, 2001) the country is losing 1% of cultivable land every year. Horizontal increase of production is nearly impossible due to limited cultivable land area. Therefore, it is becoming imperative to go with increase in vertical crop production. Moreover, rice cultivation alone is no more profitable enterprise for the farmers of Bangladesh. During dry season the demand of power supply increases to 40% which causes huge load shading all over the country. Evaporation is also high in dry season. Abundant sunshine in Bangladesh is a blessing of nature that can be exploited to increase agricultural productivity in many fold. Combining knowledge and wisdom of agronomy and astronomy the concept of two storied cropping system has been evolved which can efficiently drive the non profitable rice cultivation to a profitable one. The present cropping intensity of Bangladesh (180%) can be increased by double and even triple through the innovation *Two-Storied Agriculture with Solar Irrigation in Bangladesh*. Moreover the cropping system for lifting ground water for irrigating rice as the base crop and cucurbits vegetable as the second layer, crop even during the driest period

of the year. Moreover the two storied agriculture with solar panel requires zero or no electricity as the top layer is furnished with solar panel thus minimized load shedding and creates less demand on national power grid.

With the on station successful experimentation, RDA started implementing GoB funded action research project entitled “Poverty Alleviation through Livestock Management and Bio-Gas Bottling (2009-2015)” targeting 112 areas through community approach all over the country. Under this action research project there is a provision of constructing community based biogas plant with capacity of 130-200 m³ each rather than traditional household level with a package support of skill development training and distributing cattle among the beneficiaries as on leasing out basis as a source of input of the biogas plant (*Sarkar, et.al. 2011*).

Rural Development Academy, Bogra has conducted research on two storied cropping system keeping rice as the base crop and bottle gourd (Vegetables) on the 2nd layer and solar panel for irrigation on the 3rd layer. The gross additional income was US \$ 1400 from one hectare of land where rice yield was not significantly decreased compared to single layer method of rice cultivation. Deducting the cost of trellis and other operational cost, a net additional income of US \$ 1250 was obtained from one hectare of land by applying multistoried cropping system of RDA. More over, the solar panel irrigation system helps in reducing huge pressure on national power grid it harvests sunshine as 3rd crop and generates power for lifting ground water using sunshine, and brings the electricity consumption cost to zero. About 1.3 million units of small borehole used for irrigating rice each consuming 5 kW of electricity put huge load on power sector can be solved by popularizing two storied agriculture model.

The difficulty of community bio-gas was accumulation, handling and managing the degradable waste produced over the village. Overcome the difficulties and in addition to incorporate the production of solar energy for lighting the load shedding period and using renewable energy (Bio-gas and Solar Power) for lifting and supply of water. The piece of study is the success experience of using renewable energy in multi-dimensional sectors of rural development in efficient way.

2. Main Objectives

The main objective of the study is to explore out the impact of using renewable energy for food security and livelihood of rural Bangladesh

The specific objectives are as follows:

- i. To focus the RDA-model of community based biogas, produced from all degradable waste in a village community as a model of better solid waste management;
- ii. To use bio-gas in multi-dimensional livelihood activities (cooking; electricity generation for compensating load shedding and water lifting) for the safety net of rural women health and improvement of rural life style;
- iii. To focus the RDA-model of direct solar power irrigation with two-layer agriculture in increasing cropping intensity for food security and reduce the extra thrust on national grid; and
- iv. To explain a sustainable waste management model for accumulating all waste by constructing a cooperative based multi-storied rural housing “Palli Janapad” with modern urban amenities.

3. Materials and Methods

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

The Rural Development Academy (RDA), Bogra, Bangladesh, completed a community based action research project at 106 sub-projects areas of Bangladesh out of total targeted 112 during (2009-2015). Necessary data were collected from purposively selected site (Tearbond village of Shahjadpur upazila under Sirajgonj district), where there was no gas supply from national grid while the community biogas project started in September 2012 with direct participation of village people but with single ownership who contributed necessary land for biogas plant installation along with deep tube-well (bore-hole), biogas generator, slurry processing floor and deposited as down payment on behalf of the community \$1812.5 (10% of total cost \$18125). Respondents interviewed were engaged in community biogas plant management and allied energy generation and distribution activities at the community level.

The Tearbond village community is being oriented in organized form by the intervention of Community Biogas Project (GoB funded action research project of RDA) since its inception in February 2013. A participatory approach was used for both qualitative and quantitative data collection during March to May 2015.

Regarding solar powered irrigation model data were recorded from 31 March 2013 to 29 June 2013 in daily basis with a time period one hour interval from 07.00 am to 06.00 pm. Static water level, total time of pump run, time of full flow by pump, pumping water level (in meter), water flow (liter per hour), voltage and ampere loaded by pump, total water discharge (in m^3), total land area (in hectare) coverage by irrigation etc. data were recorded in daily basis. Two storied cropping data, rice as the base crop and cucurbits vegetable (Bottle Guard) as second crop, were also recorded. Types of crop, variety, plantation, plant height, distance of plant to plant and row to row, weeding, irrigation, use of fertilizer, use of pesticide, yield etc. data were collected from both experiment and control plot.

After collecting data were compiled, tabulated and analyzed according to the objectives of the study. The collected data were verified to eliminate errors and inconsistencies. For cost benefit analysis the collected data, the probable cost induced with year-wise project cost of establishment and the revenue (benefit/return) were incorporated in a spread sheet. Then the economic and financial analysis i.e. Net Present Value (NPV), Benefit-cost Ratio (BCR) and Internal Rate of Return (IRR) were calculated.

4. Result and Discussions

Biogas: Biogas is a colorless fuel gas, which is produced as a result of decomposition of cow dung and other perishable materials in absence of air. It contains 50% to 55 % of methane gas and the rest part is Carbon dioxide. In the biogas production process, high value organic manure is produced as byproduct.

4.1 Scope of Biogas production and RDA's Experiences

Rural Development Academy, Bogra has successfully carried out experimentation on renewable energy. Firstly two bio-gas plants having capacity of 130m³ each were constructed at RDA campus under the ADP funded project “Expansion, Renovation and Modernization of Physical Infrastructure of the RDA Bogra” during 2003. At present, a total number of 61 households, Guest house, DG's Bungalow have been connected under bio-gas facilities. Moreover a 4.6 KVA generator is being operated using bio-gas and electrified a small portion of RDA demonstration farm. The slurry (fermented cow dung & Kitchen waste) produced from bio-gas plant are processed as organic manure and sold at market in a brand of “Palli Joibo Sar” (Rural Organic Manure)

Community biogas technology offers a potential for boosting up rural productivity and changing livelihoods and stakeholder participation to the policy process may help to facilitate the creation and establishment of a successful biogas sector. The challenges are therefore to improve stakeholders' participation to the policy-making process and ensure successful establishment of a waste management strategy as well as enhancing biogas sector in Bangladesh.

RDA-developed Community Bio-gas Plant (CBP) offers a package system which mainly includes for e.g. a demand based biogas plant (Capacity 100-200m³) for managing all sorts of degradable wastes produced by a particular community; biogas generator for producing electricity, Deep Tube Well (DTW) to have safe water both for domestic use of the community and for running biogas digester smoothly, pipeline both for water and biogas supply to the households level and with a drying-cum processing floor to manage organic fertilizer etc. along with this to some extent financial support is also provided to the community people on training match income generation activities (IGAs) towards sustainability.

This paper fills a gap in the literature by identifying methods to improve a policy making process for a national biogas framework in Bangladesh. Stakeholder collaboration was identified suitable as an approach of community participation for waste collection and benefit sharing which should result in an improved policy making process. These tools include Participatory Rural Appraisals, Power Analysis, Social Network Analyses, Stakeholder Analysis Matrices, Micro-political mapping, and Value Chain Analysis. These tools combinedly can be used to improve stakeholder collaboration, which can be used to improve the policy making process to establish a national biogas framework for increasing biogas technology, which can then be used to improve the quality of life and livelihoods of community people (Bernhard Heikoop, 2013).

4.1.1 Bioslurry as Palli Jaibo Sar in Bangladesh

Palli Jaibo Sar has highly positive impact on the agricultural production in Bangladesh. Research findings confirmed that bio-slurry as an organic fertilizer has affected crops by increasing the yields. Furthermore, bio-slurry has vital role on restoring soil organic matters which are at alarmingly low levels (less than 1% to some regions) in Bangladesh.

About 200 community based biogas plants run by RDA over the country which have been proved as environment friendly and economically feasible model through her action research projects (2009-2015). The average production of each bio-gas plant is about 90-100 tons/day bio-slurry contents 100% organic fertilizer that has been proven as the most suitable fertilizer for supplementing chemical fertilizers in Bangladesh. As one of the marketing & extension partners

the private company ACI has vast network has engaged to promote the use of bio-slurry as organic fertilizer with the brand name as “Palli Jaibo Sar” (Reg. No. M-604, Pack: 40 Kg.).

A proper fertility management of soil as seen very critical, because farmers are used mostly to chemical fertilizers (with under/over doses of certain nutrients). To conserve and boost up the soil health farmers need motivation and convert locally available organic resources into resources through community biogas plants to capture multidimensional benefits such as- biogas for cooking & electricity generation, organic fertilizers and safe water supply with various scopes of having friendly environment, employment generation and overall economic supports etc. This organic fertilizer would certainly put a vital role to reduce the quantity of using chemical fertilizers and would help to get sustainable agricultural practice in Bangladesh.

A community bio-gas plant is a waste management unit capable to manage the total degradable waste of a village and make the village a green one. The comparative identification of a community based bio-gas plant is notice in the Table below.

Table-1: Comparative analysis Between Community Biogas Plant and Household level Biogas Plant

Community Biogas Plant	Household Biogas Plant
Community based	Family based
Bigger in size (100-200 m ³)	Small unit (1.2-4.8 m ³)
Active participation in waste management	Waste management in household level
Common output sharing	Individual family use
Community investment without subsidy	Individual contribution with subsidy
Package support for sustainability	Only Bio-gas plant
Total investment \$18125	Cost \$437.5-\$750
Family coverage: 120-200 families	One family only
Waste management capacity- 2.5-3.0 Ton/day	Waste management capacity- 30-60 kg./day
Proper decomposition	Improper decomposition
Daily gas output- 50-90 m ³	Daily gas output- 1.1-2 m ³
Manure output- 400-500 kg/day	Manure output- 6-12 kg/day
Safe water supply system	No water supply system
Biogas generator for electricity (5kVA)	No generator
Main grid pipeline for supply of water and biogas to the community households	Only biogas line connected to individual family
Average cost minimal	High cost
Maximum scope of benefit sharing	Least scope of benefit sharing

Out of 106 bio-gas villages Tearbond is a representative sites. Initially the cattle farm owner of Tearbond was in breakeven point as milk was the only product. To develop his farm as profitable one an initiatives has been taken by him and installed a community based bio-gas plant with techonological support of RDA. The facilities developed at Tearbond are a Bio-gas plant (130 m³); Gas supply line; a Borehole; Overhead Tank; water supply main line; Organic manure drying yard, Bio-gas operated generator etc. The rural communities are trained on collection, handle & management of waste, bio-gas and water supply, cattle rearing, feed production, organic manure production and processing. The cattle population of the village has increased by providing loans for cattle rearing and some cows are provided to the local beneficiaries as traditional lease basis. The monthly inputs and mixing ratio of waste materials supplied in Tearbond sub-project are given in Table-2 and Table-3.

Table 2: Daily Average Inputs Feeding to the Biogas Plant by Waste Category

Month	Amount (kg) of feeding materials used/day				Total
	Cowdung	Poultry droppings	Kitchen waste	Others	
January	2415	155	52	17	2639
February	2314	145	49	23	2531
March	2585	124	63	29	2801
April	2980	126	67	28	3201
May	2617	127	78	33	2855
June	2780	132	84	36	3032
July	2312	224	67	27	2630
August	2357	238	77	19	2691
September	2440	131	83	21	2675
October	1912	218	64	22	2216
November	2019	232	58	26	2335
December	2517	181	64	27	2789
Average	2437	169	67	26	2700

As there is no availability of gridline gas, most of the respondents depend on natural sources of biomass for cooking. Due to insufficiency of natural forests the farmers collect fuel wood from the homestead forestry. The major sources of biogas production feeding materials are from livestock waste (91%), poultry droppings (6%), kitchen waste (2%) and others (1%) etc. (Figure 1).

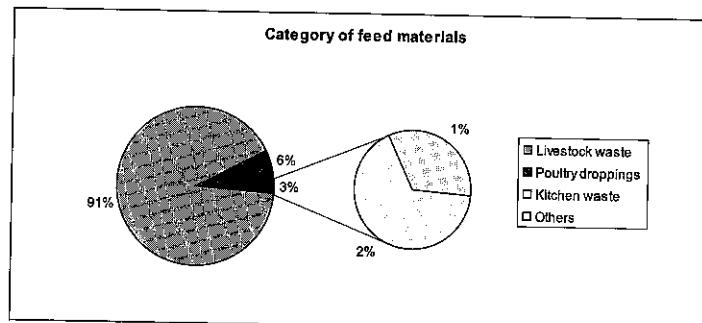


Figure 1: The Categorywise Input supplied to Tearband, Shahjadpur, Sirajgonj, Bangladesh

Table 3: The Input Ratio and Cost of Wastes Per (Kg) supplied to Tearband, Shahjadpur, Sirajgonj

Item	Category of raw materials				Comment
	Cow dung	Poultry droppings	Kitchen waste	Other	
Feeding to biogas plant (%)	91	6	2	1	Depends on availability
Input Ratio (Water : Waste)	1:1	1:2	1:0.5	1:1	Depends on raw materials
Average price \$ per (kg)	0.005	0.007	0.0125	0.006	Including carrying cost

After introduction of community bio-gas 240 HHs are getting direct benefits out of the total population (500 HHs) of the village. Number of cattle increased 390 in total with improved brid. Forty families are enjoying biogas connection and asked for \$6.25 for double burner. Ensured water supply at 29 HHs and a cattle farm of 200 cattle in numbers. So the water borne diseased from 60% to 10%. The utility facilities prevailed in the village area are illustrated in Table 4.

Table 4: Impact of Tearbond Community Biogas Project during (2014)

Sl. no.	Item	Before Project	After Project	Remarks
1.	No. of beneficiaries	-	240	500 Families in the village
2.	No. of cattle	1000	1390	
3.	Vaccination (%)	70	90	Cattle
4.	Cross bred cattle (%)	44	78	
6.	Silage technology adoption	-	5	
7.	Organic fertilizer production	-	197 ton	140 ton marketed through ACI and 57 ton used in community land.
8.	No. of farmers in fodder cultivation	3	216	Napier, bucsha, khesari etc.
9.	Waste management	-	985 ton	Induding household waste
10.	Bio-gas connection (Family)	-	40	Double burner
11.	Electric connection (Appliance)	-	49	45 Bulbs, 4 fan
12.	Water borne diseases	60%	10%	
13.	Production of biogas (Cubic meter)	-	34475 m ³	
14.	Safe water supply (Number)	-	30	1 Cattle farm (200 Cattle) 29 Family
15.	Trained manpower on different IGA	-	80	Beef fattening, Livestock rearing, Silage production, Fertilizer processing etc.
16.	Awareness building	-	255	

4.1.2 Yearly Return

The yearly income and expenditure of the Tearband scheme is noticed in following Table 5. The net income from bio-gas supply secured \$2725, electricity supply \$412.5 and water supply \$200. The income from organic manure and beef fattening sectors showed significant income \$9355 and \$2314.37 respectively. Finally deducting all expenditure (\$18455.62) from the gross income (\$33462.5) the net benefits of the farm captured \$15006.87. So the farm earlier identified as breakeven has graduated as profitable farm by introduction of community bio-gas plant.

Table 5: Analysis of yearly Income & Expenditure of Tearbond Community Biogas Sub-project

Item	Input(No.)	Yearly expenditure (USD)				Household (No.)	Yearly income (USD)		Net Income
		Labor (No.)	Other	Total	Farm (No.)		Total		
Deep tube well	200	300 (1)	50	550	450(29)	300 (1)	750	200	
Biogas generator	225	300 (1)	37.5	562.5	735(49)	240 (1)	915	412.5	
Biogas supply	225	300 (1)	50	575	3000(40)	500 (1)	3300	2725	
Organic fertilizer	4927.5	805 (322)	75	5807.5	15162.5	-	1516.25	9355	
Beef fattening	10016.87 (16)	900 (1)	43.75	10960.62	13275	-	13275	2314.37	
Total	15594.37	2605		18455.62	32622.5		19756.25	15006.87	

NB: 1. Figures in the parenthesis indicate number of users

4.2 Two-Storied Agriculture with Solar Powered Irrigation

Abundant sunshine in Bangladesh, a blessing of nature can be exploited to increase agricultural productivity in many fold. Combining knowledge and wisdom of agronomy and astronomy the concept of two storied cropping system has been evolved which can efficiently drive the non profitable rice cultivation to a profitable one. The present cropping intensity of Bangladesh (180 %) can increase the intensity by double and even triple through the innovation **Two-Storied Agriculture with Solar Irrigation in Bangladesh**. Moreover the cropping system for lifting ground water for irrigating rice as the base crop and cucurbits vegetable as the second layer, crop even during the driest period of the year. Moreover the two storied agriculture with solar panel requires zero or no electricity as the top layer is furnished with solar panel thus thus minimized load shedding and creates less demand on national power grid.

Rural Development Academy, Bogra has conducted research on two storied cropping system keeping rice as the base crop and bottle gourd (Vegetables) on the 2nd layer and solar panel for irrigation on the 3rd layer. The gross additional income was US \$ 1400 from one hectare of land where rice yield was not significantly decreased compared to single layer method of rice cultivation. Deducting the cost of trellis and other operational cost, a net additional income of US \$ 1250 was obtained from one hectare of land by applying multistoried cropping system of RDA. More over, the solar panel irrigation system helps in reducing huge pressure on national power grid it harvests sunshine as 3rd crop and generates power for lifting ground water using sunshine, and brings the electricity consumption and cost to zero. About 1.3 million units of small borehole used for irrigating rice each consuming 5 kW of electricity put huge load on power sector can be solved by popularizing two storied agriculture model.

Benefits of Solar Irrigation System

The ultimate long term impact of two storied agriculture with solar irrigation is to reduce poverty and improve livelihood of farmers and limit dependency on ever crying electricity for irrigation. Round the year farmers can produce, sale and consume paddy and vegetables on the same piece of land by efficient utilization of abundant sunshine. Through this system, Cropping intensity can be increased from 180% to 360% and even 500% in Bangladesh.

4.2.1 Instruments used

In our study total number of 24 solar panels was set up where each panel's capacity was 270 watt, and the total capacity of these panels was 6.48 KW (Table 1). Panels were installed in scattered manner at $\angle 24^0$ with a height of 2.13m. Depth of DTW was 27.44m where housing pipe was 12.20m. With the DTW a D.C submersible pump of 3.5 KW was set up (Table 6).

Table 6: Technical Information of Solar Irrigation System

Instruments	Description
Solar panel	Polycrystalline (270 Wp; 18.20% efficiency)
Panel capacity	24 X 270 Wp = 6480 Watt (6.48 kW)
Placement of panel	Panels are installed in scattered manner North - south = 5.18m; East - west = 4.27m Panel height = 2.13m, at $\angle 24^0$
Deep tube - well (Borehole)	Depth - 27.44m; Housing pipe - 12.20, dia - 35.56cm, Strainer - 12.20m dia - 101.6cm; Bail plug - 3.05m, dia - 35.56cm
Pillars for cucurbit production	Wide = 1.22m Height - 1.52m
Raised pit for cucurbit production	0.46m X 0.46m X 0.46m
Distance raise pit to pit	5.18m
Pump	D.C submersible pump (H = 816m; Q = 3560 m ³ /hr; 3.5 kW);
Groundwater level	Static water level (SWL) = 9.15m; Pumping water level (PWL) = 11.80m, Drawdown = 2.13m
Charge regulator and panel board	Over load/voltage, low voltage protection and dry protection
Irrigation area	6.07ha.

4.2.2 Opportunity for solar power: sunshine hour and solar intensity

Geographically Bangladesh is a subtropical country where sunshine does not fluctuate too much like high latitude countries. The total sunshine hour in the country lies 10 to 13 hours per day throughout the year, during January to December shown in figure 2 (Shariar *et. al.*, 2011). It is a great opportunity that sunlight remains almost same throughout the year. Solar radiation also varies from season to season in Bangladesh. Annual average solar radiation varies 3.5 to 6.0 $\text{KWhm}^{-2}\text{day}^{-1}$ and in our study period on April 4.5 to 6.5 $\text{KWhm}^{-2}\text{day}^{-1}$, on May 4.5 to 6.0 $\text{KWhm}^{-2}\text{day}^{-1}$ and on June 3.5 to 5.5 $\text{KWhm}^{-2}\text{day}^{-1}$ (NREL, 2010). Bangladesh receives the maximum amount of solar radiation in April and minimum in November-December-January are shown in the following figure 3 (Anam and Bustam, 2011). Solar intensity in Bangladesh in January and July are 0.95 KWhm^{-2} and 1.05 KWhm^{-2} respectively shown in figure 4 (Shariar *et. al.*, 2011).

Bangladesh is located between 20.30 and 26.38 degrees north latitude and 88.04 and 92.44 degrees east longitude which is an ideal location for solar energy utilization. As a subtropical country, 70% of sunlight of year dropped in Bangladesh (Rahman *et. al.*, 2013) For this reason, we can use solar panels to produce electricity largely. Solar radiation and solar intensity does not fluctuate too much in Bangladesh, it fluctuates very little and therefore, solar power would be very much feasible in Bangladesh. Solar radiation and solar intensity is comparatively high in the north and north-eastern part of the country. So Bangladesh is the ideal country for solar power as well as solar powered irrigation.

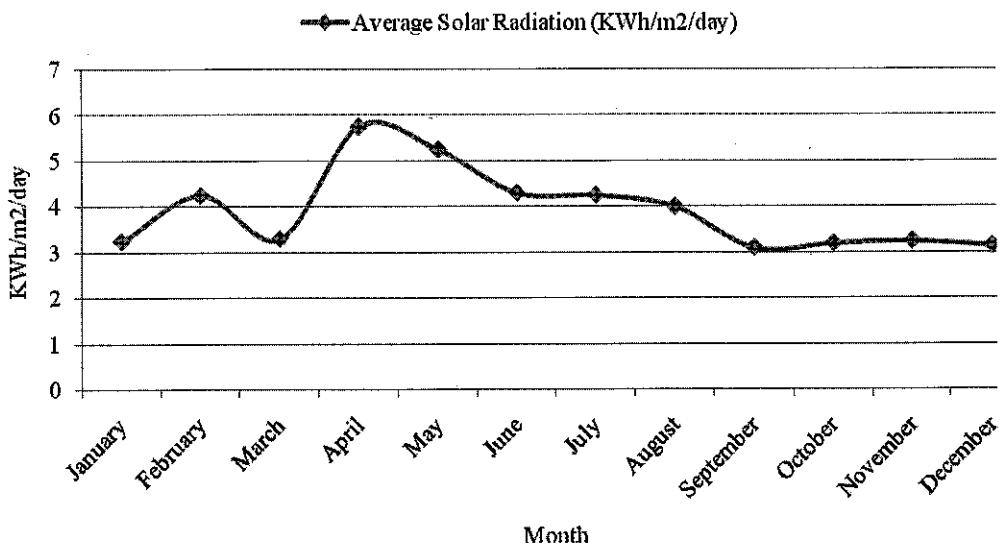


Figure 2: Monthly average solar radiation profile in Bangladesh

4.2.3 Capacity of the solar panel: volt and ampere loaded by pump

Considering the opportunity of direct solar power irrigation, a solar plant as well as deep tube well (DTW) was set up on RDA demonstration farm. In our study total number of 24 solar panels was set up where each panel's capacity was 270 watt, and the total capacity of these panels was 6.48 KW (Table 1). A 3.2 KW submersible pump was set up at the DTW with direct connection to the solar power. Loaded volt by the pump varies from 160V to 272V and ampere varies from 7.76 to 12.68 (Figure 5). The average loaded volt and ampere was 220.88V and 10.5 ampere respectively. The generation of ampere and volt directly related to the absorption of sunlight as well as solar intensity by solar panel or photo-voltaic (PV) cells. For maximum ampere and voltage, PV cells need to absorb higher intensity of sunlight. A cloudy weather lowers the solar intensity of sunlight as a result lowers the production of voltage as well as ampere by the solar panel.

4.2.4 Drawdown: static and pumping water level

The static water level of the study area was 9.15m from March 31 to May 21, it moves up to 7.78m and 12.7cm from May 24 to June 9 and then down again on 9.15m. Static water level moves up due to rain fall as well as recharges the aquifer. Average pumping water level of a day varies from 8.84m and 20.32cm to 11.28m and 7.62cm, therefore drawdown varies from 2.13 to 2.74m. The water level of pumping depends on the static water level also. Lower the static water level; lower the average water level of pumping.

4.2.5 Pumping time and water discharge

In our study pump was run upto ten (10) hours and few days it did not run due to unfavorable weather condition as rainfall and the average running time of pump was eight (08) hours. Full flow of water discharged six (06) hours in maximum and one (01) hour in minimum on a day of pump run. For the full flow of water discharge pump has to load maximum voltage, for maximum voltage solar panel of PV cell need to absorb higher intensity of sunlight. A cloudy weather hampers

absorption of higher intensity of sunlight. As a result the time of full flow varies. Average water flow or discharge varies from 27202 to 48397 liter per hour of a day. On an average 40710 liter per hour water was discharged by the pump. Water discharge also depends on the total run time of pump, full flow by pump as well as solar intensity. The higher the solar intensity higher is the water discharge per hour.

4.2.6 Total water discharge and irrigated land area

Total water discharge varies from 96 m^3 to 477 m^3 per day and average discharge of a day was 310.08 m^3 (Figure 8). Through this discharged water 0.08 to 0.89ha. of land could be irrigated and its average was 0.53ha. Total discharge of water depends on total run time of pump as well as full flow of water. When pump runs more time with a full flow, it discharges more water and covers more land for irrigation. From figure 10 in the month of June water discharge more but land covered is less due to some water store on pond and lake. On an average 0.53ha of land can irrigated per day from this system, the solar powered irrigation, with free of cost.

4.2.7 Comparison of yield between experimental plot and control plot

Two pieces of land were selected to evaluate the comparison of production of base crop (rice), while both plots were in same size (10 decimal). The plot where solar panel were set up and arranged for two-storied cropping system named experiment plot and other called control plot which was meant for cultivate traditionally. In the experimental plot some portion of cultivable land could not be planted which was occupied by the pillar of solar panel. Treatments viz. plough, irrigation, weeding, application of fertilizer were same in terms of time and quantity. Rice variety of Hybrid (HIRA) was cultivated as Raised Bed method. The comparison of yield of base crop (rice) between experiment plot and control plot. In the experiment plot base crop (rice) production was lower (146 Kg) than the control plot (153 Kg) and it decreased by 4.79% but it produced secondary crop as an extra production. Some portion of land occupied by the pillar of solar panel in experiment plot as a result total number of rice bunch was fewer in experiment plot than control plot. Owing to these causes production of base crop decreased in the experiment plot while nourish treatment was same to the both plots. Though some portion of land in the experimental plot could not be planted as it was occupied by the pillar of solar panel, so it is natural that total production of experimental plot would less than the control plot. Therefore, total production of base crop (rice) in the experiment plot decrease only 4.79%. But experiment plot produces secondary crop, 127 Bottle Guard, as extra production where control plot produce only rice (Table 7). It would be a good practice for more production to meet the food demand.

Table 7: Yield comparison between experiment and control plot

Component	Experimental Plot	Control Plot	% Increase or Decrease
Yield/10 Decimal (Weight in m. ton)	0.146	0.153	4.79
Yield/Decimal (Weight in m. ton)	0.0146	0.0153	4.79
Yield/ha (Weight in m. ton)	3.57	3.741	4.79
Total bundle of paddy	301	310	3
Total weight of paddy tree (in m. ton)	0.274	0.295	7
No. Bottle Guard	127	—	

4.2.8 Cost Benefit Analysis

Total cost for the installation of a solar operated irrigation system was \$22201.56 only. Of the cost, deep tube well boring was \$4687.5; solar panel, DC pump, fitting etc. was \$16125 and panel holding was \$1150 only. In addition to installation cost as a fixed cost variable cost, \$4250 per year, for operation and maintenance was also calculated. For income, saving cost for fuel (diesel or electricity), irrigation charge, value of base crop (rice) and cucurbit vegetable (Bottle Guard) was calculated. We assumed the economic project life is 25 years and the salvage value is 10% of the total investment. We assumed here the lower discount rate is 15%. The detailed financial and economic analyses sheet the projects with income and expenditure was calculated. The study finding of financial value of NPV was \$58437.5. The value was > 0 so the project would be acceptable and should be pursued. In addition to this the Financial value of BCR was 2.26, which is >1 so the project is acceptable and should be pursued. Furthermore the Financial value of IRR was 32%.

Table 8: Overall summary cost of installation of a solar operated irrigation system

Item	Cost (USD)
Deep tube well boring	6887.5
Solar panel (6480Wp) with submersible DC pump including controller module, sensor, connecting cable, fitting and fixing	16125
Panel holding frame with bamboo pole fitting and fixing	1150
Total	24162.5

4.3 Cooperative Based Multi-storied Rural Housing “Palli Janapad” (RDA Proposed)

The main difficulties of the community bio-gas sub-project sites are to accumulate, transport, handle and manage the total amount of waste produced in a village community. RDA's experience on opportunities of using renewable energy (biogas and solar power) in irrigation, water lifting, load shedding. Besides every year about 1% of our agricultural land is being decreased for housing and other urbanization activities and the percentage of organic materials of our farming land is decreasing day by day that stands less than 1% but the standard is 5%.

Addressing the discussed issues a model of Community Based Multi-storied Rural Housing will be constructed to accumulate total of 288 farm families in a common tower with all modern urban amenities (piped water supply, biogas connection, biogas and solar based electricity, best solid waste management). If such numbers of families construct their house in agriculture land, a huge amount of crop field will be lost for housing as well as approach road. The flat owners have the scope of rearing 500 cows and 16126 poultry birds. The total generated wastes (human excreta, cow dung, poultry drop and kitchen waste) of 3.8512 million tons/year are used to generate bio-gas, supplied to the individual household for cooking and a portion is used to produce electricity for ensuring water supply. The decomposed waste will be converted to organic manure (Palli Joibo Sar) and yearly produced 145152 m³ of bio-gas. A good amount (Two ton) of organic manure will be produced daily of market price \$59312.5 per year. In the roof top of Palli Janapad

50kW of electric power will be produced using solar energy. During the time of load shedding every flat owner will be enjoyed three light and one fan facilities. The solar power will be used for lifting water and domestic supply to reduce the extra thrust on national grid. The dwellers will be trained on income generating activities (IGAs) get flexible loan, security for their economic improvement.

4.3.1 Facilities and Benefits of Cooperative Based Rural Housing (Palli Janapad)

The following utility facilities will be ensured if someone live in Community Based Rural Housing (Palli Janapad) and secured the following amount (Matin *et.al.* 2013)

- Rehabilitating 288 households into a multi-storied building of 1.52ha saves 7.81ha of land.
- Developed modern facilities of rearing 500 cows and 16126 poultry birds with drying yard and storage facilities for grains.
- Scope of handling waste (accumulating all drops, cow dung and excreta in gravity flow) become easier and produce bio-gas and organic manure, finally converted waste as value.
- Total generated waste of 3.8512 million tons/year will be received from a single point by gravity flow, that can produce biogas of 145152 m³/yr and two tons of organic fertilizer daily of market value \$59312.5/year.
- The study revealed that 57.56% of the respondents have plan for building new house. On an average 0.03ha agricultural land per household is going to be turned into homestead area. This proposed project will restore 7.81ha. of land from being converted to homestead area very soon.
- Installation of the community bio-gas plant will save annual fuel cost of \$102000 and minimize the carbon emission as well
- Connecting metal road construction cost of about \$1.36 million at per LGED rate on 6.55ha. of land will be saved by constructing a single metal road of \$5000 on 0.24ha. of land.
- Saves 6.15 km of overhead electric cable line.
- Comparison of construction cost building using Ferro-cement/EPS technology with PWD rate schedule revealed that it was about 30% less than traditional one.

5. Conclusion & Recommendations

Community based biogas is more suitable to organize in a comprehensive manner of community participation which creates new opportunities for waste management with energy, organic fertilizer, economic benefits as well as friendly environment.

Bangladesh as a sub-tropical country is suitable place for the generation of solar power. The country receives sunlight, solar radiation as well as solar intensity more or less same throughout the year. Although, the installment cost of solar systems is very much high, but once installed it can give service up to 20-25 years with proper maintenance.

Integrated introduction of bio-gas and solar energy in a model building of Palli Janapad change the livelihood and income of the rural people as well as the scenario of rural Bangladesh.

1. Community biogas technology might be one of the best ways for meeting up energy crisis in Bangladesh.
2. Community based organic manure production & utilization is very much effective for soil health improvement and quality crop production.
3. In the northern territories of Bangladesh where the solar intensity is very high, solar thermal power plant can be installed for both photovoltaic and solar thermal technology, Bangladesh is a perfect location.
4. RDA developed Community based Biogas Plant (CBP) and Two-storied Agriculture with Solar Irrigation System found as the best options to be replicated at each village of Bangladesh for sustainable technology as a means of socio economic change in rural livelihood.
5. The success of Green Building of RDA (Palli Janapad) will be a Model building for better waste management, restoration of agricultural land and optimal use of renewable energy for rural Bangladesh and similar countries over the globe.

To explore the technology as well as make more profitable to the country following measures would be taken

- To know the better result it needs further study and wide replication of the mentioned model.
- Before implementing to the farmer level it needs to consider the installment cost; it will be better for community base implementation and give subsidy or credit.
- To minimize the installation cost, it may require further study.

It will be better to develop multiple use of solar power with the irrigation practice and for this it requires further study.

6. Observation

To minimized the problems on renewable energy sector in Bangladesh for continuous quick extension, popularization and replication of RDA's experience at the field level and as well as development of new technologist in this connection Board of Governors (BoG) 41st Meeting of RDA approved Renewable Energy Research Center in 2012 under the administrative control of RDA.

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Women's Empowerment through Seed Business under WISE project

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Abstract

The study was conducted to investigate the role of seed business and related factors in promoting empowerment among women under WISE project in Shariakandi and Shajahanpur upazila of Bogra district, Mithapukur upazila of Rangpur district and Raninagar upazila of Noagong district. Data were collected from 100 rural women involved in WISE project through direct interviews using structured questionnaires. A combination of criteria was modeled using Multiple Linear Regression, revealing that, for all criteria, the women involved in seed business exhibited greater empowerment than women not involved in seed business. Through Seed business rural women were able to increase their confidence and decision-making power with regard to their household and personal care and experienced increased self-esteem, expansion of their social circles, and ultimately enhanced empowerment through the breakdown of traditional socio-cultural norms. Thus, the expansion of seed business under WISE project in other rural areas of Bangladesh is likely to contribute to the empowerment of more rural women.

Key Word: Seed business, WISE project, women's empowerment index

Introduction

Rural women in Bangladesh are highly involved in agricultural activities, but their roles are undervalued in formal statistics and are usually overlooked by formal research and extension system. They are excluded from the marketplaces and their male counterparts deal with all economic transactions. Rural women have always been the caretakers and primary source of good seed. They contribute significantly to the improvement of local seed system in Bangladesh and in South Asian Countries. Women play a vital role in the production and preservation of seed. For instance, they process through which high quality seed are produced requires careful handling. However, even this critical job is considered as marginal and support function and men continue to dominate the seed sector. To transition into entrepreneurial roles, these women require resources, market access and a shift in perception.

Use of poor quality seed often results in low productivity and low income for the farmers in Bangladesh. The formal seed sector provides only about 20% (MoA, 2015) of the seed requirement for rice and vegetable farming; the rest of the requirement are usually met by the seed retained by the farmers from previous crop cycles; for example, grains in case of rice. To address this situation South Asia Enterprise Development Facility (SEDF) undertook an initiative through the Women in Seed Entrepreneurship (WISE) component of the AGRI-SEEDS project.

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The interventions are designed to converting crop growing farmers into seed growing farmers and placing them in the formal seed supply chain by linking them with seed dealers and retailers. WISE project was implemented through the Rural Development Academy (RDA), Bogra. In WISE, women farmers along with their husbands were trained in the best practices regarding seed production, preservation and marketing. A total of 6000 women farmers were trained during SEDF (2010-2014). WISE initiative relates to IFC South Asia's strategic focus on inclusion of marginalized population in private sector development. The intervention has been a pioneer in developing rural farm household women into seed entrepreneurs, empowering them both financially and socially along with promoting gender balance.

Women's empowerment is one of the significant issues for upholding status of rural women in Bangladesh. Women's empowerment involves improving decision-making, control over income, awareness about personal rights and freedom, improving position in the family, and in general the confidence of rural women in their capabilities. In Bangladesh, rural women are largely deprived of autonomy as their lives are controlled by male governance in the patriarchal society. Due to long-standing traditions in rural Bangladesh society regarding the role of women, a husband will commonly seek to limit the autonomy of his wife in all regards and will not show affection or respect, in contrast to standards in many western cultures. Following the marriage, a woman enters her husband's house and immediately takes on responsibility for all household work. Her most important duty, however, is to bare a male child. These women are not at liberty to express opinions in front of their husbands or to make their own decisions and instead must obey any rules dictated by their husband or members of the husband's family. Rebellion against the mandates of the husband can result in physical and mental and even threats of divorce. This oppression is a common experience for every woman in the traditional rural Bangladesh society and highlights the importance of fostering women's empowerment to remove gender inequality both within the family unit and in society. Because rural Bangladesh society seeks to suppress even female independent thought, if these women will successfully escape the patriarchal society, they must first be taught and encouraged in building a strong independent mindset. Only by establishing a new standard of personal independence will these women gain confidence in their own capacity for governing their lives and thereby develop the strength to stand strong in the face of subsequent oppression. Additionally, gender equality and empowerment of women are vital to achieve sustainable improvement in the rural society (Afzal et al., 2009). Shefner-Rogers et al. (2009) stated that women's empowerment is the construction of a route to foster women's ability to be self-reliant and to improve internal power. Promoting the participation of rural women in income generating activities is one important route toward encouraging independence and facilitating empowerment. Indeed, more recently, the situation within rural societies in Bangladesh is changing, due to increasing involvement of rural women in economic activities, which can foster the development of increased self-confidence, self-motivation, personal and economic mobility, decision-making ability, and general autonomy.

Through their participation in income agricultural activities like seed business, rural women are able to transcend traditional barriers and have the potential to escape oppression such as domestic violence that limits their empowerment. Currently, seed business is considered one of the best ways for these rural women to utilize their limited resources and to develop skills that will contribute to their empowerment.

Objective

Objective of the present study was

- to quantify the empowerment of rural women under WISE project who are involved in seed business
- to identify key factors affecting their empowerment

Review of Literature

A widely-accepted definition of women's empowerment remains intangible given the popularity and wide use of the term in academic and general sectors. However, discussions of women's empowerment often place emphasis on decision-making roles, economic self-reliance, legal rights to equal treatment, education, and inheritance, and protection against discrimination. Reasonably so, then, women's empowerment has been described as a process through which women gain authority in previously restricted areas of their lives (Kishor & Gupta, 2004; Haque et al., 2011) and whereby women direct their lives with the purpose of changing inferior status (Keller & Mbewewe, 1991).

Women's empowerment may also be generally defined as an ongoing process where in a woman acquires the ability to define and successfully pursue personal objectives (Kabeer, 1999). Page and Czuba (1999) similarly defined empowerment as a multi-dimensional process that helps people gain control over their own lives (see also Sen, 1999; Malhotra, 2003) and also fosters empowerment in communities and society.

According to Kishore and Lekha (2008) empowerment entails a woman's increased control over her life, body, and external environment, while Charmus and Wieringa (2003) note that it is a process that encompasses the development of consciousness, choice, resources, voice, agency, and participation. Hashemi and Schuler (1993) identified a number of domains in which women have traditionally been stripped of autonomy, such as physical mobility, financial security, and freedom in social interactions, thus as Batiwala (1994) highlighted, women's empowerment must encompass a direct challenge of institutions of power (e.g. family, media) and power structures (e.g. legal, economic) toward the goal of gaining autonomy. Similarly, Mujahid et al. (2015) highlighted the importance of economic and social equality for women's empowerment in Pakistan. Economic empowerment is fostered by decreases in poverty, access to credit programs, and lucrative work while social empowerment encompasses education, health care access, and other social opportunities. Workshops and media campaigns can further encourage rural women to break away from traditional views. Within Bangladeshi society, empowered women possess freedom for self-development and decision-making and equal access to domestic and community resources (Kumar et al., 2013). Nazneen et al. (2011) examined women's empowerment in post-independence Bangladesh and noted improvements in female education, treatment in health facilities, and participation in the labor force. However, due to traditional patriarchal attitudes, social and financial inequalities still prevail among men and women. Similarly, Haque et al. (2011) used three dimensions to define women's empowerment index and found that economic and family decision-making authority is satisfactory while mobility is very low, and negative social views about female autonomy are still prevalent.

Islam et al. (2014) examined the impact of microcredit on women's empowerment in rural Bangladesh, defining empowerment with the dimensions of economic and household

decision-making, mobility, property ownership, and social awareness. Their results showed that the microcredit program was positively associated with each dimension of women's empowerment and overall empowerment. Sultana and Hossen (2013) also investigated the role of employment in women's empowerment in Khulna, Bangladesh and found that employed women were more empowered than the unemployed, with age, educational access, and household income also having a significantly positive effect on women empowerment. Islam et al. (2012) also identified that homestead poultry rearing among rural women in Bangladesh promotes empowerment by encouraging independent decision-making and increased involvement in family affairs. Based on this collection of previous research, we identified two factors that are important to consider in the measurement of women's empowerment. First, empowerment is not directly measurable and must be quantified.

Methodology

Location

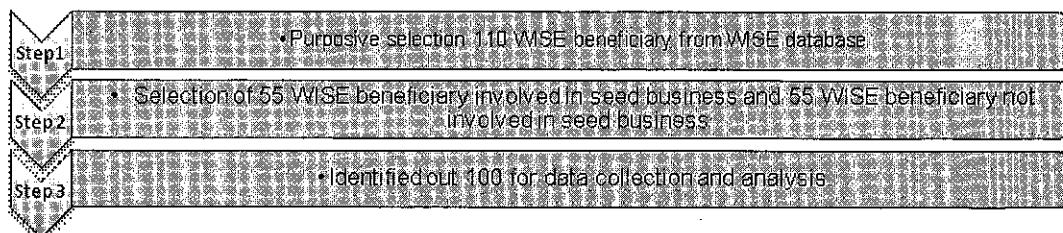
The study was conducted in Sariakandi and Sajahanpur of Bogra district, Mithakupuk upazila of Rangpur district and Raninagor upazila of Noagoan district where WISE project was implemented at the beginning.

Sample Size and Sampling Procedure

All the WISE beneficiary of Bogra, Noagoan and Rangpur district was population of the study. Among them a total 100 WISE beneficiary was the sample of the study which was selected purposively. 50 women who are involved in seed business and 50 who are not involved in seed business was the respondent of this study.

Data Collection

Data used in the study were collected from the primary source through face to face interview with a structured questionnaire. For qualitative data collection and data validation 4 FGDs were conducted in each upazila.



Construction of a Women's Empowerment Index

In this study, women's empowerment was quantified by making a women's empowerment index using the dimensions in accordance with Malhotra (2011), and Mahmud et al. (2012). The dimensions used are: decision-making, economic empowerment, social empowerment, Legal empowerment and psychological empowerment. Each dimension further contains several indicators which have been identified according to Hashemi et al. (1996), Schuler et al. (2010), and Islam et al. (2012). Figure-I represents these different dimensions with their relevant indicators for

the construction of the women's empowerment index. Questionnaire responses were based on a four point Likert-scale (1=not at all, 2= to some extent, 3= to an average extent and 4= to a great extent). In order to standardize the results and generate a scale with minimum and maximum levels of empowerment, the score for each dimension was assigned a maximum value of 1 for the highest empowerment and minimum value of 0 for lowest empowerment. Thus the standardized scale ranges from four to one.

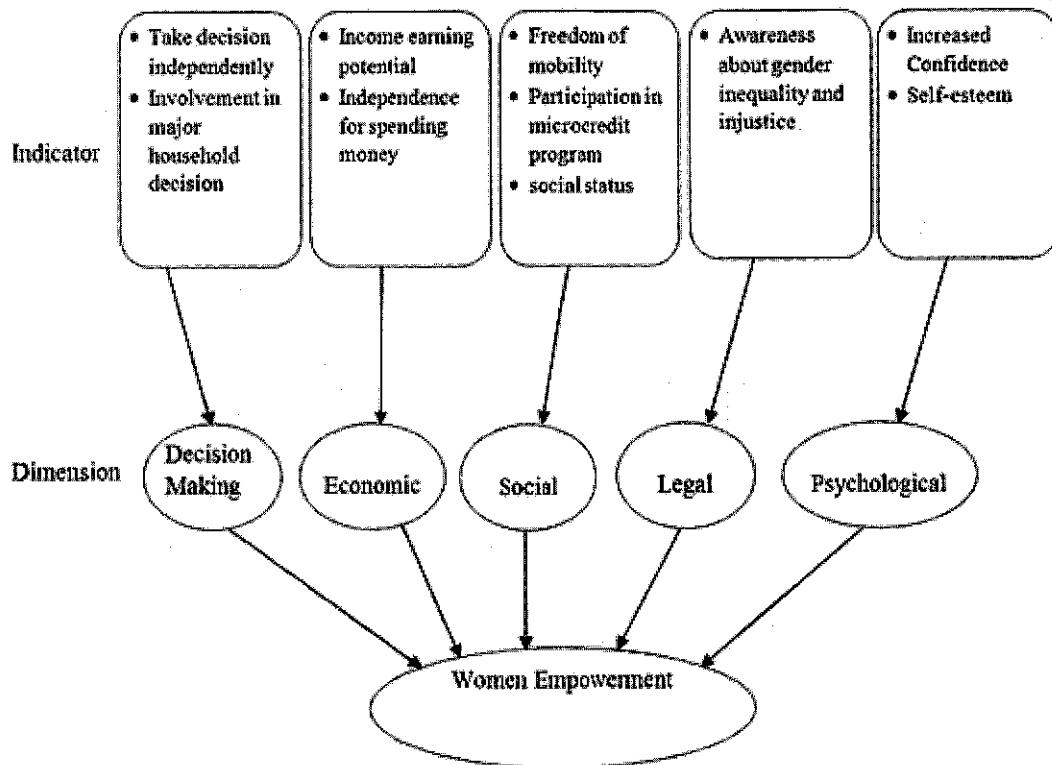


Figure 1. Conceptual framework of the women's empowerment index employed in this study, including dimensions and indicators

Decision Making Index

Two indicators have been used for the dimension of decision making. Empowerment in decision making is represented by the following formula

$$\text{Decision-making index } I_1 = \frac{x_1 + x_2}{2} = \left(\sum_{i=1}^2 X_i \right) / 2 \quad \dots \dots \dots (1)$$

$$\text{And for standardization } I_1 = 0 < \frac{\left(\sum_{i=1}^2 X_i \right) / 2 - 1}{3} < 1$$

Where, X1 represents independent decision-making and X2 represents the involvement in major household decisions.

Economic Empowerment Index

Two indicators have been used for the dimension of economic empowerment. Economic empowerment of women is represented by the following formula:

And for standardization, $I_2 = 0 < \frac{(\sum_{i=1}^2 X_i)/2 - 1}{3} < 1$

Where, X1 represents income earning potential and X2 represents autonomy of choice over how income is spent.

Social Empowerment Index

Three indicators have been used for the dimension of social empowerment. Social empowerment of women is represented by the following formula:

And for standardization, $I_3 = 0 < \frac{(\sum_{i=1}^3 X_i)/3 - 1}{3} < 1$

Where, X1 represents a woman's freedom of mobility, X2 represents her participation in a microcredit program, and X3 represents a woman's social status.

Legal Empowerment Index

One indicator has been used for the dimension of legal empowerment. Legal empowerment of women is represented by the following formula:

$$\text{Legal empowerment, } I_4 = \frac{x_1}{1} = \left(\sum_{i=1}^1 X_i \right) \quad \dots \quad (4)$$

And for standardization, $I_4 = 0 < \frac{(\sum_{i=1}^1 X_i)/1 - 1}{3} < 1$

Where, X1 represents the awareness raised about injustices suffered and women's corresponding legal rights.

Psychological Empowerment Index

Two indicators have been used for the dimension of psychological empowerment. Psychological empowerment of women is represented by the following formula:

And for standardization, $I_5 = 0 < \frac{(\sum_{i=1}^2 X_i)/2 - 1}{3} < 1$

Where, X1 represents increases gained in confidence and X2 represents level of self-respect.

Overall Women's Empowerment Index

The overall women's empowerment index was calculated with the following formula:

Where, I1-I5 represent the standardized levels of empowerment as classified in Decision-making, Economic empowerment, Social empowerment, Legal empowerment, and Psychological empowerment, respectively.

Factors Affecting Women's Empowerment through Seed Business

Specification of the Variables

The variables that may affect women's empowerment through seed business are: the husband's behavior, successful reduction of the dependency of rural women, increase knowledge and skill, and breakdown of traditional socio-cultural norms, and types of dairy animal breed (see below).

Explanation of the Variables

Seed Business

This variable was defined by using the following designations: 1= Get training but currently not involved in seed Business and 2 = Involved in Seed Business.

Husbands' Treatment of their Wives

This variable was measured by using a 3-point Likert scale with the following designations: 3 = good, 2 = moderate and 1= bad

Breakdown of Traditional Socio-Cultural Norms

This variable was further broken down into two categories, namely reduction in domestic violence and reduction in prevalence of early marriage. These variables were measured using a five point Likert scale ranging from 5 = strongly agree to 1 = strongly disagree.

Increase in Knowledge and Skill

This variable was assigned 1= yes (increase in knowledge and skill) and 0 = no

Reducing Dependency of Rural Women

This variable was assigned 1 = yes (reduction in dependency) and 0 = no

The Model

The following multiple linear regression model was used to estimate the effect of the above independent variables on the dependent variable, women's empowerment:

Where, Y = women's empowerment index, $X1$ = husband's behavior, $X2$ = breakdown of traditional socio-cultural norms, $X3$ = increase in knowledge and skill and $X4$ = reducing dependency, $\beta_1, \beta_2, \beta_3$, and β_4 are the corresponding coefficients, and e_i is the error term.

Data Analysis

Data were analyzed using SPSS program and a multiple linear regression model was used to measure the effects of the different independent variables on women's empowerment. Results were considered at 1%, 5%, and 10% significance levels.

Results and Discussion

Selected Characteristics of the Rural Women

The general characteristics of the respondents were selected for the present study included age, level of education, farm size and family annual income, Knowledge on seed production, training exposure, extension contact, organizational participation and decision making role adoption of seed business have been presented in Table 1

Table 1: General characteristics of WISE beneficiary

Sl. No.	Characteristics	Measuring Unit	Possible range	Observed range	Mean	Standard deviation
1.	Age	Actual years	Unknown	18-50	34.21	6.10
2.	Level of Education	Years of schooling	Unknown	0-12	3.03	3.46
3.	Farm Size	Hectare	Unknown	0.02-1.75	0.49	0.40
4.	Family Annual Income	In Tk.1000	Unknown	10.50-181.50	62.08	34.28
5.	Knowledge on seed production	Score	0-30	12-26	19.85	3.82
6.	Training Exposure	Score	Unknown	6-18	6.93	3.10
7.	Extension Contact	Score	0-40	3-18	9.79	2.83
8.	Organizational Participation	Score	Unknown	0-12	3.86	3.46
9.	Decision Making Role	Score	0-30	4-30	12.95	5.86

The average age of the respondent was 34.21 years, observed range 18-50 years with standard deviation 6.10 and average education level 3.03, observed range 0-12 years with standard deviation 3.46. The average farm size 0.49 hectare, observed range 0.02- 1.75 hectare with a standard deviation 0.40 and average annual income 62.08 thousand taka, observed range 10.50-181.50 taka with standard deviation 34.28. Observed range on Knowledge of seed production was 12-26 with average 19.85 and standard deviation 3.82. The training exposure average score was 6.93 with observed range 6-18 and standard deviation 3.10. The average score of decision making 12.95 with an observed range 4-30 and standard deviation 5.86.

Women Empowerment Indicators

In this study, several empowerment indicators have been used to measure the level of empowerment among women living and working on agricultural farms who are involved in seed business and who are not involved in seed business in WISE (Women in Seed Entrepreneurship)

project. Regarding the different empowerment indicators, the percent distributions of all women's responses are shown in Table 2.

Table 2. Percent distribution of respondent women's response on empowerment indicators

Women empowerment indicators	Involved in seed business				Not Involved in seed business			
	To a great extent (%)	To an average extent (%)	To some extent (%)	Not at all (%)	To a great extent (%)	To an average extent (%)	To some extent (%)	Not at all (%)
Independent decision	53	24	7	20	15	41	25	19
Major household decision	34	30	17	22	13	29	31	27
Income earning potential	37	22	26	20	0	23	52	25
Independence in spending money	27	35	18	24	16	27	24	33
Freedom of mobility	23	40	35	3	11	21	32	36
Participation in microcredit	25	46	21	8	8	31	52	9
Social status	21	37	35	7	12	22	55	11
Injustice and legal right	26	38	17	19	18	33	29	20
Confidence	44	22	18	16	19	27	28	26
Self-esteem	33	23	28	16	13	35	26	26

In general, higher scores for most variables were observed for women involved in seed business indicating that the women's empowerment was higher in women engage in seed business than of the women not involved in seed business.

Result of Measuring Women Empowerment Index

A women's empowerment index was been used in this study to measure women's empowerment in the case of women involved in seed business and the women who are not involved in seed business under WISE project. The fitted women's empowerment index of both cases is shown in the figure 2, conforming the higher empowerment index for the women involved in seed business than the women are not involved in seed business. Entrepreneurs' women are much more benefitted and empowered than the general women under seed business. The decision making, economic and psychological dimensions indices were vary also more important for entrepreneur women than the general women.

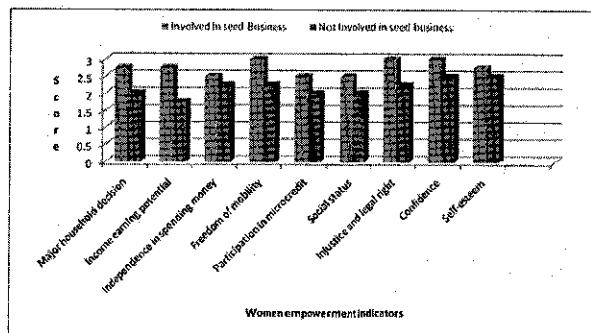


Figure 2: Empowerment indicators of women involved in seed business

Decision Making Index

Independence or autonomy refers to the freedom for expression of a women's personal preference, a freedom of choice when presented with many alternatives, the successful improvement of self-worth, and eventual achievement of target future goals. The higher a level of women's independence, the greater the potential for her to be empowered (Panda, 2000.) Freedom of decision making play a substantial role in corresponding quality of life for women, and here we used two indicators to quality the dimension of decision making: i). the power of taking independent decisions and ii). The extent of involvement in major household decision. By comparing these factor between two categories of women involved in seed business (0.64) and not involved in seed business (0.45). The women involved in seed business have more power to make independent decision and work freely than the women not involved in seed business.

Historically the lives of rural women have been dominated by a patriarchal social system and upon marriage, typically a women is expected to obey all the rules mended by her husband, is prohibited from making independent decisions, and has no right to challenge her husband authority. All decision regarding activities within and outside of the household are made solely by male members (Mujahid et. al., 2015). During childhood, women are dependent on male family members and not educated or taught self-dependency. Upon marriage, bearing child and in particular a son becomes a prime responsibilities for these women, along with household duties such as cooking for family members.

However women's sense of self and self determination has increased. Through this research it was found that rural women involved in seed business served significant decision making roles in family affairs, including decisions about their own health and their children health. In particular, in the face of sickness, pregnancy or related health matter the women involved in seed business were (To a great extent) able to choose independently to visit a hospital or health clinic. Women were also allowed to make decision regarding the health and general care of their children, such as choosing to vaccination their newborns, making nutritious food choices and opting to seek better treatment for their sick children. The women involved in seed business also exhibited increased expression of personal preference and had the freedom to make good daily food and nutritional choices for their family and had authority in deciding seed production, post harvest operation, storage and seed marketing etc. The women were also involved in major family decision making on issue related to family members, the marriage of their son or daughter, household repairs and large purchases. In contrast, women not involved in seed business had few decision making rights within the family because they had little autonomy and power. Ultimately, the increased decision making power exhibited by the women not involved in seed business is representative of significant progress toward the achievement of gender balance in their society.

(Different women's empowerment dimension index scores, where the empowerment index score ranges between 0 and 1).

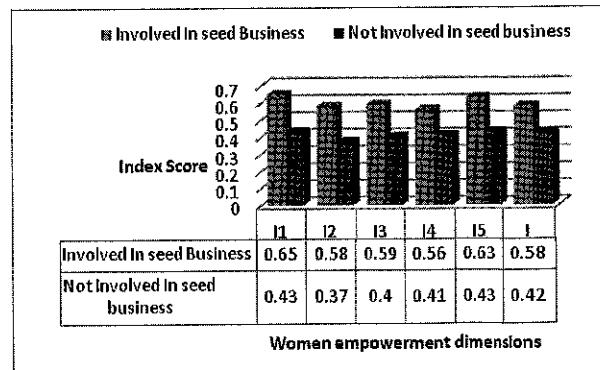


Figure: Women empowerment index of the women involved in seed business and not involved in seed business

Economic Empowerment Index

Economic empowerment is another significant dimension of women's empowerment and research has suggested that economic empowerment of women enhance through their participation in economic activities (Parveen and Chowdhury, 2009). Rural women involved in income generating activities experiences greater empowerment rather who are not engaged in any economic activity (Nessa et. al., 2012). From the results gathered in this study, the economic empowerment index was found to be higher for the women involved in seed business (0.56) than the women not involved in seed business (0.38). The women involved in seed business earned much more money from seed business. The economic decisions the women make in seed business also foster independence with regard to making other expenditures for their family, on items such as clothing medicine. In contrast, women not involved in seed business did not have such financial autonomy in financial decisions surrounding their family and family member and did not exhibit the same economic success like the women involved in seed business.

Social Empowerment Index

Social empowerment is the process of accessing opportunities and resources in order to make personal choices. Poor rural women are socially empowered through the improvement of their practical knowledge, self-perception and physical mobility and this process served to remove social barriers and obstacles. Social empowerment among the women involved in seed business and the women not involved in seed business was quantified by considering three indicators: mobility, participation in microcredit programme and social status. Figure 3 show that the social empowerment was determined to be higher in case the women involved in seed business (0.54) than the women not involved in seed business (0.41). Indeed, women who were involved in seed business exhibited greater freedom of mobility than the women not involved seed business and were able to leave their home and visit market, health care centre or the house of a neighbor or relatives without permission from their husband or other elder member of their family. Following their engagement in seed business the women were able to extend their social network and mobility, increase communication with those outside their family and develop further independency. In this study it a ground that many women who was not involved in seed business still require permission for going outside of their home and their mobility is restricted. Women in both cases also participate in microcredit program, where they can interact with other women and exchange knowledge, skills, and experiences. Research evidence has previously demonstrated that microcredit programs can improve the productivity and development of income-generating activities (Alhassan & Akudugu, 2012), thus the women who partake in these programs they are more socially empowered than their peers who do not partake (Awojobi, 2014). Involvement in the microcredit program did expand the social network for their business engagement and enhance their social status and social recognition. However, for the women not involved in seed business also participation in the microcredit program but did not lead to the same social empowerment.

Legal Empowerment Index

Following the above trend, the legal empowerment index was also found to be higher in seed entrepreneur women (0.55) than general women (0.42). Since becoming involved with seed business, the women are now more conscious of their legal rights. Through the process of earning money and using this income for family, the women acquired bargaining skills and could express their differing opinions and disagree with their husband or other family members. Banu et al. (2001) have shown that rural women, who involved in Bangladesh Rural Advancement

Committee's Program, are able to acquire more knowledge of property rights and other legal issues such as lawful marriage age, dowries, and divorce. For example, some women learned that it is illegal for their husbands to remarry without the first wife's consent. In contrast, many women who are not involved in seed business are less conscious about their legal rights and powerless to seek them.

Psychological Empowerment Index

Psychological empowerment is vital for the development of poor rural women in Bangladesh. The results revealed that women involved in seed business have much more experiences which increase their confidence level and this has helped to enhance their efficiency and productivity. Level of self-respect is another important indicator for psychological empowerment, and in compare general WISE beneficiary with entrepreneur women exhibited an increase in self-respect and enhanced status in their family after becoming involved in seed business. In case of the general WISE beneficiary, the patriarchal social system is still strong and the women are dependent on their family, have limited self-confidence, and are less inclined to take initiative. Including the psychological empowerment index with the others above, we find overall that the empowerment index in Entrepreneur women (0.58) is higher than General WISE beneficiary who were not involved in seed business (0.42).

Factors Affecting Rural Women's Empowerment through Seed Business

Table 3. Descriptive statistics of the empowerment indicators

Variables with category		Involved in seed business			Not Involved in seed business			
		Frequency	Percent	Mean	Frequency	Percent	Mean	
Husband's behavior	Good	33	66	2.63	12	24	1.44	
	Moderate	9	18		17	34		
	Bad	8	16		21	42		
Breakdown of traditional socio-cultural norms	Reduce violence	Strongly agree	23	46	4.3	0	0	2.53
		Agree	15	30		6	12	
		Undecided	1	2		13	26	
		Disagree	11	22		27	54	
		Strongly disagree	0	0		3	6	
	Reduce early marriage	Strongly agree	30	60	4.67	3	6	1.96
		Agree	15	30		5	10	
		Undecided	4	8		6	12	
		Disagree	1	2		23	46	
		Strongly disagree	0	0		10	20	
Increase in knowledge and skill	Yes	37	74	0.74	18	36	0.35	
	No	13	26		32	64		
Reduce dependency	Yes	32	64	0.64	35	70	0.27	
	No	18	36		15	30		

A multiple linear regression model was used to estimate the effects of different factors on women's empowerment through seed business under WISE project. Table 3 presents the descriptive statistics of independent variables which were used for analysis. The results of multiple linear regression analysis are shown in Table 4. Involvement in seed business was considered in this model as an important determinant for women empowerment. Women entrepreneur earning more money from seed business through they are more empowered.

Table 4. Results of factors affecting women's empowerment under WISE project

Predictors	Standardized Coefficient(Beta)		Sig.	
	Involved in seed business	Not Involved in seed business	Involved in seed business	Not Involved in seed business
Constant			0.000	0.713
Husband's behavior	0.297 (4.534)	0.210 (1.473)	0.000***	0.237
Breakdown of traditional socio-cultural norms	0.276 (4.480)	0.181(1.278)	0.000***	0.251
Increase in knowledge and skill	0.193(2.971)	0.158(1.169)	0.005***	0.248
Reduce dependency	0169 (2.176)	0.095 (0.695)	0.035**	0.490
R ²	0.913	0.121		
Adjusted R ²	0.833	0.044		

Dependent variable: Y (women's empowerment index)

Note 1) *** indicates significance at 1% level, ** indicates significance at 5% level and * indicates significance at 10% level and t values are in parenthesis

In case of seed entrepreneur women their husband's behavior was found statistically significant in women's empowerment (Table 4). In rural areas of Bangladesh, traditionally husbands do not allow their wives to participate in family or major household decisions. Rural women married to especially patriarchal and controlling husbands have been constrained in pursuing empowerment (Schuler et al., 2010). More recently, however, traditional ways of thinking are changing among seed entrepreneur women. For example, women involved in seed business now have the right to spend the family income and make decisions independent of permission from their husband or other male members of the family. Similar social progress is stalled case of the women who are not involved in seed business have little influence in personal and household matters. Women receive little respect from their husbands and the family-in-law may even consider the wife and her children as expense burdens on the husband, contributing to family conflict. It was observed from Table 3, with the majority of the respondents (66% involved in seed business) reporting good behavior from their husbands while a higher percentage of respondents (60% from who were not involved in seed business) reported bad behavior from their husbands. Particularly women's involvement in seed business is fostering a desire for independence. Their husbands are supportive of these efforts, recognizing the financial support the women can bring to the family. Therefore, rural women are being empowered through seed business and able to redefine their position in their family. The husbands' supportive behavior towards their wives is therefore an important factor for women's empowerment in case seed entrepreneur women. Research evidence has also previously reported that when women are allowed to start and run their own business, their status in the family improves considerably (Islam et al., 2012).

The breakdown of traditional socio-cultural norms was observed to be another important factor contributing to the greater empowerment of women in case of seed entrepreneur women (Table 4). Before beginning seed business, the primary role of these women was as housewives and they had no independence. According to Parveen and Leonhauser (2004), the most common forms of domestic violence against women at the hands of their husband or family include physical abuse, threats of divorce from the husband, unwillingness from the husband to provide family support,

and mental abuse. All these can have a serious negative consequence on women's health and quality of life and prevent empowerment. Since participating in income-generating activities such as seed business, however, these women play a more active role in family finances and acquire some bargaining power within their family, thus diminishing the prior gender inequality and providing some protection against domestic violence. In the women involved in seed business the majority of the respondents (46%) strongly agreed that violence against them have been reduced (Table 3). The women were also able to increase their mobility, develop more interpersonal interactions, and through exposure to the media (via television), are made more aware of illegal treatment at the hands of their husbands and may seek to demand their rights. Another consequence of women's involvement in seed business is the increased awareness of education and in particular the importance of educating girls from young age. Previously, early marriages were a predominant factor preventing the education of young girls and stalling any empowerment process (Hossain, 2011).

Additionally, early marriages could often lead to early motherhood and various health risks to mother and child. The prevalence of early marriage has now begun to decrease as education level has increased, leading also to improved health among young women. Additionally, previously it was a common perception that sons were more valuable than daughters and was more capable of supporting the family and caring for parents in old age (Parveen & Leonhauser, 2004). Women might suffer abuse at the hands of their husbands for bearing a female child, and would be coerced to continue to carry children until successfully bearing a son. Women now have more control over the number of children and pregnancies they have, which has led to an overall improvement in the health of the entrepreneur women. This social and cultural progress has not been made in case of the women who are not involved in seed business, where early marriages and repeated pregnancies are still common and gender discrimination is still prevalent. In case general WISE beneficiary (not involved in seed business) the majority of the respondents (54%) disagreed that early marriage was reduced (Table 3). Overall women under WISE project experienced an increase in knowledge and skill through training and seed business (Table 3). It was observed that 74% of the respondents increased their knowledge, skill and capability through seed business (Table 3). As also shown in Table 3, the income earned through seed business has reduced the dependency of entrepreneur women as general women who not involved in seed business, as the seed entrepreneur women no longer need the same financial support from their husbands. It was observed that 64% women who are involved in seed business reduced their dependency and the women who are not involved in seed business, lowest percentage of the respondents (26%) reduced dependency (Table 3). Indeed, research evidence has shown that if Bangladeshi women are gainfully employed outside the household, their contributions to the household are not only more visible but their economic dependence on their husbands is decreased (Kamal et al., 1992). The women also have more freedom to make decisions, go to the market, and make purchases without approval, as research evidence has shown previously for Bangladeshi women (Banu et al., 2001).

Conclusions

From this study, It was observed that seed business helps in increasing empowerment among women under WISE project. Rural women who are involved in seed business are more empowered than general member (who are not involved in seed business) with regard to decision-making, in achieving economic, social, and legal rights, and are experiencing more general psychological growth. The greatest factors influencing this empowerment among entrepreneur women were the

support from the husband, the successful breakdown of traditional cultural norms, the ability to increase knowledge and skill. While these factors were not as significant for the general beneficiary who are not involved in seed business. A positive correlation was observed between seed business and the above factors. Overall, we find empirically that the entrepreneur women of WISE project are more empowered seed business than the general beneficiary. These findings have important implications for the potential substantive role in other rural areas of Bangladesh. By encouraging and promoting seed business in additional rural communities, gender inequality may be further diminished and correspondingly more women may be empowered. Such economic activity has the potential to reduce the prevalence of early marriages, decrease spousal abuse, and foster the development of new practical knowledge, skills, and confidence, thus making an important contribution to the improved female status in families and society.

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Evaluation of Capacity Development Course for Local Government Support Project: a Qualitative Study

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Abstract

Local Government Division of the Government of Bangladesh undertook the Local Governance Support Project (LGSP) with support of UNDP. The project focused on strengthening of the lowest tier of local governance, Union Parishad. Objectives of this study were to evaluate implementation of a capacity building course for the personnel concerned with LGSP. The parameters included implementation of the course by the resource persons, document and assess the views of the course participants and note and analyse the opinion of the villagers about the course. The study described and analysed outcome and quality of capacity development course for LGSP in two sub-districts using qualitative method. Findings, mainly, delineate that participation of women and civil society members, as resource persons, were low, although course organisers and resource persons expressed satisfaction over the level of attendance. Participants viewed that the information which they gathered from the training could be more relevant with their activities at the Union Parishad, though all the topics mentioned in training module were discussed. The study found, not only local people's participation but also the clear articulation of their perspectives and ideas at higher levels of the policy planning echelon was crucial for improving access of disadvantaged population. As in many low income countries, villagers' voice often remain unheard and the citizenry was simply too weak to exert any influence. LGSP, at its current manifestation, is therefore not sufficiently accountable to the citizenry. The tasks of course organization and co-ordination should be more widely distributed among government officers and civil society members. For wider dissemination and acceptability of the learning and practice of the course, it should address some more cross-cutting issues like: gender, health, education, and like. Course participants should remain at their places of posting for a considerable period of time after receiving training.

1. Background

Local Government Support Project (LGSP) owes its origin to Sirajganj Local Government Development Fund Project (SLGDFP) that was in operation during 2001 to 2006. SLGDFP was undertaken by the Local Government Division (LGD) of the Government of Bangladesh (GoB) with the financial and technical support of United Nations Development Programme (UNDP) in Bangladesh. SLGDFP was, in fact, an action research project with locations in all 82 Union Parishads (UPs – lowest tier of local government institution) of nine Upazilas (UZs - sub-district) of Sirajganj district. The focus of the Project was strengthening of Union Parishads (UPs) as institutions to enable it deliver goods and services to the people. The basis of the capacity

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development was greater amount of fund, greater degree of autonomy and putting the elements of governance in place. The major elements of governance included here were: participation, transparency, accountability, predictability and others. The governance aspects were manifested in organising participatory planning, holding open budget sessions, writing of UP plan/fund outlay, and budget, etc. and hosting those in the form of bill-boards, sign-boards, following of Public Procurement Rules (PPR) for hiring goods and services, and others (GoB, April 2012, and GHK, Dhaka, February 2004).

With the success of SLGDFP as an action research project, it was replicated gradually throughout the country. During 2006 to 2011 period, it was named Local Government Support Project (LGSP) that also included Learning Innovation Components (LIC). LIC was aimed at creating a competitive atmosphere among the participating UPs. LIC meant more fund for more successful UPs. Currently, LGSP II is in operation for the duration of 2011 to 2016.

Capacity development forms an important element of LGSP II. Three specialised institutions – Rural Development Academy (RDA), Bogra, Bangladesh Academy for Rural Development (BARD) and National Institute of Local Government (NILG) - were assigned to undertake training of trainers (ToT) that included Upazila level government officers and members of the civil society at the Upazila level. At the completion of the course, RDA like other institutions, made follow-up visits to the respective Upazila headquarters to evaluate the quality of the course offered at the Upazila level. The current paper describes and analyses outcome of a quality evaluation capacity development for LGSP organised by URT in four UPs at two Upazilas, vis-a-vis the qualitative views of the people at the grassroots level.

2. Sirajganj Local Government Development Fund Project (SLGDFP)

Towards strengthening the institution of local governance system in Bangladesh, the national government initiated the Sirajganj Local Government Development Fund Project (SLGDFP) on an experimental basis with the technical and financial support of United Nations Development Programme (UNDP), Bangladesh, in the district of Sirajganj in 2001. The main components of SLGDFP were (Open Budget Session for Madhainagar Union Parishad (2012-2013):

- Formulation and adaptation of development projects at Union Parishad(UP) level through people's participation;
- Direct allotment of the development fund to UP level with greater autonomy to utilise the fund following the minimal guidelines(fund allocation by the government directly to the UPs in a designated Bank Account of UPs to be jointly operated by the UP Chair, a Woman Member and the Secretary);
- Increased flow of fund than before;
- Put elements of good governance (e.g. transparency, accountability, participation, predictability, etc.) in place while administering development works under LGSP; and
- Taken the factors above together, strengthen the institutional basis of UP to enabling it be providing better service delivery to all stakeholders, especially the community people;
- Support for the formulation, selection and implementation of local community schemes; and
- Analyse, documentation and dissemination of lessons learned to key stakeholders including at Upazila, local/national (e.g., Local Government Division - LGD) and international development partners' (UNDP, UNCDF, etc.) levels.

For ensuring governance in place, participation in project planning and implementation at the Union Parishad (UP) and Ward was put in place at SLGDFP (Table – 1). It was, in fact, a pilot project (an action research project). It was envisaged that if successful, this pilot project will be replicated throughout Bangladesh phase wise. SLGDFP continued till 2006 in 9 Upazilas consisting of 82 Union Parishads of Sirajganj district under the auspices of Local Government Division of the Government of Bangladesh (GoB) with technical and financial support of United Nations Development Programme (UNDP), Bangladesh. The direct and implied results of SLGDFP upon infrastructure and service delivery were commendable. The outcome of the project has shown what can be achieved in Bangladesh using innovative mechanisms which empower local government institutions. This can serve to inform and influence wider GoB policy. It was foreseen in a study that wider replications, however, will require an understanding of the policy context and of the difficulties and barriers to the more effective implementation of the SLGDFP approach (Open Budget Session of Madhainagar, 2012-2013).

Following the success of the project it was replicated throughout the country phase wise, under the nomenclature of Local Governance Support Project (LGSP) and Learning and Innovation Components (LIC), a second generation progression of the project. LGSP was in operation from 2006 to 2011 with fund outlay of Taka 14210 million. The major contributors to LGSP were UNDP, WB, UNCDF, EU and DANIDA besides the host country Bangladesh (LGSP-II, 2012). The Union Parishads (UPs) to enjoy the benefits of LGSP were selected on a number of criteria, set by the Project and as suggested by the concerned Upazila Nirbahi Officer (UNO) from among the UPs of a given Upazila. The elements of this criterion included: clean audit report, appreciable income generation (including collection of holding tax), open budget session, participatory development planning and application for LGSP fund by the Union Parishad (UP), among others. The entrants to LGSP were selected from a ranking of UPs on the set criteria and preliminary determined by the UNO. The process of selection was gradual throughout the country on the ranking of UPs vis-à-vis the available fund allocation.

Table 1: Committees established under SLGDP

	Union Development Committee	Ward Development Committee	Scheme Supervision Committee
Composition	20 persons, 13 Union Parishad Chair and members. 1 school headmaster, 1 block supervisor, 3 women representatives of NGOs, 1 co-operative members, 1 family health worker.	7 persons: Union Parishad Member (Chair), Union Parishad Female Member for Ward (Deputy Chair), 2 Respectable Persons in Village, Primary School Teacher, NGO Group Member, Female Member of VDP/Social Worker.	7 persons 3 Male beneficiaries, 2 Female beneficiaries, 2 respectable persons in scheme area
Responsibilities	Overall management of the SLGDP process, Final Scheme selection, Support for the Union Parishad.	Participatory planning, Financial management of Scheme implementation, Scheme monitoring.	Supervision of scheme implementation, Informing local people of progress.
Comments	Representatives selected by the organisations they represent.	Responsibilities now incorporate those of former Scheme Implementation and Maintenance Committees.	A temporary committee formed for the duration of scheme implementation.

Source: Local Governance and Service Delivery to the Poor: Bangladesh Case Study, p.26.

To bring about a competitive atmosphere among the UPs, the system of Learning Innovation Component (LIC) was introduced. LIC consisted of larger amount than LGSP. It required a relatively high position in ranking for a competing UP within a given Upazila. LIC was introduced in six districts of the country: Sirajganj, Hobiganj, Satkhira, Feni, Boroguna and Narsingdhi (Open Budget Session 2012-2013). The tenure of LGSP – II followed the success of LGSP and its period is determined to be years 2011 to 2016. The total outlay for LGSP- II is Taka 39118 Million (nearly). Of the total fund 53% is the contribution of World Bank (WB) and the rest is by GoB.

3. Local Governance Support Project (LGSP) –II

LGSP – II is in operation with the financial support of GoB and WB. The aim of the project is capacity development of UPs to provide improved service to the door-steps of the people through transparency and accountability (governance). LGSP – II has been formulated based on the experience gained in the LGSP (LGSP – II Training Manual, pp. 3 - 12).

Basic Characteristics of LGSP- II

- Provide financial support to UPs through Basic Block Grant (BBG) and Performance Based Grant (PBG);
- Basic criteria of Union Parishads (UPs) for receiving PBG and BBG:
 - UP audit report without any objection,
 - Participatory planning,
- Open budget session; besides these three elements, the UPs have also to strictly follow environment policies;
- In addition to the fund allocation under BBG, UPs will get fund allocation under PBG beginning financial year 2012 – 2013. To availing of the fund allocation under PBG, UPs have to prove excellence in certain respects like: improved financial management, transparency and accountability and more local resources mobilisation;
- Towards increasing their efficiency, UPs will be provided with required training at respective Upazila (UZ) headquarters by initially a Upazila Resource Team (URT);
- At a later stage, UPs will receive training from pre-qualified institutions as required;
- LGSP-II has put stressed on gender parity. Gender parity will be ensured in criteria like: decision making, plan formulation and implementation. Awareness building ventures will be taken at UZ level through Women's Forum.

Components of LGSP - II

1. UP Grants:

BBG and PBG;

2. Flow of information and accountability;
3. Organisational development (efficiency);
4. Project management.

Capacity Development of UP Chairmen and Members for LGSP - II

For capacity development (training) of the UP Chairmen and Members, the grassroots implementers of LGSP – II nationwide, an MoU was signed between the service providers or the training institutes, viz., Rural Development Academy (RDA), Bangladesh Academy for Rural Development (BARD), National Institute of Local Government (NILG) with the Local Government Division (LGD) of the Government on 20 December 2011(MoU 2011).The capacity building course was planned and implemented in a stratified manner, as envisaged in the MoU. At the apex of the stratum, 150 Master Trainers (MTs) along with 140 DDLGs (Deputy Director Local Government) and DFs (District Facilitators) were trained by the three training institutes. MTs and the three training institutes trained the Members of Upazila Resource Team (URT) for the concerned areas. URT consists of ten members: five UZ level government officers and rest five were a mix of local resource persons (college/school teachers, retired government officers, civil society members, etc.). These three training institutes, according to the Section 11 of the MoU: a. carried out an independent evaluation of the training programme and would submit the report to LGSP authority, b. would provide support to monitor the quality of training for UP functionaries provided by URTs. RDA as its share of the contract provided training to URT Members and undertook monitoring and evaluation programme for the training provided by the relevant URT Members.

Training of Trainers (ToT) for the Upazila Resource Team (URT) of LGSP at Rural Development Academy, Bogra (RDA)

1. Duration of the Training Course: 5 working days for each batch; from 8 July 2012 to 31 January 2013;
2. Total number of batches: 35, total number of participants: 1273, male: 1192 (93.64%) and female: 81 (6.36%), composition of participants: Upazila level government officers: 819 (64.34%), Upazila level civil society members: 454 (34.66%); the Upazila Nirbahi Officer (UNO) of a Upazila was the Team Leader of a URT of a Upazila;
3. Participants of the ToT Course for the URT Members came from the administrative divisions of: Rajshahi and Rangpur and the districts of Kushtia, Chuadanga and Meherpur of Khulna (Training Division, RDA 2013).

Scope of the study: The study focused on the following issues and problematic:

- a) Immediate quality and effectiveness of the LGSP training courses, as perceived by the course participants on, mainly, some pre-set indicators;
- b) Views of the course organisers; and
- c) Villagers' general opinion on the working in studied UPs (within the Upazilas).

Objectives: The major objectives of the study were:

- i) To evaluate the imparting and implementation of LGSP training by the URT (Upazila Resource Team) members at the UZ level;
- ii) To document and assess the views of the course participants about the usefulness of the training received; and
- iii) To note and analyse the opinion of villagers about LGSP generally.

4. Methodology:

a) **Study design:** This was a population and facility based exploratory study. Qualitative methods were utilised following the behavioural change theories and ecological model with some modification (Ahmed et. al, 2010). Ecological model was mainly used for data collection, especially at the inception stage of any kind of intervention (Ahmed et. al, 2010). Following this model data was collected at i) Organization level, ii) Community level, iii) Individual level, iv) Interpersonal level and v) Policy level to identify the major factors in behavioural determination:

- » Environmental characteristic
- » Personal characteristic
- » Behavioural characteristic

In this study to fulfil the objectives data was collected for first three levels instead of five levels. The data was described in to three thematic areas. These are: i) views of URT team leaders and members about existing LGSP training course, ii) views of representative of UP about the existing LGSP training course, iii) community perception from the villagers.

b) **Selection of the study area:** To evaluate the LGSP training course, researchers used a stratified sampling method. Firstly, one district (Rajshahi) was selected randomly. Subsequently, two Upazilas: Puthia and Godagari were selected purposively as it was easy to communicate for the researchers. It should be noted here that each Upazila covers multiple number of unions and each union is divided into nine wards. Researchers had planned to collect information from two unions of each Upazila where LGSP course was completed relatively in the recent past or just before data collection period. Union Parishads were Jewpara and Shilmariya from PuthiaUpazila. From Godagari Upazila, Godagari Sadar and Mohanpur Union Parishads were selected.

c) **Study population:** The study primarily targeted two URT team leaders from two Upazilas, two URT members (one of them from Upazila level government officers and the other a member of civil society, who received ToT on LGSP from RDA), representatives of UP and common villagers. UP representatives included Chairman, Secretary, one female member of reserved seat and other two general members of UP. Tables:1 and 2 depict study population:

Table 2: Number of UNOs and team Members

Sl No	Name of Upazila	Team Leader (UNO)	Team Members		Total
			Govt. Officials	Member of Civil Society	
01.	Godagari	01	01	01	03
02.	Puthia	01	01	01	03
Grand Total		02	02	02	06

Table 3: Number of Union Parishad Members

Si. No	Name of Union Parishad	Category of Union Parishad Members				Total
		Chairman	Secretary	Members	Female Members of reserved seats	
01.	Godagari	01	01	02	01	05
02.	Mohonpur	01	01	02	01	05
03.	Shilmariya	01	01	02	01	05
04.	Jewpara	01	01	02	01	05
Grand Total		04	04	08	04	20

- d) Data collection procedure:** Based on the pre-tested check-list, data collection tools were finalized. Separate tools for URT team leaders, URT members, representative of Union Parishad and villagers were used. Data were recorded after the respondents had consented. One public administration specialist and an anthropologist were responsible for the data collection and analysis. Data was collected during May-June 2013. In-depth interview, four Focus Group Discussions (FGDs) with 6 – 8 persons, informal discussions continued until the saturation of data. Document reviewed included course guide line, completed speakers' evaluation form, project profile of LGSP, MoU signed between RDA and GoB, course related official documents and other available research-evaluation materials.
- e) Quality control:** Principal investigator (Public Administration) and co-investigator (Anthropologist) was involved in data collection. Inconsistencies in transcription were reviewed, scrutinized under close supervision of the principal investigator.
- f) Analysis:** Ecological model was followed for data analysis. At first, collected data were grouped under three broad sectors. Those were: i) Organization level, ii) Individual level and iii) Community level. Then data were coded line by line manually. Content analysis techniques were followed for thematic data compilation.
- g) Ethical approval:** This study has been undertaken as per the provision set in the MoU signed between RDA and LGD (Ref. Clause 10). RDA senior faculty members approved the study protocol. Verbal informed consent was obtained from all the respondents before interview. Respondents were ensured about the confidentiality and had the freedom to quit from the interview at any point in time.
- h) Limitations:** The respondents for evaluating LGSP training course were selected in an organized way. However, the place of discussion with the respondents i e., villagers could be better. For example, researchers could do better if they had talked to the villagers in their own setting i. e., in the village location. In a couple of cases researchers had to talk to them in the UP offices or at the courtyards. In such situations, it was later realised, their expressions were less free-flowing than could be otherwise.

5. Major Findings

The current paper describes and analyses outcome of a monitoring and evaluation tour of URT organised courses in four UPs vis-a-vis the qualitative views of the stakeholders, particularly at the grassroots level. The findings section is divided into different themes, which were explored from the data of a) Organization level, b) Individual level, c) Community level. It needs to be mentioned here that the data provided the information on perception of community people and some information through document review during the data collection period May-June 2013.

- a) Organization level: Researchers collected organizational level information of LGSP training course from two Upazila Parishads (Upazila Council). Respondents were two URT team leaders and six URT members. URT team leaders were Upazila Nirbahi Officers (UNO). The URT members included one government officer and one member from civil society from each Upazila (Table – 2).

Study found that five batches of LGSP training course (two batches in Puthiya and three were in Godagari) were completed. Five training batches consisted of 115 numbers of trainees. Only 25 (22%) of them were female participants. This happened because of the fact that only one-third of the UP members were female. From the review of the concerned documents, it was found that among the trainers only four (18.18%) were from members of civil society out of a total of 22 trainers. Rest of the 18 resource persons/trainers were Government officers. This gender disparity clearly depicts the dominant trend of highly limited access for female to socio-economic arena and dominant social value system (Nasreen et. al., 2006). All those trainers received ToT from RDA except one in Puthiya.

In one Upazila, it was found that some of the Resource Persons employed in this Training Course did not receive training at RDA. That was due to the fact that these officers got transferred elsewhere and the UNO did not replace them with an acceptable resource person.

Generally, UNOs were the course directors and other government officers were the course co-coordinators. None of any members of civil society were involved in coordinating the training course. A negligible involvement of members of civil society and number of female as participants and as trainers was noticeable from data.

Views of URT team leaders and Members

- i. Views of URT team leaders: URT team leaders (UNOs) provided the researchers with necessary documents to evaluate LGSP capacity development course and skill of speakers by the trainees. They also mentioned the ToT at RDA was useful for them to organize LGSP training course. Team leaders expressed satisfaction about competence of government officers as resource persons (trainers) over members of civil society. Team leaders were satisfied about their presentation of subject matter but mentioned about stumpy use of training materials (board, power point, projectors, posters etc.) by the trainers of both categories. None of any team leaders mentioned about the weakness of training course rather they thought training was successful with satisfactory level of participation of representatives of UPs. This could have been sweeping and subjective remarks, as they were the Corse Directors.

ii. Views of URT members: Views of URT team members differed little from team leaders. Some of them were not fully satisfied about the level of participation of representatives of UPs. They were not happy about relevancy of the training content with the UP activities of the participants. Like the team leaders, URT members also found ToT at RDA helpful for them. URT members identified some weaknesses of the LGSP training courses and offered some suggestion to improve over it. Those were in the main:

- » Village physical infrastructural improvement, women's health and empowerment, education, income generating activities (IGA) related topic may be incorporated into the course contents;
- » Practical, hands-on sessions, post training evaluation of the trainees may be included in training module;
- » Follow up of activities of trainees after receiving of LGSP training may improve the quality of training course; and
- » Training course may continue for more than five days to twenty days.

Views of UP representatives

b) Individual level: To gather information on capacity development course from representatives of UP, researchers interviewed them at individual level (one-to-one basis). The data of four UP representatives revealed their opinion on total course management, expectation and suggestions for improvement of LGSP course. Those are portrayed below:

- i. Views on presentation by the facilitator: Majority of the respondents expressed their satisfaction on competence of the facilitators. Facilitators tried to maintain the relevancy of the discussion with the topic but mode of their expression and style of clarification needed to be improved. They expected the training methods to be little more updated. Use of modern training equipments could increase attraction of deliberations of the resource persons at the course even further. LGSP training provided updated information but scope of group discussion or activities during the training course had remained limited that did not make them fully satisfied.
- ii. Level of expectations: In response to a question by the researchers, representatives of UP members mentioned the training course did not fulfil their level of expectations. The information which they gathered from the training was not that much relevant with their activities at the UP, though all the topics mentioned in training manual were discussed. Some of the UP representatives thought that if the training could continue for more than five days then it would possibly fulfil their expectations better.
- iii. Overall environment and logistics support: Respondents thought that course management needed to be more concerned on sufficiency of ventilation and lighting, comfortable sitting arrangement in the training room besides ensuring better sound system and usefulness of other training equipments (projectors, posters, etc. e.g.). The course organisers could even take better care of sensitive items like: food supply and its quality. All in all, very few of them were fully satisfied on total course management.

Community voice and LGSP

Community level: LGSP encouraged community participation and empowerment of the community people so that UP personnel remain accountable to them. Participation, particularly at grassroots level (i.e., at any given area, like: Upazila, Union Parishad, Ward, Village, etc.) is a multi-faceted concept. It may include elements like conceptualization and formulation of plan (following construction of basic vision, mission, goals, targets, timeframe, periodic review and reformulation, etc.), breaking down the plan into divisible components, i.e., need-based project formulation, implementation, monitoring and evaluation and profit/benefit sharing.

Community participation is also a measure that facilitates accountability. Accountability is the, “capacity and will of those who set and, crucially, implement a society’s rules— including the executive at different levels and public officials – to respond to citizens’ demands” (ODI 2007, p.2, See also O’Neil et al. 2010 and Campbell and Graham 2006). Accountability involves measures to ensure that the person or organization with the authority to provide a service actually delivers that service to the best of their ability (O’Neil et al. 2010).

Basic components of LGSP highlights, as mentioned above, characteristics like: governance (transparency, accountability, participation, predictability, etc.), autonomy for UP, greater amount of fund for UP, strengthening of institutional base of UP, and such others. These elements in deed strengthen the process of development at community level. There is evidence that community participation in relation to development project contributes to positive outcomes (ODI 2007, Goetz et al. 2003, Malena 2004). Indeed, Newell’s analysis of successful projects where community participation was a key factor strongly influenced the development of the concept of different project (Newell 2011).

The study suggests, not only people’s local participation but also the clear articulation of their perspectives and ideas at higher levels of the policy planning echelon was crucial for improving access of disadvantaged population. However, as in many low income countries, villagers’ voices of four Union Parishad often remain unheard and the citizenry was simply too weak to exert any influence. LGSP is therefore not sufficiently accountable to its citizens. In accordance to LGSP policy it demonstrates that they should have delivered what it was agreed and that they would deliver based on community demand. It is also important that community members can enforce a response and to use sanctions if services are inadequately provided (DFID2007, DFID 2006). In this study, data revealed that community people were not aware of much of the activities related to LGSP. They were even not informed about development activities taking place in their area. Exceptions could be found only in case of those who had connections with political persons. However, the nature of political patron-client relationships often determined the process of fund allocation for a development project, its implementation, monitoring and evaluation.

6. Conclusion and Recommendations:

The study was carried out in Jewpara and Shilmariya Godagari Sadar and Mohanpur Union Parishads. The study findings represent in-depth scenarios of that particular areas and it might differ with other places or regions. Based on the key findings of the study, following issues should be considered:

- The tasks of course organization and co-ordination should be more widely distributed among government officers and civil society members, besides the UNOs.

- For wider dissemination and acceptability of the learning and practice, the course should address the issues of greater gender parity.
- Provisions should be made for keeping the person in their place of posting for a considerable period of time after their return with receiving training from RDA (or elsewhere). This would ensure better utilization of investment made on them and better result thereof.
- It was apparent from the comments of the UNOs that they were somewhat inclined towards highlighting the performance of government officials. So they made more attempts for capacity development of the civil society members. Because, ideally, a collaborative effort of these two groups of resource persons can enhance the effectiveness of the training at UP level.
- To address the views like limited use of proper training equipments, techniques and such other training related matters, LGSP authority or URT can organise review meetings. It can also seek the help of RDA and other specialized institutions.
- LGSP authority should also think of considering the views of the course participants of the grass roots and review the course design with possible inclusion of some of the suggested topics.

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Changing Pattern of Rural Livelihoods in Bangladesh: An Impact Study on the Hatikumrul–Bonpara Highway in Chalan Beel

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Abstract

The study examined how the Hatikumrul–Bonpara Highway had impacts on rural livelihoods of Chalan Beel. The main theoretical concept of the study was Sustainable Livelihood Framework (SLF) that how a development work influenced on rural livelihoods in terms of enhancing people's capacity, accessing to livelihood assets and undertaking livelihood strategies. The study areas were four selected villages from the core of Chalan Beel area in three adjacent districts i.e. Pabna, Sirajgonj and Natore. Two villages out of four are situated beside the highway and the rest of two are more than five kilometres away from it. Primarily the method of data collection was face-to-face questionnaire interview. Apart from the 200 core respondents of the study area, data were also collected from local leaders and influential persons. Though it was found from the study that the highway had a clear impact on their livelihoods, the people lived in the adjacent villages bagged more benefits from the highway compared to the people who lived in the distant villages. Different asset pentagons of study areas were drawn for comparing how the patterns of the five livelihood assets (i.e. natural, physical, human, financial and social) were changed after the construction of the highway. The respondents earned more opportunity to utilise and access to all assets except natural capital. Furthermore, the respondents of the adjacent villages obtained more benefits from human capital than the respondents of the distant villages. Moreover, influence of the highway on two livelihood strategies i.e. crop intensification and livelihood diversification was increased, though it had no significant impact on migration pattern of the study area. Finally, the study concludes that the government should take appropriate initiatives for how local people can take maximum benefits from development works in terms of enhancing their livelihoods through proper uses of all livelihood assets to increase their skills and knowledge.

Key Words: : *infrastructural development, rural livelihoods, asset pentagon, Chalan Beel.*

1. Background of the study

The study examined whether and how Hatikumrul–Bonpara Highway had impacts on rural livelihood of the people of Chalan Beel. This chapter is broadly divided into three sections. The first section concentrates the background of the study in order to reviewing the three inter-linked issues. Therefore, it justifies why this study is important to aid in reducing the knowledge gap and finally discusses the plan of the report.

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Wetlands in Bangladesh are an integral part of the life of rural people. Some of these wetland-dependent socio-economic activities are the only means of livelihood for a large group of people. Besides, about 60 percent of rural people are directly dependent on agriculture for their livelihoods and many others indirectly depend on agriculture inputs and crop marketing activities in wetland areas. Number of development interventions e.g. construction embankments, dams, hydraulic structures, road, etc. have been undertaken since 1960s for country's economic development particularly for increased agriculture production and improved road communication. These have both positive and negative impacts (BCAS, 2006). The livelihoods of the people of the Chalan Beel, the largest wetland of the country, is changing after the construction of the Hatikumrul–Bonpara Highway though the main purpose of the road was to offer direct and time-saving link between Dhaka and some western districts of the country. However, there is no study conducted to measure how the highway influences on people's livelihoods. Thus, the present study encompassed three inter-related issues – sustainable rural livelihoods, development intervention (e.g. the Hatikumrul–Bonpara Highway) and wetlands (e.g. Chalan Beel).

1.1 Sustainable rural livelihoods

The concept of sustainable rural livelihoods encompasses the goal and strategies of poverty alleviation through socioeconomic development in such a manner so that an individual or a household can cope with adverse events. In the light of Vision 2021, the Government of Bangladesh has recently approved Seventh Five Year Plan (2016-2020) to eradicate poverty through ensuring sustainable livelihoods, particularly for the rural poor of the country (GoB, 2015).

The 'Sustainable Livelihoods Approach' (SLA) concept and framework adopted by the Department for International Development (DFID) in the late 1990s (building on work by IDS, IISD, Oxfam and others) (Figure 1), have been adapted by different organisations to suit a variety of contexts, issues, priorities and applications (Eldis, 2002).

As one of UNDP's five corporate mandates, sustainable livelihood offers both a conceptual and programming framework for poverty reduction in a sustainable manner. Conceptually, 'livelihoods' denotes the means, activities, entitlements and assets by which people make a living. The sustainability of livelihoods becomes a function of how men and women utilise asset portfolios on both a short and long-term basis.

The definition used by DFID is: "A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not understanding the natural resource base" (Chambers and Conway, 1992).

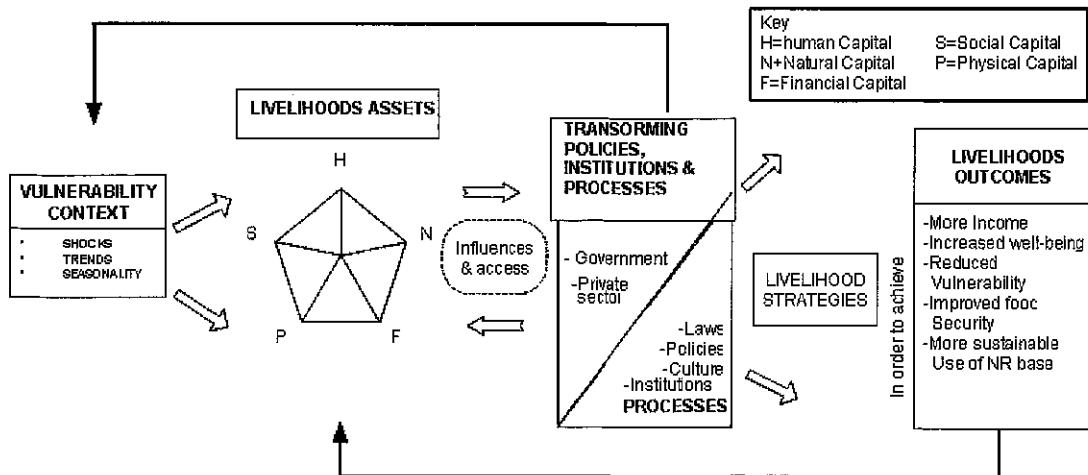


Figure 1: Sustainable Livelihood Framework (SLF)

(Source: DFID, 2001)

At the micro level, a livelihood can be considered as the “assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household”. Because rural households typically cannot obtain sufficient food and income from farming alone, they develop and depend on a diverse ‘portfolio’ of activities and income sources, nurturing the social networks of kin and community that enable such diversity to be secured and sustained. In addition, access to safe drinking water, sanitation, health and nutrition services, safe housing and easy communication systems are also vital components of livelihoods. Diversification of food and income sources requires a relatively complex network of social relations to buttress them. Diversification is the “creation of diversity as an ongoing social and economic process, reflecting factors of both pressure and opportunity that cause families to adopt increasingly intricate and diverse livelihoods strategies” (Ellis, 2000:14).

At the heart of the SRF lies an analysis of the five different types of assets upon which individuals build their livelihoods. The approach also relies on an analysis of the vulnerability context in which assets exist (the trends, shocks and local cultural practices that affect livelihoods). It also aims to develop an understanding of the structures (government organisations and private sector) and processes (policies, laws, cultures, etc.), which define people’s livelihood options. The livelihood approach suggests a longer-term commitment to target groups/areas (Zurayk and Haidar, 2004). However, the section includes two further sub-sections as the study mainly concentrated on livelihood assets and strategies.

Livelihood assets

People and their access to assets are at the heart of livelihood approaches. In the original DFID framework, five categories of assets or capitals are identified, although subsequent adaptations have added others, such as political capital (power and capacity to influence decisions). Table 1 describes the original five categories of livelihood assets.

Table 1: Category of livelihood assets

<i>Human capital</i>	skills, knowledge, health and ability to work
<i>Social capital</i>	social resources, including informal networks, membership of formalised groups and relationships of trust that facilitate co-operation
<i>Natural capital</i>	natural resources such as land, soil, water, forests and fisheries
<i>Physical capital</i>	basic infrastructure, such as roads, water & sanitation, schools, ICT; and production equipment
<i>Financial capital</i>	financial resources including savings, credit, and income from employment, trade and remittances

(Source: DFID, 2001)

Assets can be created or destroyed as a result of the trends, shocks and seasonal changes in the vulnerability context within which people live. Policies, institutions and processes can have a great influence on access to assets - creating them, determining access, and influencing rates of asset accumulation. Those with more assets are more likely to have greater livelihood options with which to pursue their goals and reduce poverty (Eldis, 2011a).

Livelihood strategies

Livelihood strategies are the combination of activities that people choose to undertake in order to achieve their livelihood goals. They include productive activities, investment strategies and reproductive choices. Livelihood approaches try to understand the strategies pursued and the factors behind people's decisions; to reinforce the positive aspects of these strategies and mitigate against constraints.

The choice of strategies is a dynamic process in which people combine activities to meet their changing needs. For example, in farming households, activities are not necessarily confined to agriculture but often include non-farm activities in order to diversify income and meet household needs. Migration, whether seasonal or permanent, is one common livelihood strategy. A major influence on people's choice of livelihood strategies is their access to assets and the policies, institutions and processes that affect their ability to use these assets to achieve positive livelihood outcomes (Eldis, 2011b).

1.2 The Hatikumrul–Bonpara Highway

The Hatikumrul–Bonpara Highway, the only toll paid road in Bangladesh crossing through the Chalan Beel. The highway has directly connected Rajshahi, Natore and Nawabganj district with Dhaka along with the eastern region of Bangladesh. The highway was jointly financed by the Government of Bangladesh and the World Bank under the RRMP-III. The total length of the highway is 55 kilometres. The main carriage way, width is 7.30 metres, is used for the high speed and heavy vehicles e.g. bus, truck, microbus, car, etc. On the other hand, the slow traffic lane,

width is 4.00 metres, is used for low speed and light vehicles like cycle, rickshaw, van, motorcycle, votivoti/ mosimon (engine-made rickshaw van), etc. The vehicles of the main carriage way have to pay the highway toll. But the vehicles of the slow traffic lane, usually carrying local people and goods within or surrounding villages of the highway, pay nothing. The total numbers of culverts and bridges in the highway are 86 and 12 respectively. The date of commencement of the highway is December, 1998 and the date of completion is December, 2002. The highway has saved at least an hour and 50 kilometres when someone goes to Rajshahi via Natore from Dhaka (RHD, 2002).

1.3 Chalan Beel

Chalan Beel is the largest wetland of Bangladesh, marshy in character, with rich flora and fauna. Forty-seven rivers and other waterways flow into the area, fast in silting up. In the past it covered an area of about 1,085 km² but was reduced to 368 km² in 1909. In the 1950s, various reclamation works reduced the beel to about 25.9 whereas, in 1987, it appeared completely dry except for some small human-made ponds.

The wetland extends over four adjacent districts, Rajshahi, Pabna, Sirajganj and Natore. It lies between Singra upazila (Natore district) and the north bank of the river Gumani. The southeastern extremity of the Beel is at Astamanisha in Pabna district, close to Nunnagar, where the Gumani and the Baral meet. The greatest breadth of the beel is about 13 km from Tarash at the northeast to Narayanpur, near the north bank of the Gumani. Its greatest length is about 24 km from Singra to Kachikata on the Gumani.

Chalan Beel was formed when the Old Brahmaputra diverted its water into the new channel of the Jamuna. Chalan Beel was probably a back swamp before it was greatly expanded with the inclusion of abandoned courses of the Karatoya and the Atrai and became a vast lake. The formation of the Chalan Beel is historically linked with demise of the Atrai and the Baral. The Atrai or the Gur was the principal feeder channel of Chalan Beel, which used to drain the districts of Dinajpur and Nawgaon. The Baral worked as an outlet of the Beel and eventually found its way into the Jamuna.

Land in Chalan Beel is being reclaimed and new villages are springing up alongside. The outlying marginal lands are cultivated with Boro and HYV (High Yielding Variety) rice in the dry season. In the wet season, the shallow peripheries are cultivated for deep-water Aman rice and jute (Banglapedia, 2016).

2. Aim and objectives of the study

The main aim of the study was to find out the impact of the 'Hatikumrul-Bonpara Highway' on livelihoods of the rural people of Chalan Beel. Besides, the study may support policy-makers of the government and development partners as how they can plan for large developmental work considering local level livelihoods. Keeping the aim in view the objectives of the study were set as follows:

- To assess the livelihood capitals of the study area;
- To determine the livelihood strategies of the study area; and
- To compare and analyse the impact of the highway on rural livelihood among the selected villages.

3. Research methodology

3.1 Study area

The study was conducted in four villages of the central part of the Chalan Beel. Two villages (Doribamon and Dobila) are situated beside the highway and other two (Shikarpur and Hasupur) are at least 5 kilometres away from the highway. Table 2 shows the location of the four study villages.

Table 2: Location of the study villages

Village	Union	Upazila	District	Location
Shikarpur	Moshinda	Gurudaspur	Natore	5 kilometers away from the highway
Dobila	Naogaon	Tarash	Sirajgonj	Beside the highway
Doribamon	Moshinda	Gurudaspur	Natore	Beside the highway
Hasupur	Handial	Chatmohar	Pabna	6 kilometers away from the highway

3.2 Selection of the respondents

A total of 50 respondents were selected from each study village. Besides, concerned UP Chairmen and Members were interviewed to seek their views on certain selected areas where they were involved. In addition, reports and other relevant records were consulted to get secondary data in the relevant areas of the study.

3.3 Methods of data collection

In order to have information relevant to the objectives of the study, a structured questionnaire was used for face-to-face interview. The concerned four UP Chairmen and four Ward Members were also interviewed as key informants. The data were collected by the research investigators of RDA with direct supervision of the researchers.

3.4 Data processing and analysis

It was decided to employ both iterative and fixed quantitative analysis when analyzing the data. The data analysis process was started during the data collection period. In this case, data were collected, coded, conceptually organised, interrelated, analysed and evaluated in the field. The researchers scrutinised the collected data thoroughly, and sometimes met with research colleagues to discuss their findings, compare notes, check consistency, conduct data analysis and draw conclusions before continuing with further data collection. Data analysis was also conducted after data collection.

4. Results and discussion

As the study analyses two separate but interlinked issues – livelihood assets and strategies of the people of Chalan Beel, this chapter is divided into two sections.

4.1 Livelihood assets

The study focused on how the highway had an impact on livelihood assets of the people of Chalan Beel. Here the respondents of the study were asked about their different selected components of five livelihood assets before and after the highway. Then different asset pentagons were made using a common scale for each capital.

Figure 2 presents the asset pentagons of the four selected villages before and after the highway. It is shown from all pentagons that all assets except natural capital of the respondents were increased after the highway. Firstly, in case of Shikarpur village, their capitals i.e. social, human, physical and financial capitals were increased by 67.81%, 22.77%, 80.88% and 51.02% respectively whereas natural capital was decreased by 11.39%. Secondly, the four capitals of the respondents of Doribamon village were increased by 77.95%, 30.09%, 80.29% and 81.30% respectively but natural capital was decreased by 18.92%. Thirdly, in case of respondents of Dobila village, their social, human, physical and financial capitals were increased by 70.83%, 33.71%, 70.30% and 61.24% respectively whereas natural capital was decreased by 12.26%. Finally, like other three villages, the four capitals of the respondents of Hasupur village were increased by 64.21%, 4.38%, 55.03% and 77.11% respectively but natural capital was decreased by 12.42%

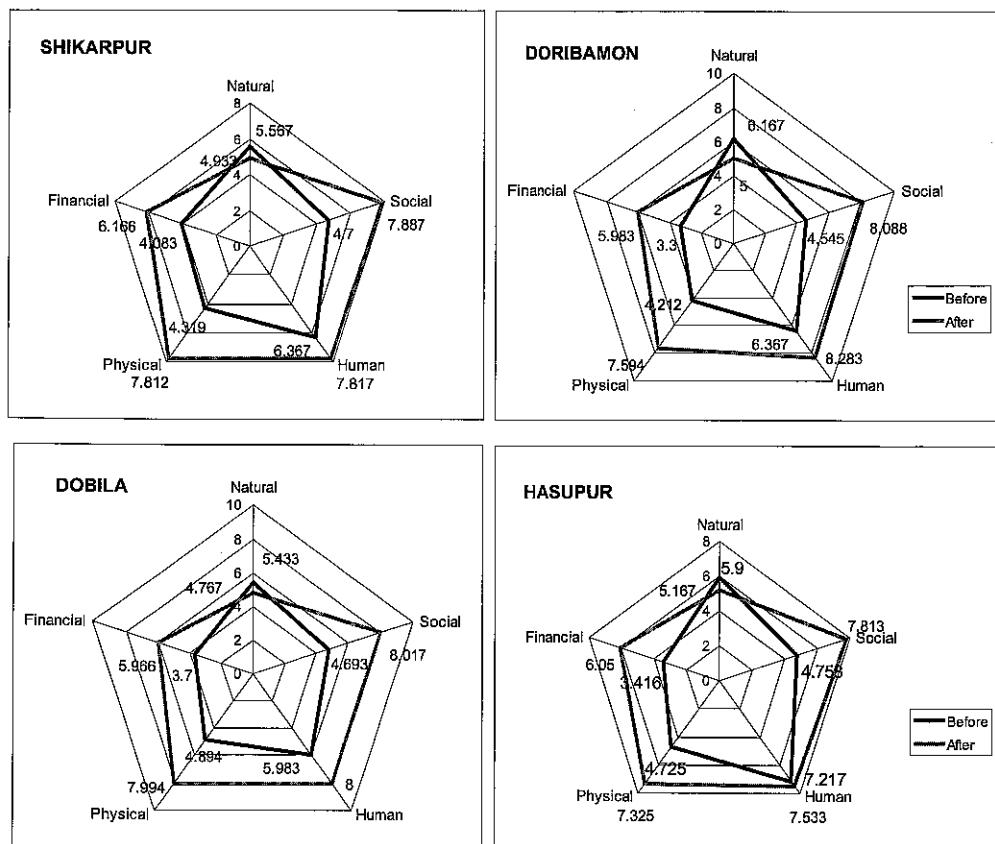


Figure 2: Asset pentagons of the four selected villages before and after the highway

Figure 3 shows how the highway impacted on livelihood assets. It is found from the figure that before the highway, the respondents ranked their livelihood assets like as human (6.483 out of 10.0), natural (5.767), social (4.674), physical (4.538) and financial (3.625). Thus, they mainly used their natural (e.g. nature-based on-farm activities) and human capitals (e.g. personal skills and knowledge) for their livelihoods.

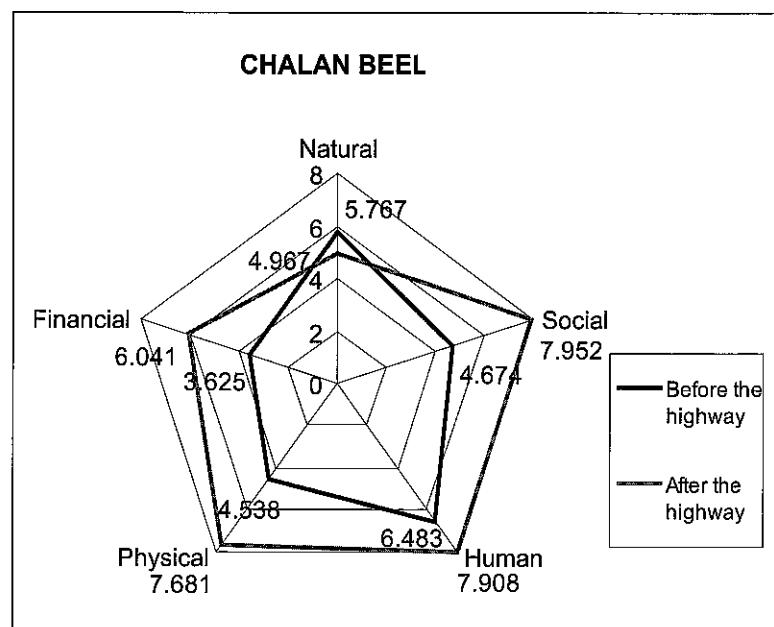


Figure 3: Asset pentagon of Chalan Beel before and after the highway

However, after the construction of the highway, their social, human, physical and financial capitals were increased by 70.13%, 21.98%, 69.26% and 66.65% respectively whereas natural capital was decreased by 13.87%. It is because after the highway new off-farm activities were available for the respondents. In case of social, physical and financial capitals, these were increased reasonably because of good communication and availability of NGO and banking services. Though human capital of the respondents was increased but it was much lower than aforesaid three capitals. The respondents replied that though there were medical services in their villages they had no proper access to those services due to financial crisis and lack of their willingness to spend money for better treatment. Thus, more awareness programmes need for resolving the problem. Besides, they thought they need trainings for appropriate use of technical know-how related to their professions.

Figure 4 illustrates how asset pentagons of the villages differ in terms of their distance from the highway. In case of nearer villages (i.e. Doribamon and Dobila), the assets i.e. social, human, physical and financial capitals of the respondents were increased by 74.35%, 31.85%, 71.18% and 70.71% respectively whereas natural capital was decreased by 15.81%. On the other hand, the four capitals of the respondents of distant villages (i.e. Shikarpur and Hasupur) were also increased by 66.00%, 13.00%, 67.38% and 62.88% respectively but natural capital was decreased by 11.91%.

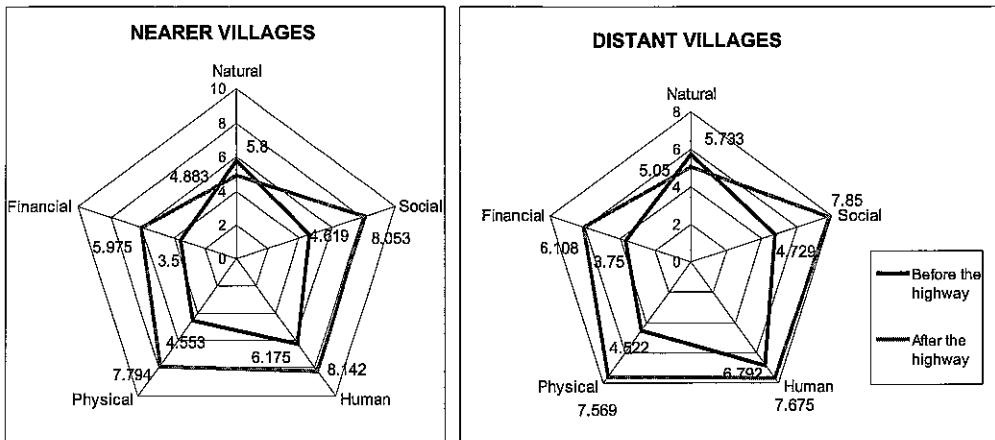


Figure 4: Assets pentagons of the nearer and distant villages before and after the highway

It is already understood from the above discussion that though the highway had positive impact on all selected villages in terms of increasing availability of and access to livelihood assets except natural capital, the rate of impact was higher in case of nearer villages than distance villages. The main difference was seen for human capital. Before the highway, the respondents of the distant villages (6.792 out of 10.0) scored for human capital higher than the respondents of the nearer villages (6.175). Nevertheless, after the highway, the figures were 7.675 and 8.142 respectively. The respondents of the nearer villages had more accessibility to highway related off-farm activities e.g. van/rickshaw pulling, small roadside business. Besides, they could easily go to doctors for their treatment compared to respondents from the distant villages.

4.2 Livelihood strategies

The study also analysed how the highway influenced on livelihood strategies of the people of Chalan Beel. The highway had positive impact on crop intensification – the first livelihood strategy as 73 percent of the respondents argued that the production per unit of land was increased after the highway. Though the dependency on natural capital was decreased availability of agricultural inputs and credits were the main causes for it.

The highway also made people's livelihoods more diversified especially off-farm occupations were increased by 80 percent. However, the highway had no influence on migration pattern of the study area. Furthermore, people of the nearer villages obtained more benefit from the highway, choosing livelihood strategies i.e. crop intensification and livelihood diversification based on livelihood assets, rather than those of the distant villages.

5. Conclusion

The study mainly focused on how the Hatikumrul–Bonpara Highway had an impact on the rural livelihoods of Chalan Beel. It examined different selected components of five livelihood assets and three strategies adopted from DFID's SLF. The respondents argued that their accessibility to all livelihood assets except natural capital was increased after the highway. However, people from the

nearer villages had more access to livelihood assets especially human capital compared to people from the distant villages. The findings of the study were analysed and presented through different asset pentagons. The study, in addition, discussed livelihood strategies. It was found from the study that the highway influenced on crop intensification and livelihood diversification, though it had no significant impact on migration.

It is recommended that the government may take appropriate initiatives so that developmental works cannot affect natural resources and local people should have access to the resources. Besides, the people of Chalan Beel need trainings for dealing with modern technology in order to improve their human capital. Furthermore, the findings of the study will be helpful for assessing impact of developmental works on people's livelihoods in the context of geographical locations and socio-economic conditions of beneficiaries. The study, however, does not consider vulnerability context of the study area. Future study may address vulnerability and livelihood outcomes for strengthening sustainable rural livelihoods.

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A TCV Analysis on DPPIS Digitally Completion and Standardization of Plants Problems Identification System

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Abstract

Digital Plant Problems Identification System, locally known as 'KrishokerJanala', is an online system to suggest farmers on plant problems. This service has been developed with an application which provides instant support to the service recipients in terms of saving Time, Cost and Visit. A structured questionnaire was used to gather data. The telephone survey has been conducted among service recipients and the secondary data were used to manage the other sectors of research. Broad objectives of this study were to find out the monetary and non-monetary benefits of the provided facility among service recipients. The monetary benefits are related to the exploration of the reduction of time, cost and visit. The non-monetary services are related to the findings of the behavior of service providers, service quality, advantages and disadvantages of the service, the satisfaction level of service recipient & appropriateness of the provided service. The study findings show that TCV, through this service facility, has reduced the time up to 48%, Cost up to 86%, but the visit was almost the same because in both processes it took one visit to receive the service. At the same time, it reduced people's hassle, complaints against service provider and increased the satisfaction level of beneficiaries. These are the basic findings of this study. The service has a positive outcome among the population, though few recommendations to improve the service were made. Major recommendations of this study are to increase the internet speed and connecting the facility in UDC premises.

Key Words: Digital Plants Problems Identification System (DPPIS), TCV, a2i,

Introduction and Background

In South Asia, most farmers are familiar with conventional farming practices, they are often ill positioned to promptly deal with diseases and plant infestations affecting their crops (Hannuna, S., et.al, 2011). Digital Plant Problems Identification System (DPPIS) is one such project developed by the app developer for the farmers and agricultural workers who need services and information regarding plant pest Problems and associated problems with minimum cost, time, and

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frequency of visits. This application is well known to the local farmers as 'KrishokerJanala'. The rate of growth of agriculture in Bangladesh and its share in GDP is decreasing. The rate of growth in agriculture came down from 4.5 percent in 2011 to 2.5 percent in 2013 (*World Bank*). This declining trend in growth of agriculture sector can largely be attributed to the gradual loss of cultivable land, lack of invention, adoption and dissemination of new technology and lack of sufficient support for agricultural research and training in the country (*Van Dijk et.al, 2015*). ICTs can be a useful solution to reduce the problems of farmers. ICTs make it possible to reach many farmers with timely and accessible with farm related knowledge. ICT efforts and knowledge management in agriculture for rural livelihoods, it is necessary to put in place a centralized search engine, or harvester, to access the decentralized and dispersed digital agricultural information repositories and network of experts (*Claire J. G. et.al, 2012*).

When a farmer comes to the agriculture office or to an agriculture extension worker, sometimes he/she fails to come with a symptom of the disease or the farmer fails to explain the problem clearly to the extension worker and thus, it becomes difficult for the extension worker to identify the disease. He/she then has to make field visit to identify the problem and suggest requisite solution to overcome the problem. The process is costly both in terms of money and time. The problem becomes larger when the farmer is an ethnic or disabled one. This conventional system associated with complexities in the system can be improved through an online dynamic system. Nowadays, mobile and internet access can enable us having all these services through e-specialized resources at our doorstep. The a2i Programme is playing an important role in simplifying existing services and creating new services so that the citizens of the state can receive public and private services at a minimized cost, time, and frequency of visits. The present Digital Plant Problems Identification System (DPPIS) is, therefore, targeted for the farmers and agriculture workers who need services and information regarding identification and recovery of plant diseases and associated problems with minimum cost, time, and frequency of visits for better production and quality of their products. Such ICT system will help to recognize the disease before it spreads to entire crop (*Vijayakumar, J., & Arumugam, D. S., 2012*). Such ICT system also will enable the farmers to identify the disease in their crop, its cause and symptoms using digital image processing and pattern recognition instantly without waiting for an expert to visit the farms and identify the disease (*Mittal, N., et.al, 2014*).

Objective of the Study

The broad objective of this study is to find out the monetary and non-monetary benefits of farmers who take services from DPPIS.

Specific objectives of this study are:

- To determine the amount of time saved on average of beneficiary farmers who take services from DPPIS
- To determine the amount of cost saved on average of beneficiary farmers who take services from DPPIS
- To determine the number of visits saved on average of beneficiary farmers who take services from DPPIS
- To assess the non-monetary benefits of farmers who take services from DPPIS.

Limitation

- The researchers faced several challenges at the time of collecting data, such as; contact numbers of the beneficiaries who took service from previous method was unavailable. As a result, interviewers had to spend considerable time for setting up appointments.
- Also, some appointments had to be rescheduled due to the unavailability of target respondents.

Methodology

The study was based upon two types of data collection;

1. Primary Data and
2. Secondary Data

Primary data were collected by field survey, telephone interview and key informant interview with project focal persons was conducted. To complete this research in-depth Interview was conducted of 201 farmers to gather data, among them four (04) were gathered as key informant interview.

Secondary data were collected from the sources to fulfill the objectives of the study through reviewing secondary documents. Baseline survey report and internet browsing were the main sources.

Research Approach and Design

This study consists of both qualitative and quantitative approach. A descriptive survey design was used. It provides an accurate portrayal or account of the characteristics, for example, behavior, opinions, abilities, beliefs and knowledge of a particular individual, situation or group.

The Study Area and Population

The study was conducted at Fulbariaupazila under Mymensingh district. Population of the study were those farmers and agriculture workers who need services and information regarding identification and recovery of plants' diseases and associated problems with minimum cost, time, and frequency of visits for better production and quality of their products.

Data Analysis

Data was analyzed with SPSS software (IBM, v22). The researchers reviewed, edited and cleaned the data by performing a series of frequency and data range checks. All kinds of inconsistencies were checked visually by comparing the electronic entry to the entry on the original questionnaire. Data was analyzed by using descriptive statistics.

Findings of the Study

Findings of the study revealed that existing online service saved huge amount of cost, time, and a number of visits of its consumer. Findings also suggested that existing service method took minimum time and effort than previous training method.

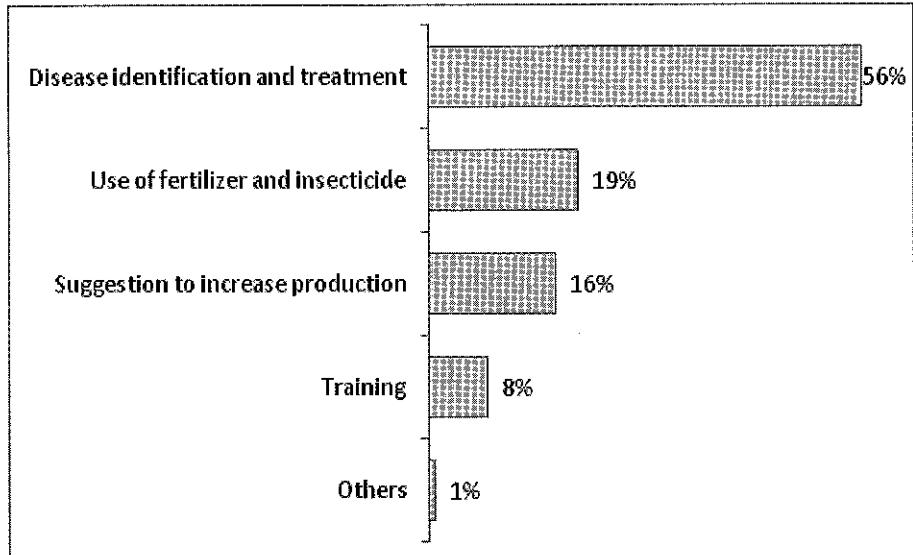


Chart-1: Type of service received

Digital Plant Problems Identification System (DPPIS) provides services for farmers in a systematic way. In this service, 56% farmer takes this service to identify the diseases and their treatments. Few of them use this service for fertilizing and uses of insecticides.

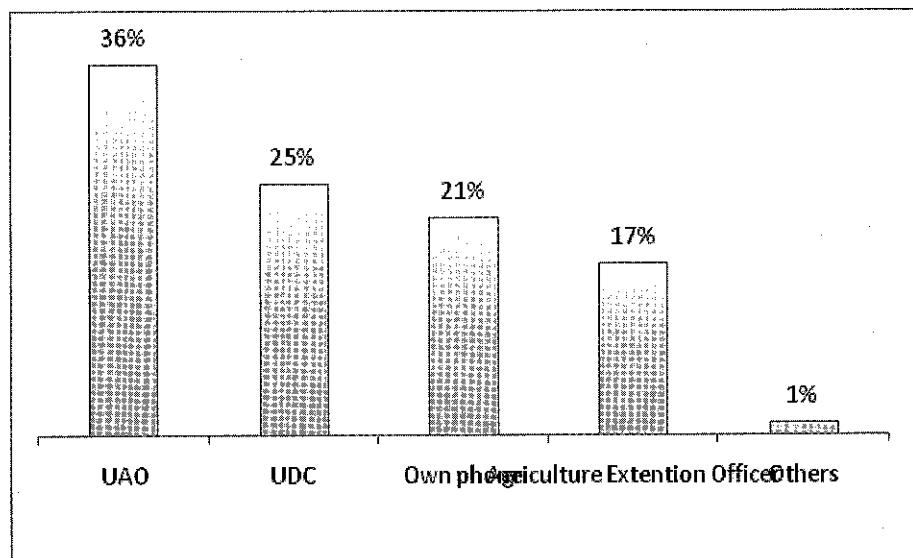


Chart-2: Place from where the last service has been received.

Chart-2 revealed that- 36% farmer attain the service from Upazilla Agriculture office and 25% get the service from UDC and among the respondents 21% farmer get the facility from their own phone. And the other handrest, 17% farmer get the service from Agriculture extension officer of acertain locality.

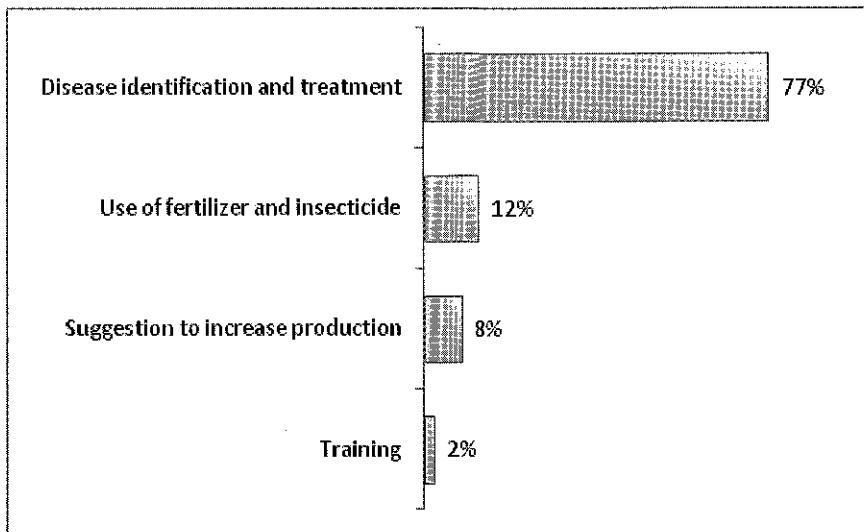


Chart-3: Type of Problem faced

Chart-3 indicates, In the manual process, majority of respondents mentioned that they faced problem in disease identification and treatment of plants. Other problems they face include using fertilizer and insecticides and lack of suggestions to increase production.

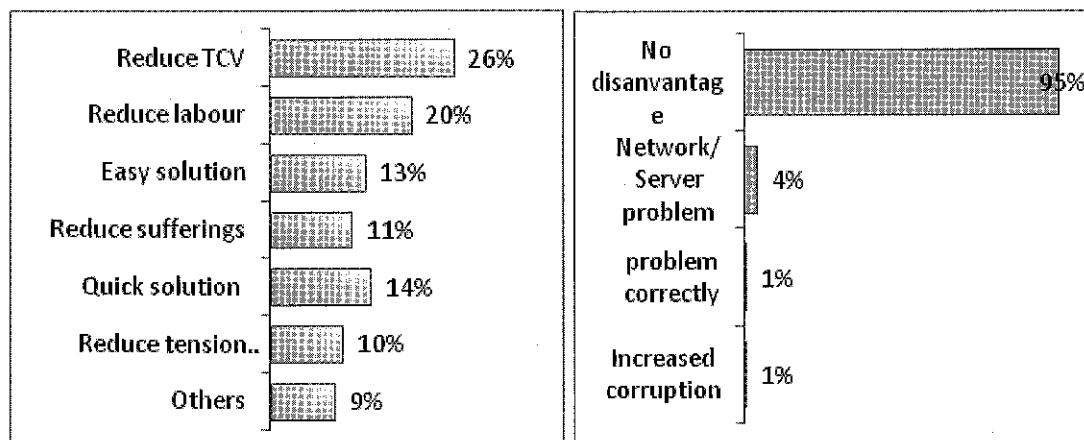


Chart-4: Advantages and disadvantages of receiving online service

Chart-4 revealed that among the receivers of Digital Plant Problem Identification system, Respondents (26%) mentioned that - this service has reduced their consumption of Time, cost and Visit. 20% respondents mentioned that this service has reduced their labor. They got an easy solution to identified problems, 13% informants mentioned about these advantages. Besides, they also mentioned that the digital service has reduced their sufferings. They now can avail a quick solution and it also reduced tension and chances of facing corruption by the farmers who used to get this service from the digital center. 95% of respondents mentioned that they don't face any problem while availing this service. They mentioned no disadvantages of the service. A few respondents complained about network or server problems.

TCV Analysis

On the separate analysis of time cost and visit the comparative benefit of the both service processes are as given in the following chart;

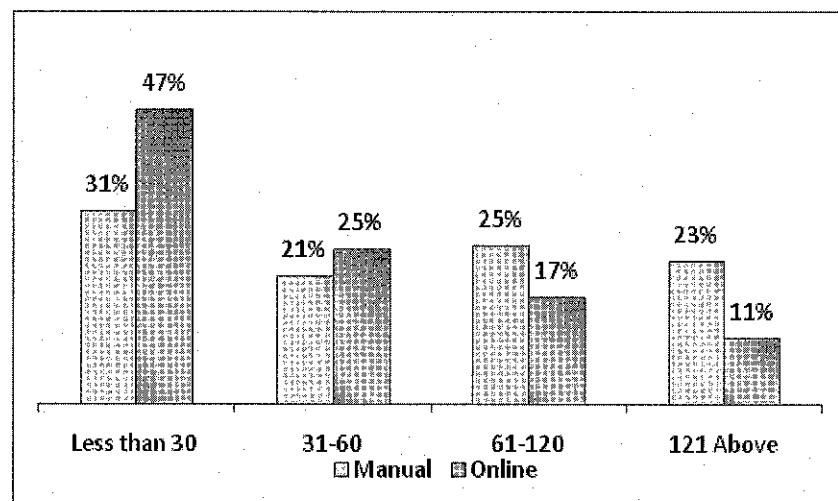


Chart 5: Total time required in both process.

Chart-5 showed that about 47% respondent stated it took less than 30 taka in online service while 31% respondent said it took less than 30 taka in manual service. By contrast, 25% online service recipient and 21% manual service recipient mentioned it took 31 to 60 taka. On the other hand, 11% online service recipient and 23% manual service recipient stated it took more than 121 taka.

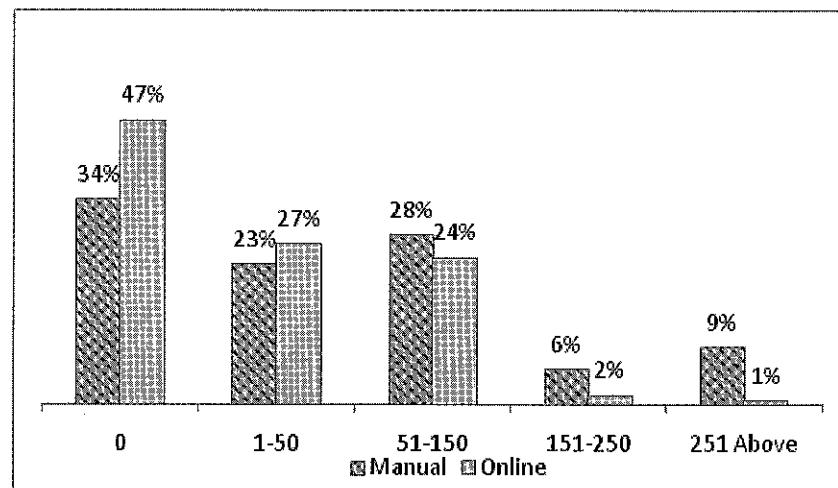


Chart 6: Total cost in both processes.

Chart-6 revealed that about 47% respondent stated in online service no cost needed while 27% online service recipient and 23% manual service recipient said it took 1 to 50 taka. On the other hand, only 1% online service recipient and 9% manual service recipient mentioned it took more than 251 taka.

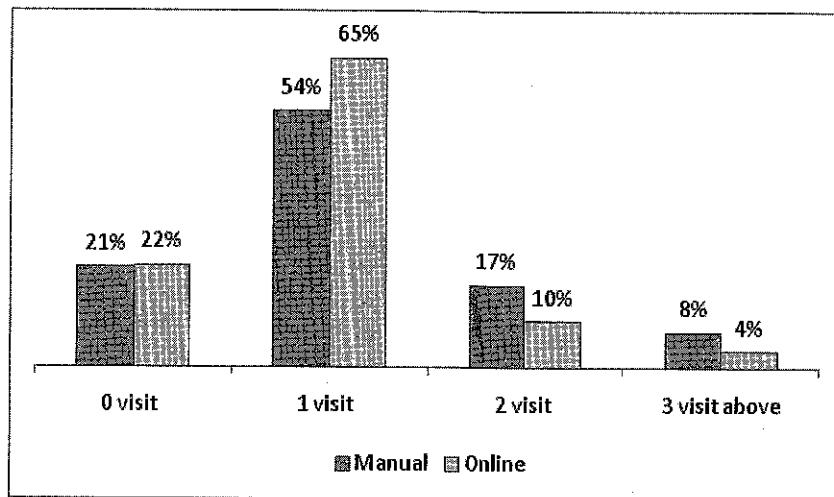


Chart 7: frequency of visit in both processes

Chart-7 showed that- taking the digital service in the manual process and online process, 21% got it in no visit and 22% get the service in no visits respectively. On the other hand, 54% got the service manually in one visit and 65% get the service online through one visit. 17 percent manual users got it in two visits and 10 percent online users get the service in two visits.

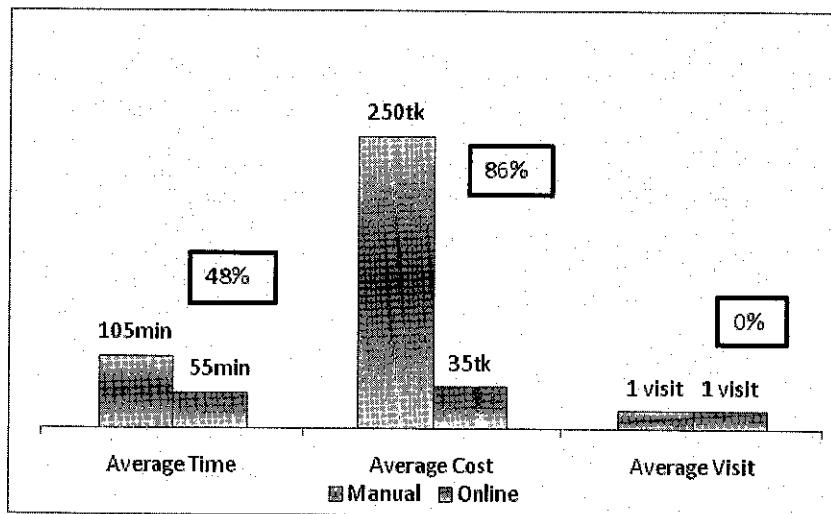


Chart 8: Average Time, Cost and Visit in both processes.

The study focuses on the monetary and non-monetary benefits of the digital services. In the TCV part, it describes the comparison between the before and after scenario in terms of TCV. The Chart-8 showed that for manual agricultural service the farmers needed 105 minutes (about 2 hours), BDT 250, and single visit on average. Whereas, agricultural service from DPPIS only needed 55 minutes (less than 1 hour), BDT 35, and single visits on average. Thus, the study revealed that DPPIS has reduced time and cost by 50 minutes (about an hour) and BDT 215 respectively. This chart-8 also showed that after implementing the DPPIS services, the average time has been reduced up to 48% and the cost has been deducted up to 86%.

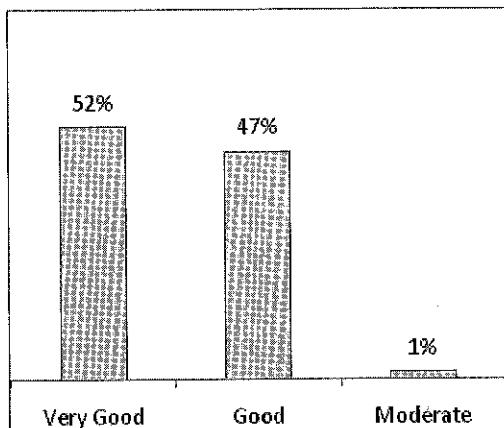


Chart 9: Behavior of service provider.

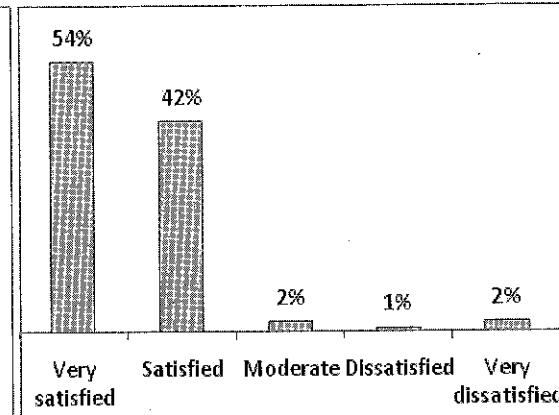


Chart 10: Level of satisfaction by getting service.

This analysis focuses on the non-monitory benefits and other related things of this project. Getting access to this service, 52% of the informants get the government officials' behavior toward them as very good and 47% of them mentioned that their behavior as good and other one percent rated their behavior as moderate as showed in Chart-9. Chart-10 showed that the Satisfaction levels of the farmers after getting the service majority (54%) of respondents are very satisfied followed by 42% of them are satisfied with the service.

Recommendation

Though the study has completed its survey, there is still scope for improvements of DPPIS. The following recommendations may contribute in this regard-

- Network problem is one of the major problems in providing agriculture service with DPPIS. It is, therefore, critical to development of the internet server and providing easy access to the internet.
- Plant Problems Identification System (DPPIS) is still unknown to large portions of farmers. Therefore, an awareness raising campaign should be launched to popularize it among the farmers.
- Increasing UDC's volunteer and manpower was a strong recommendation because it will continue the service of UDC.

Conclusion

DPPIS is the service to provide agricultural facilities among farmers, who take services for plant problems and identification. DPPIS introduced a facility regarding Digital Plants Problems Identification System. The vision of this program was to reduce time, cost and visit of the farmers in terms of taking fertilizer recommendations. From the analyzed data and gathered report, the scenario could be summed up that the provided new service has created an easy and quick access on plant problem identification, treatment and fertilizer recommendation. Now it takes 30 minutes less time to receive this service. Besides the time, cost and facility reduction, this study also discloses the beneficiaries' satisfaction level regarding service time and service provider beneficiaries. Therefore, it could be said that this newly introduced facility has reduced the time, cost and visit of beneficiaries and showed a changing scenario about service facility.

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Project Risk Management in Housing Projects in Dhaka, Bangladesh

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Abstract

Project risk management is considered as integral part of project management. Aim of the research was to explore, investigate and analyze different risks and risk management practices in housing projects in Dhaka, Bangladesh.

A positive relation has been found between project risk management and project success. Major risks in global as well as Bangladesh context in housing projects have been identified as time, cost and quality risks. Ultimate consequence of any risk was time overrun, cost overrun and inferior quality. In Dhaka, disaster risk, political crisis, corruption, policy and bureaucracy and legal risk were investigated as dominant risk factors. Housing sector of Bangladesh lacks proper risk management strategy. The status of risk management practices in housing projects in Dhaka was found to be at primary stage. However, it is recommended that systematic, modern and efficient risk management must be practiced in public and private housing projects in Dhaka, Bangladesh for sustainable and eco-friendly urbanization and housing.

1. Introduction

Risk is a brutal reality and great challenge for life and projects. The eternal presence of risk offers surprises and sensation throughout the project cycle. No project, event, and activity in our social, national and personal life are risk free.

Project risk management (PRM) provides an effective way to improve decision making and minimize project risk. Through efficient risk management, a number of risks can be eliminated, avoided, transferred or insured against (Enhassi et al. 2008).

Consequence of poor risk management is gigantic and devastating for the project. In recent year PRM has been viewed as a powerful weapon to achieve project success in the domain of project (Jahan 2008)

To meet the increasing housing demand of rising population, public and private housing projects are booming sharply. According to REHAB report (2013) around 1200 public and private housing companies have been running their housing business in Dhaka.

Due to lack of proper housing policy, disaster, financial crisis, political turmoil and spiraling price of land and construction materials, housing projects have been facing multi dimensional risks.

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Real estate companies are more interested to make profit rather than risk management for sustainable urban development. Research on project risk management in housing project is imperative for sustainable urbanization in Dhaka. So, evaluation and analysis of existing PRM practices will open a new horizon to formulate new approaches for project risk management in future.

2. Methodology

This piece of research is a finding of literature review. This secondary research is a comprehensive literature review was conducted to build up a foundation of this study. Data and references were collected from reputed academic journals, periodicals, books, magazines, newspaper and seminar papers using Discover, Scopus and Google scholar. Personal observation, intuition, experience and analytical ability served as important tools for analysis and evaluation.

3. Literature Review

3.1 Project Risk and Risk Management

All resources and project management efforts are directed to achieve project success. However, projects often fail to achieve its desired success due to presence of various risk factors (Besner and Hobbs 2006). Project success is treated, defined, judged and measured by different stakeholders of a project from different angles and parameters (Cook-Davis 2002). The concept of project success is still an enigmatic and complex phenomenon to project managers and stakeholders (Pinto & Slevin 1988)

Project risk management is a critical consideration in corporate as well as service world as it has intense effect on project success (Gabriella and Lagos, 2012) A project is associated with several types of risk, including financial, technological, insurance related, environmental and regulatory.(Zuikael and Ahn, 2011)

Various studies have found a positive correlation between project risk management and project success. Mu et al. (2009) conducted an empirical study in China and found a positive relationship between risk management and the performance of New Product Development project.

Traditionally project success is measured by the three aspects of the “triple constrain” or iron triangle”: cost, time and quality (Atkinson, 1999). These three dimensions are considered central to measuring project success.

Rapid urbanization is a reality of today’s world. To meet the housing demand of burgeoning people in urban areas massive housing projects have been running in developed and developing countries. Due to steady demand housing industry has emerged as a booming economic sector in the world. Despite having different risks this sector has experienced phenomenal growth and success during last 15 years. As construction is the main part of housing projects it bears all risks related to construction projects along with other socio-political and environmental risks. Housing projects have been progressing with threats and opportunities towards massive success to solve housing crisis in the world (Alam and Ahmed 2013)

3.2 Risks associated with housing projects in Bangladesh

The housing sector of Bangladesh has established itself as one of the major drivers of economic growth. In 2011, 16% of the country’s gross domestic product [GDP] came from housing sector

and annual turnover was \$38.46 million. This sector created huge employment opportunity and flourished ancillary industries. (Sarker et al, 2008)

In a densely populated country like Bangladesh well planned housing project is imperative. Unplanned and faulty housing projects will make Dhaka city into a hell rather than making a heaven for peaceful living. Corruption, lack of good governance, political instability, lack of accountability, bureaucratic complexity, black money are the major causes of retarded growth of housing sectors in Bangladesh(Talukder, 2013, Shams et al 2014)

3.2.1 Engineering and construction risk

Spiraling price of construction materials and its unavailability is a bitter reality in housing construction sectors in Bangladesh. Over the last 10 years price of construction materials has been increased by 90% to 400% causing massive cost overrun in housing projects. (Alam & Ahmed 2013)

3.2.2 Earth quake risk

Housing projects of Dhaka are vulnerable to earthquake risk due to poor construction, unplanned urbanization and geographical location. Data of Earthquakes show that Bangladesh and surrounding areas experienced at least 1000 earthquakes having magnitude of greater than or equal to 4 in the last 100 years (Alam et al. 2011)

Due to shortage of land the housing companies have been expanding their project towards marshy low land. A recent study conducted by Comprehensive Disaster Management Programme(CDMP) of the Government of Bangladesh indicates that Eastern and South Eastern parts of Dhaka is highly susceptible to Liquefaction (Rahman, 2010)

Bangladesh has some major fault lines, including the Dauki fault, Madhupur fault and tectonic plate boundaries. CDMP (2012) study reveals that more than 100000 people may die and thousands of people needs hospitalization if a 7.5 magnitude earthquake hit the capital. Some 400000 buildings in Dhaka, Chittagong and Sylhet are extremely vulnerable to earthquake.

3.2.3 Financial Risk

As an emerging sector housing industries need massive and soft financing from government and private financial institutions. Insufficient and poor financing in housing projects has created cost and quality risks. (Sarker, 2008)

Sky rocketing price of land in Dhaka and other cities in Bangladesh has pushed housing projects towards deep financial risk. Price of land in Dhaka city has been increased by 300% to 1500% between 2000 and 2010 (Talukder, 2013)

3.2.4 Corruption Risk

Corruption is a dominant and widespread risk in housing sector in Bangladesh. Corruption is practiced from planning stage to delivery stage by public agencies, law makers, political leaders, bureaucrats, consultant, engineers, contractors, suppliers and environmentalist. Corruption itself is a potential root of completion delay, cost overrun, poor quality, disaster risk, delivery dispute and legal risk(Jamil and Panday, 2012)

3.2.5 Political Risk

Political instability is a major risk in housing sector in Bangladesh. Political crisis, hartal and blockade and strike generate completion delay, cost overrun, financial risk, quality risk, marketing

risk, image crisis and legal risk. Changes in political government bring about changes in policy and strategy, thus creating new risks for housing projects. When a new government comes in power they bring about changes in top management and administration and eventually projects management is affected (Islam, 2011)

3.2.6 Legal and policy risk

Housing and construction projects in Bangladesh are planned, monitored and regulated by different legal and strategic instrument. Legal machineries to control and monitor housing and urbanization are- i) Dhaka Metropolitan Development Plan(DMDP)- 1995, ii) Building Construction Rules 1996, iii) Private Residential Land Development Rules 2004, iv) Wet land Conservation Act 2002 and v) Building Construction Rules 2006. Weaknesses of these laws and inappropriate application resulted different housing risks and disputes in housing projects. (REHAB 2012)

3.2.7 Coordination Risk

Housing projects in Bangladesh require clearances from 10 different agencies involved in the management of megacity Dhaka. The Bangladesh Water Development Board (BWDB), Water and Sewerage Authority (WASA), Dhaka City Corporation (DCC), Department of Environment (DOE), Dhaka Electrical Supply Authority (DESA) and RAJUK are the main actor in city management. Lack of coordination among these agencies generated risks in different stages of housing projects (Mahmud 2007, Jamil and Panday 2012)

3.3 RM Practices in Bangladesh

Talukder (2013) studied project risk management in Bangladesh and found frustrating picture in this regard. In housing projects little or very poor risk management practices were applied. Despite being a public body and leading player in housing sector risk management strategy of RAJUK is not satisfactory and enough.

The Purbachal housing project had been brutally criticized by the civil society, environmentalists, local affected people, and journalists for its poor risk management strategy, snail pace and faulty planning. Most of the private housing company breached or ignored building code, disaster risks and legal issues (Kibria, 2013)

4. Discussion

International and national journals on Project Management, risk management, urban policy and regulations were reviewed to investigate risk management practices in housing projects. Different types of risks associated with housing and construction projects were identified in global as well as Bangladesh context. Cost overrun and time overrun found to be very common risk in housing projects in developing and developed countries. In Bangladesh these two major risks further intensified by coordination risk, corruption and political risk.

Legal, policy, coordination and bureaucratic risks are very prominent and have pronounce effect on project success in housing project success in Dhaka. Political turmoil and interference seemed to be a major risk in housing projects.

Due to lack of proper risk identification, risk analysis and response many mega housing projects such as Purbachal Housing Project Uttara Housing project and Eastern Housing project have

severely suffered from completion delay, cost overrun, quality and safety.

REHAB does not have any policy and procedure for monitoring proper execution of project risk management in housing sector

Disaster risk was reviewed very prominent and devastating for Dhaka and its adjacent areas. Poor construction planning, breach of building code, geographical location and policy made Dhaka more vulnerable to disaster risk.

5. Conclusion

PRM in housing sector of Bangladesh is still in its infancy. In global context, main risk factors associated with housing projects have been identified as cost overrun, time overrun, strategic and financial risks. However, In Bangladesh context political risk, bureaucratic risk and corruption risk have been identified as high impact risk along with other engineering risks.

Housing sector of Bangladesh lacks proper risk management strategy. Therefore, suitable risk management strategies to manage risks and challenges of housing sectors should be formulated and practices by housing companies and government agencies. Coordination among the different government agencies must be maintained with positive view to promote risk management practice in public and private sector housing projects. A national culture for efficient risk management in public and private should be developed and cultured.

Failure to manage engineering, disaster, political, and corruption risk may bring about a disaster and set back in emerging housing industry. So, government, REHAB, civil society, engineers, planners and all concerned quarters should come forward with efficient risk management strategy for sustainable flourishing of housing sector.

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Livelihood Condition of Disabled People: A Case Study of Tiruchirapalli District of Tamil Nadu, India

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Chandrakanta²

Abstract

The human labor forces including disabled people are very important to nation's development. They are facing many problems such as accessing education, employment, social activities and so on. In addition, they have lower standard of living than common people in India. The government has introduced so many income generation and employment schemes for them. But it is only limited as well as those schemes are not viable to disabled people. In this view, the researchers used to plan to study the following objectives: 1) To find out the livelihood conditions of disabled people of Tamil Nadu State, and 2) To recommend proper measures to improve the life of disabled community. In this study, Primary data have been collected from disabled people in Tiruchirappalli district while secondary data have been gathered from population census 2011. The study employed census method. Hence, 50 visually challenged people have been collected from Gandhi Nagar in Tiruchirappalli district. In this study descriptive statistics have been used. Analyzing overall data, the study concluded that the disabled people are still living in poverty. Therefore, the government should initiate suitable measures in order to improve their livelihood condition and also their developmental growth.

1. Introduction

The human labor forces, including that of disabled persons, are very important to a nation's development. According to the World Health Organization (WHO), "Disability is any restriction or lack of ability to perform in a manner or with the range considered normal of a human being". United Nations definition of disability is "a person unable to ensure by himself or herself wholly or partly, the necessities of normal individual and or social life, as a result of deficiency either congenital or not in his or her physical or mental capabilities". The International Labor Organization (ILO) definition of disabled person is "an individual whose prospects of securing, retaining and advancing in suitable employment are substantially reduced as a result of a duly recognized physical or mental impairment. According to Helander, "a disabled person is one who in his/her society is regarded or officially recognized as such because of a difference in appearance and behavior, in combination with a functional limitation or activity restriction. People may be

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disabled by many types such as- physical, intellectual or sensory impairment, mental illness etc. About 386 million of the world's working aged people are disabled (ILO, 2004). The disabled people are larger in Sikkim and Odisha which constitute 2.98% and 2.96% respectively. Tamil Nadu state also has a high (1.64 %) number of disabled persons.

Table-1: Percentage of Disabled People to Total Population in India, 2001 and 2011

Year	Total disabled people in India (%)			Rural (%)			Urban (%)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
2001	2.37	1.87	2.13	2.47	1.93	2.21	2.12	1.71	1.93
2011	2.41	2.01	2.21	2.43	2.03	2.24	2.34	1.98	2.17

Source: Census of India, 2001 and 2011

Table-1 shows total disabled people in India. Percentage of disabled people has increased from 2001 to 2011. On the other hand, percentage of disabled people has increased both in rural and urban areas in the last decades. It is also evident that male disabled people are higher than female both in rural and urban areas.

Table- 2: percentage and Types of Disabled people in India, 2001 and 2011

Types of disabled people	Census 2011 (%)		
	Male	Female	Total
Seeing	17.60	20.20	18.80
Hearing	17.90	20.20	18.90
Speech	7.50	7.40	7.50
Movement	22.50	17.50	20.50
Mental retardation	5.80	5.40	5.60
Mental illness	2.80	2.60	2.70
Any other	18.20	18.60	18.40
Multiple disability	7.90	7.80	8.10

Source: Census of India, 2011

Table- 2 shows the types of disabled people in India, in which movement of disability is higher among the types of disabled people and it is followed by hearing and seeing.

Poverty and Millennium Development Goals (MDGs)

It is estimated that about 10% of the world population has some kind of disability. The MDGs is launched by the UN in 2000, set target for combating poverty, hunger, disease, illiteracy, and

discrimination against women. If 20% of the world poor are with disabilities, then the MDGs will only be achieved if explicit and specific efforts are undertaken to include them in programs aimed at reaching the world's poor. (Good Practices for the Economic Inclusion of People with Disabilities in Developing Countries: Funding Mechanisms for Self-Employment 2006).

People with Disability Act - 1995

In 1995, the Government of India enacted persons with disabilities act. This act clearly states that 3% vacancies must fill up in all categories of job in the public sector industries for disabled persons and incentives for public and private sector companies have at least 5% of their workforce. Preamble to this act clearly delineated its objective of promoting and ensuring equality and full participation of person with disability. The act aims to protect and promote economic and social rights of people with disabilities. It covers seven disabilities under section 2(1) of the act – blindness, low vision, leprosy cured, hearing impairment locomotors disabilities, mental retardation and mental illness.

Statement of the Problem

The disabled people are not a homogeneous group as well as whose problems are different from one to another disabled person. They suffer from multiple accounts such as- inaccessibility health care services, lack of information about health care facilities and lack of knowledge about disability, in which disabled women are facing lot of health problems than that of disabled male. Beside this, there are communication problems between persons with disabilities and common people. On the other hand, they have spent more money for their medical purposes, while some people do not fulfill their basic needs out of their income.

In employment, disabled people are earning much less and some of them even are dismissed from their job. In India, large number of disabled men and women are either unemployed or very low paid jobs. Poverty is one of the main problems for disabled people. Disability is directly linked to poverty. Disability may increase the risk of poverty and poverty may increase the risk of disability. The onset of disability may lead to the worsening of social and economic well being and poverty through a multitude of channels including adverse impact on education, employment, earnings and increased expenditure related to disability. So far, many poverty eradication schemes have been brought to them. But it is only limited as well as those schemes are not often accessible to disabled people.

Review of Literature

Ann Elwns (1999) focused on the quantitative impact of disability on education, employment, income and access to basic social services. In this connection, has mentioned that disabled people have received less education and its effects on labor market, the participation of disabled people are less likely to work and most of them unemployed. Disabled people are working many hours than common people, but who are getting lower salary. This inadequate income for disabled people, have not fulfilled their basic needs, and access health care. The majority of disabled women than disabled men are excluded in access to government and NGO programs. In addition, access to rehabilitation and other services for disabled people are very limited in developing country as a result of poverty and disability and so on.

Sophie Mitra (2005) has analyzed the relation between disability and poverty, role of safety nets on disability. In this context, his study revealed that disabled people are discriminated in accessing employment, health care, transportation, education and so on due to their disability and poverty, in

which women who is suffered more. Disabled people are included in such programs, but who are more likely to be poor compared to persons without disabilities. Because, those people spend their income on medical grants, purchase the equipment, transportation and so on. In addition, disabled people are struggling to access the health clinics due to multiple problems, particularly communication and social barriers between disabled people and staff in hospitals. The health care staffs are not trained to communicate with them.

Natalia Mattioli (2008) revealed that disabled people in poor countries are facing many barriers that limit their access to education, employment, housing, and transportation, health care. Those people are excluded from social and economic activities as a result of many of them are unemployed. In addition, those people are more likely to have incomes below poverty line and less likely to have savings and other assets than the non-disabled people. Fore and foremost, poverty is the major cause for the problems mentioned above.

The study by Ali Pezhhan and Marzieh Hajian Sepolesh (2011), on “Poverty and Disability (Case study from Iran)”, revealed that disabled people have lower incomes than common people. In rural India, disabled members are below the poverty line, had lower total assets, smaller land holdings, and greater debt than household without disabled members. Disabled people are living in poverty, and have limited access to health care, food, education, shelter and employment. All these factors are increasing the risk of illness, injury and impairment, while it is reducing access to medical care

Manoj K. Pandey (2009) analyzed the depth of poverty and examines the causal relationship between disability and poverty among Indian Elderly. Finding of his study is higher level of poverty and income inequality among disabled elderly as compared to non disabled elderly and those differences in the income levels vary significantly across different age groups, gender, Social groups and educational status.

Arne H. Eide et al. (2011) analyzed the living condition among people with disabilities in developing countries. Finding of his study is individuals with disabilities and their households are worse off than those without disabilities and their households in living condition, especially in rural areas than the urban areas.

Sophie Mitra et al. (2011) focused on socio economic status of working age disabled people in 15 developing countries and world health survey data (during the year 2000 – 2004) has been used in this study. In this view, out of 15 countries, majority of country disabled people are lived with lower socio economic conditions and who have used health services with less. This health condition may increase poverty through lost earnings and health expenditure, reduce their work and wages. In addition, this study revealed that the income and expenditure of household with disabilities may be similar to other households. But their standard of living have lower due to additional expenditure, such as health care, transportation, assistive devices, and house adaptation.

Objectives

- i) To find out the livelihood condition of disabled people in Tiruchirappalli District of Tamil Nadu, and
- ii) To recommend proper measures to improve the life of disabled community.

Methodology

The study is carried out in Tiruchirappalli District. It is the district positioned in the central part of Tamil Nadu. It encompasses a large population of which 40,276 persons are disabled (Source: Population Census 2011). It is being a city with many people including migrant working population and people resorted to seeking work in this place. The study is employed simple random sampling method. In this study primary data is collected from 50 visually challenged persons in Gandhi Nagar (near Alangudi road) in Tiruchirappalli district through structured questionnaire during February to March 2015 and secondary data are collected from population census 2011. Reason for chosen visually challenged persons, who are faced many problems compared with all type of disabled populations.

Table- 3: Percentage wise Age Group of Visually Challenged Persons

Age Group (year)	Gender wise visually challenged people	
10 -20	Male	1(2)
	Female	-
21 -30	Male	5(10)
	Female	-
31 -40	Male	21(42)
	Female	8(16)
41 -50	Male	8(16)
	Female	3(6)
51 -60	Male	3(6)
	Female	-
61 -70	Male	1(2)
	Female	-
Total	50	(100)

Source: Primary survey by author, February to March 2015

**Brackets denoted by percentage.*

From table-3, it can be observed that the maximum number of visually challenged persons are in the age group of 31-40 years in which male are 42 % and female are only 16 %. Next 22 % of visually challenged persons are in the age group of 41-50 years and only 4 % of the disabled are locomotors disability. By face to face discussion among the respondents, the researchers have found that prevalence of disability is mainly three types. First is by birth and second is small box and third is an accident.

Table- 4: percentage wise Onset of Disability

Disability	No. of Visually Challenged People
Since birth	12(24)
Later on	38(76)

Source: Primary survey by author, February to March 2015

**Brackets denoted by percentage.*

Table- 4 shows the percentage wise onset of disability. Out of which 76 % of the respondents have disability after birth and only 24 % of the respondents have disability since birth. By face to face discussion among the respondents, the researchers have found that reason for disability (after birth) is cataract, small box, glaucoma and accident.

Table- 5: Education Status of Visually Challenged Persons

Age Groups (years)	Educational status of visually challenged persons						Total
	Not Literate	Primary Level	Middle School level	Secondary level	Higher Secondary Level	Degree and above	
10 – 20	-	1(2)	-	-	-	-	1(2)
21 – 30	2(4)	1(2)	-	1(2)	1(2)	-	5(10)
31 – 40	4(8)	9(18)	6(12)	2(4)	5(10)	3(6)	29(58)
40 – 50	4(8)	-	3(6)	2(4)	-	2(4)	11(22)
51 – 60	2(4)	1(2)	-	-	-	-	3(6)
61 – 70	1(2)	-	-	-	-	-	1(2)
Total	13(26)	12(24)	9(18)	5(10)	6(12)	5(10)	50(100)

Source: Primary survey by author, February to March 2015

*Brackets denoted by percentage

Table- 5 shows the educational status of visually challenged persons. Out of which, 26% of the respondents are not literate and it followed by 24% of the respondents have completed primary education. On the other hand, only 10% of respondents have studied Degree and above.

Table- 6: Employment Details of Visually Challenged People

Types of Work (At present)	Age Groups (%)						Total
	10 – 20	21 – 30	31 – 40	41 – 50	51 – 60	61 – 70	
Instant stick	1(2)	4 (8)	18 (36)	6(12)	2(4)	1(2)	32(64)
Recanting (Chair)	-	1(2)	4(8)	3(6)	1(2)	-	9(18)
Petty shop	-	-	1(2)	-	-	-	1(2)
Weight machine	-	-	1(2)	-	-	-	1(2)
Teacher	-	-	1(2)	1(2)	-	-	2(4)
Unemployed	-	-	3(6)	1(2)	-	-	4(8)
Singer		-	1(2)	-	-	-	1(2)
Total	1(2)	5(10)	29(58)	11(22)	3(6)	1(2)	50(100)

Source: Primary survey by author, February to March 2015

*Brackets denoted by percentage

Table- 6 shows the employment details of visually challenged people, out of which 64 % of respondents work is instant stick and it followed by 18% of respondents work is recanting work. On the other hand, only 4 % of the respondents work is teaching in government school.

Table- 7: Age wise Income and Expenditure of Visually Challenged Persons

Amount (Rs.)	Age groups											
	10-20		21-30		31-40		41-50		51-60		61-70	
	M	F	M	F	M	F	M	F	M	F	M	F
1-2000	I	-	-	-	2	2	1	1	1	-	1	-
	E	1	-	-	3	1	-	-	1	-	-	-
2001-4000	I	1	-	2	-	11	2	4	2	1	-	-
	E	-	-	1	-	5	4	4	1	-	-	4
4001-6000	I	-	-	2	-	5	2	1	-	-	-	-
	E	-	-	1	-	6	1	2	3	1	-	-
6001-8000	I	-	-	1	-	1	-	1	-	-	-	-
	E	-	-	3	-	6	2	1	-	-	-	-
8001-10000	I	-	-	-	-	2	2	1	-	-	-	-
	E	-	-	-	-	-	-	-	-	1	-	-
10001- 12000	I	-	-	-	-	-	-	-	-	1	-	-
	E	-	-	-	-	-	-	-	-	-	-	-

Source: Primary Survey by author, February to March 2015

Note: *Expenditure (E) **Income (I)

Table-7 shows the majority of visually challenged persons having monthly income and expenditure are Rs. 2000 - 4000 in the age group of 21-30 years and family expenditure in the age group of 31-40 years are Rs.2000-4000. This followed by the age group of 41 -50 years. This age group people are mostly working in the field of instant stick and second is recanting (chair making) work.

Table- 8: Beneficiaries of Visually Challenged Persons in Indirect Promotion of Livelihood Schemes

Type of scheme	Beneficiaries of visually challenged people
Disability ID card	44 (88%)
Braille watches	44 (88%)
Folding sticks	44(88%)
Spectacles	35 (70%)
Travel concession	43 (86%)
Marriage assistance	04 (08%)
Unemployment allowance	03(06%)
Gas	04 (08%)
Television	37 (74%)

Source: Primary Source by author, February to March 2015

*Brackets denoted by percentage

Table- 8 shows the indirect promotion of Livelihood Schemes for disabled people. In which, 44 % of the respondents have received disability ID card, Braille watches and folding sticks. The remaining 12% of respondents have not family card.

Table 9: Beneficiaries of Visually Challenged People in Direct Promotion of Livelihood Schemes

Types of scheme	No. of respondent
SDT booth	3 (6%)
Indira Awass Yojana	46 (92%)
Assistance for self -employment from banks	5 (10%)
Wait Machine	1 (2%)

Source: Primary Source by author, February to March 2015

*Brackets denoted by percentage

Table- 9 shows the direct promotion of livelihood schemes for disabled People. In which, 92% of respondents have benefited Indira Awass Yojana Schemes. Only 10% of the respondents have received assistance for self- employment from banks. In STD booth schemes and Wait machine beneficiaries are 6% and 2% only.

Table 10: Percentage wise Beneficiaries & Non-Beneficiaries in Public Distribution System

Sl.No.	Type of Ration Card	No. of Beneficiary	No. of Non Beneficiary	Total
1	BPL (16 Kg rice)	12 (24)	-	12(24)
2	BPL (20 Kg rice)	35 (70)	-	35(70)
3	Non- Ration Card holders	-	03 (06)	03(06)
Total	-	47 (94)	03 (06)	50(100)

Source: Primary Source by author, February to March 2015

*Brackets denoted by percentage

Table- 10 shows the majority of household having BPL card, in which 70% of the cardholders have got 20 kg rice and 24% of the cardholders have got 16 kg. It depends upon their family size. About 6 % of the respondents had applied for ration card, but they could not get PDS but who are buying rice for price in market.

Findings

- The large number of the households lived in Indira Awaas Yojana house, while few households have not a ration card.
- A large majority of households were poor and who are mostly depending on the PDS system. Most of the respondent has complained about corruption in the distribution of kerosene and sugar as well many cardholders complained of irregular supply of oils and pulses. The few respondents have said it is fine quality, while nearly half of the

respondents have said they received poor quality. Many respondents reported that stones and pins are in the rice and wheat. On the other hand, single man is working in fair price shop and who has worked in more than two fair price shops. Fore and foremost, shops would be open only one day in a week. So, they spent whole day to buy.

- At present, the transport facilities have grown. So far the most respondents are struggle to cross the road from one place to another place on the road. At the same time, many accidents are happening every day.
- There is no street light facility in the study area. So, they are struggling in their life.
- Disabled people are ready to work from one place to another place including women but there is no accommodation facilities for them in outside. So far their parents and their family members are not given permission to work from one place to another place.
- They have not yet working opportunities that meet their basic social and economic needs due to insufficient or inappropriate education and training and experience transportation problems in reaching the place of work.
- The IAY schemes house are damaged and still many of non disabled people do not come forward for marrying disabled persons.
- The overall finding from the study concluded that most of the disabled people have not benefited 100% from the government schemes.

Suggestions

- Disabled person must be adequately trained with a vocational skill and then placed in suitable employment by the government.
- The transport sector should provide transport facilities and it should be easily access to disabled persons.
- The bank must reduce the rules and restriction in getting loan for their self-employment and small business.
- The Separate industries needed for disabled people in which the head and office staff must be disabled.
- The government must provide contract work to them, in which packaging work, rescanning work and clerk post in government enterprise, college and government office. These certainly generate more gainful employment for the disabled persons.
- The government must give 100 days employment need regarding to their skill development, while 100 day employment must increase to 365 day due to their disability or two disabled persons in a family must be benefited in the 100 days employment.

The government and private sector come forward for giving the job to disabled persons

- particularly textile industries regarding to their skill development and disability and also some disabled are known automobile techniques and software jobs. So the government must encourage and give opportunities in this field.
- Many disabled women are homemakers, so the government identify those people and provided employment at their home level.

- Three percent (3%) reservations are not sufficient to all disabled persons. Because of, visually challenged people are struggling to get in employment opportunities. Therefore, three percent reservations are need to each and every type of disabled people.
- The government may increase the PDS to rural disabled people as urban due to their disability and welfare. (In which kerosene, rice and pulses are very necessary).
- There is need an appropriate treatment in health care for prevent the disability.
- The government may introduce and implement anti- discrimination programs to reduce both disability and poverty.
- Policies and programs should be improved the socio economic status of people with disability and their family, especially in access to education, health care and employment.

Conclusion

The Government has introduced many sustainable livelihood schemes in order to sustainable livelihood of disabled people. But, the large numbers of disabled people are still living in poverty. Therefore, the government should bring the large number of direct livelihood program that should be easily accessible to them. In addition, the government should directly analyses and fill up all types of disabled people in order to their sustainable livelihood and also their development.

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An Economic Study on Maize Production in Some Selected Areas of Pabna District in Bangladesh

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Abstract

The focus of undertaken study is to determine the relative profitability of maize production in different categories of farmers in some selected areas of Pabna district in Bangladesh. Locations were selected purposively and the sample farmers were selected randomly. Considering the objectives of the study, data were collected from selected respondents through direct interview method using a set of well designed pre-tested questionnaire. In total 90 farmers were selected for the present study. Among them 41 were small farmers (holding 0.02-1.0 ha of land), 35 were medium farmers (holding 1.01-2.0 ha of land) and 14 were large farmers (holding 2.01 and above ha of land). Both descriptive statistics and Cobb-Douglas revenue type production function model were used to achieve the main objectives. Major findings of the study are that maize production is profitable to the farmers. According to the farmers category, large farmers obtained higher net return (Tk. 71487.00/ha) than medium (Tk. 69062.00/ha) and small (Tk. 65943.00/ha) farmers. Per hectare total production and gross costs for maize production were calculated Tk. 79334.00, Tk. 85094.00 and Tk. 86071.00 for small, medium and large farmers respectively. Per hectare gross return of maize for small, medium and large farmers were 9042.00, 11336.00, and 13126.00 kg respectively and their corresponding product values were Tk. 145277.00, Tk. 154156.00 and Tk. 157559.20 respectively. Benefit-Cost Ratios (BCR) were 1.831, 1.811 and 1.830 for small, medium and large farmers, respectively. The Cobb-Douglas production function was used for this study to measure the effect of individual input use and other related factors of maize production. Explanatory variables such as seed, human labour, power tiller, MoP and zinc were significant and indicated positive impact on maize production. Finally, the study suggests some policy recommendations to improve the maize production in Bangladesh.

1. Introduction

Bangladesh is an agro-based developing country in the South Asian region with an area of 1,47,570 km² (BBS, 2011) with population is nearly 149.7 million (BBS, 2012). Total cultivated land area is approximately 14.09 million hectares. But total net cultivable area is 7.809 million hectares of which about 2.851 million hectares are single crops, 3.984 million hectares are double cropped and 0.947 million hectares are triple cropped areas with a cropping intensity of 175.9 (BBS, 2009). In Bangladesh, nearly 2.8 million hectares are suitable for maize cultivation but it covers only 1.5 million hectares (BBS, 2011). More than 75 percent of its population lives in rural

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areas. Agriculture contributes about 19.29 percent of the GDP with 43.69 percent of its labour force (BER, 2013).

Maize (*Zea mays* L.) is one of the most important food grains in the world as well as developing countries. It is also one of the most important cereal crops because of various uses of its grains and plants. Maize is also the third major cereal crops after rice and wheat in Bangladesh. Among the world's cereals crops, maize ranks second in production. Maize grain is a good source of the best and qualitative edible oil for human consumption. It is also a primary staple food for large proportion of people in the developing countries. Almost half of the people of this country are still below the poverty level in terms of calories intake (2122 k. cal/day/person) (Country profile, 2013). So, the policy makers of Bangladesh are facing problems to make policies regarding the solution of the problem of malnutrition. Currently, maize is being used as the main ingredient of poultry and fish feed production in Bangladesh. So the maize has importance to grow more in this country. Due to its great potential for future development, maize has been taken as a test crop in the study to see its prospect deeply. But there were a limited number of studies (Alam et al. 2009; Haque, 2009 ; Hasan, 2008; Islam, 2006; Kamran Hossain, 2013; Maksuda, 2012) conducted in maize production where production was the main concerned. That's why the present study is taken for measuring the current profitability of maize production, factors affecting the yield of maize, socio-economic condition of maize producers and also gives some policy guidelines and recommendations. Therefore, this comprehensive study generates some valuable information which would be highly useful for the farmers, GOs, NGOs and policy makers to conduct a successful maize revolution in Bangladesh.

The present study is conducted with some following objectives:

- i. To identify the socio-economic characteristics of maize producers;
- ii. To estimate the profitability of maize production;
- iii. To determine the major factors affecting the return of maize production; and
- iv. To suggest some policy guidelines and recommendations.

Methodology:

In order to achieve the main objectives of the study, area was selected purposively and sample farmers were selected following random sampling technique. The relevant data were collected from Chatmohar Upazila of Pabna district in Bangladesh. It is not possible to make a farm business survey covering all farms. For this reason, sampling is done to select the representative farms to minimize cost in terms of time and resources for the study. In total 90 farmers were selected for achieving the objectives of the study. Among them, 41 were small farmers (land holding .02-1.0 ha), 35 were medium farmers (land holding 1.01-2.0 ha) and 14 were large farmers (land holding 2.01 to above ha).

In the present study, all essential primary and secondary data were collected for the study based on objectives of the study. The primary data were collected by the researcher himself from selected respondents through direct interview method using a set of well designed pre-tested questionnaires. After collecting the relevant data, editing was done before taking the data into Excel sheet for computation. Data entry and analysis were done by using Microsoft Excel Software. Descriptive statistics was mainly used during analysis of data. Proportions, ratios, average and percentages were drawn throughout the analysis. Cobb-Douglas revenue type

production function analysis was used to know the effect of variable inputs on the production of maize. The explanatory variables namely seeds, human labour, power tiller, irrigation, urea, DAP, MoP, zinc and insecticides were chosen for the model.

The survey was conducted in five villages namely Chhaikola Uttar Para, Kanairchar, Digholgram, Chhaikola Nodi Para under Chhaikola union and Noldanga under Handial union under Chatmohar Upazila of Pabna district. The main criteria for selection of the above mentioned five villages were higher concentration of maize farmers; some identical physical characteristics like topography, soil and climatic conditions for producing maize; easy communication facilities; and the farmers were cooperative so that the reliable data would be obtained.

Location was selected purposively and sample farmers were selected following random sampling technique. The present study covered six months period from January to June, 2015.

Method of Computation of Gross Return

The Gross return was calculated by multiplying the total volume of production of a product by the average price of that product in the harvesting period (Dillon & Hardaker, 1980). The following equation was used to calculate the gross return,

$$GR = \sum_{i=1}^n Q_m P_m + Q_b P_b$$

Where,

GR = Gross return of the product (Tk./ha);

Q_m = quantity of the product (Kg/ha);

P_m = Per unit price of the main product (Tk./kg);

Q_b = quantity of by product (kg/ha);

P_b = Per unit price of the by product (Tk. /kg);

Benefit Cost Ratio (BCR)

The BCR is a relative measure, which is used to compare benefit per unit of cost. The BCR was estimated as ratio of gross return and gross cost. The formula for calculating BCR (undiscounted) is shown below;

BCR = Gross return /Gross cost

Cobb-Douglas Revenue Type Production Function Model

The Cobb-Douglas revenue type production function was used to estimate the effects of key variables to the production processes of maize.

The following Cobb-Douglas revenue type production function was used in the present study:

$$Y_i = \alpha x_1^{\beta_1} x_2^{\beta_2} x_3^{\beta_3} x_4^{\beta_4} x_5^{\beta_5} x_6^{\beta_6} x_7^{\beta_7} x_8^{\beta_8} x_9^{\beta_9} e^{u_i}$$

By taking log in both sides in the Cobb-Douglas revenue type production function was transformed into the following logarithmic form because it was solved by the ordinary least square (OLS) method:

Where

In=Natural logarithm;

Y=Gross return (Tk. /ha.);

x_1 =Seed cost (Tk./ha.);

x_3 =Human labor cost (Tk./ha.);

x_5 =Power tiller cost (Tk./ha.);

x_1 =Irrigation cost (Tk./ha.);

x = Urea cost (Tk./ha.);

$x = \text{DAP cost (Tk./ha.)}$

x = MoP cost (Tk/ha)

$x \equiv \text{Zinc cost (Tk/ha)}$

$x = \text{Insecticides cost (Tk/ha)}$

α =Constant or intercept of the function (Tk₁/ha):

ϵ_i = Error term; and

$i=1, 2, 3, \dots, n$

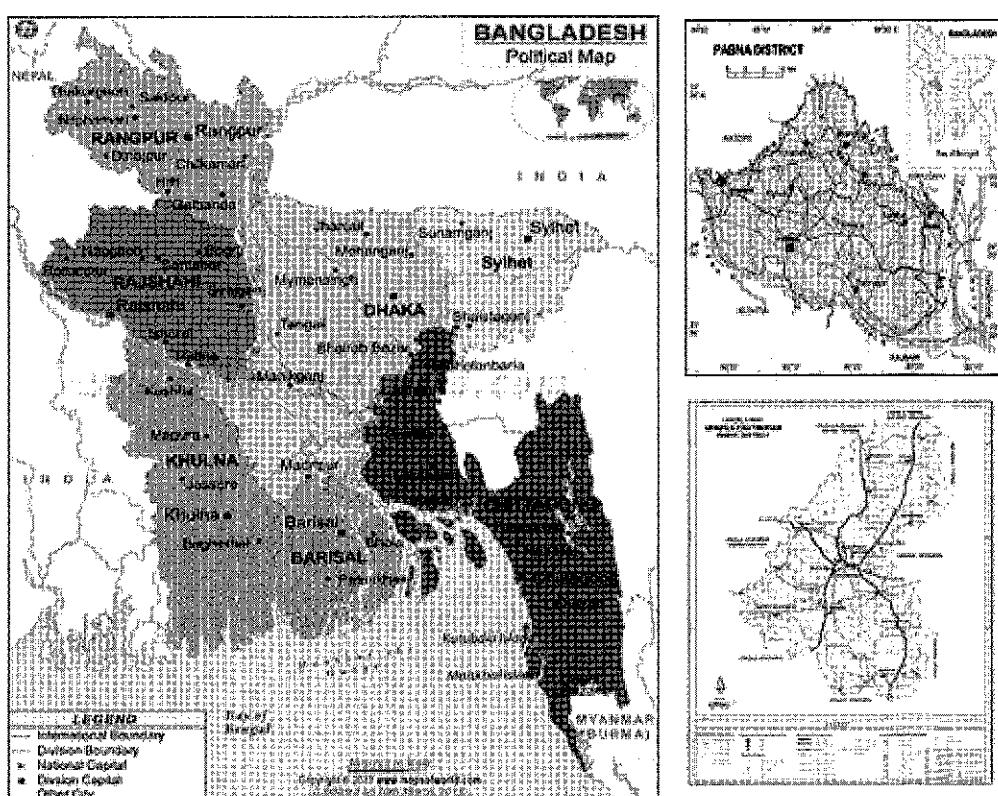


Figure 1. Map of Bangladesh along with Pabna district and Chatmohar Upazila

Results and Discussion

Educational Status of the Respondents

Education may be defined as the ability of an individual to read and write or formal literacy received up to certain standard. Educational status affects the adoption of appropriate technology and crop production. The government and various non-government organizations placed greater emphasis and extended special facilities (like free education, stipend, etc.) for increasing the literacy rate in the study area. Education helps a person to have day to day information about the modern technology, production cost, production skills, etc.

Sample farmers were classified or divided into four groups for examining the educational status of maize growers. These were a. illiterate, b. primary level (class 1-5), c. secondary level (6-10), and above secondary level of education. Illiterate are those who can't put signature and can't, read and write at all. Figure 2 shows the educational levels of maize growers.

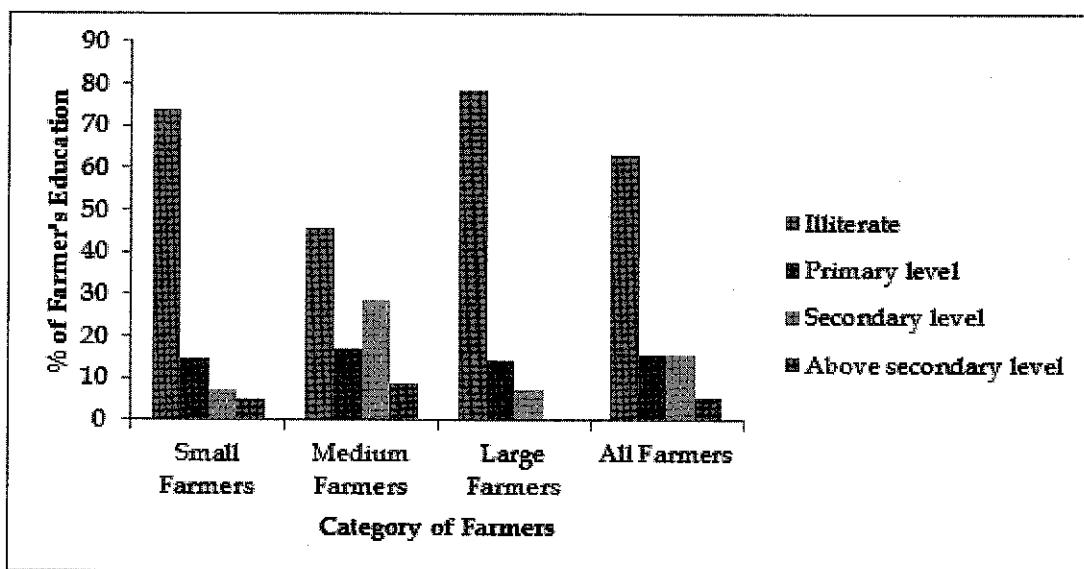


Figure 2: Literacy levels of farmers in the study area

Table 1: Per Hectare Yield, Total Cost, Gross Return, Net Return and BCR of Maize Production

Particulars	Small farmers	Medium farmers	Large farmers	All farmers
Yield (Kg)	9041.93	11336.32	13126.14	10923.30
Gross Return (Tk.)	145276.70	154156.20	157559.20	151736.40
Total cost (Tk.)	79334.23	85093.83	86071.25	83237.57
Net Return (Tk.)	65942.45	69062.39	71487.95	68498.83
BCR (undiscounted)	1.831	1.811	1.830	1.822

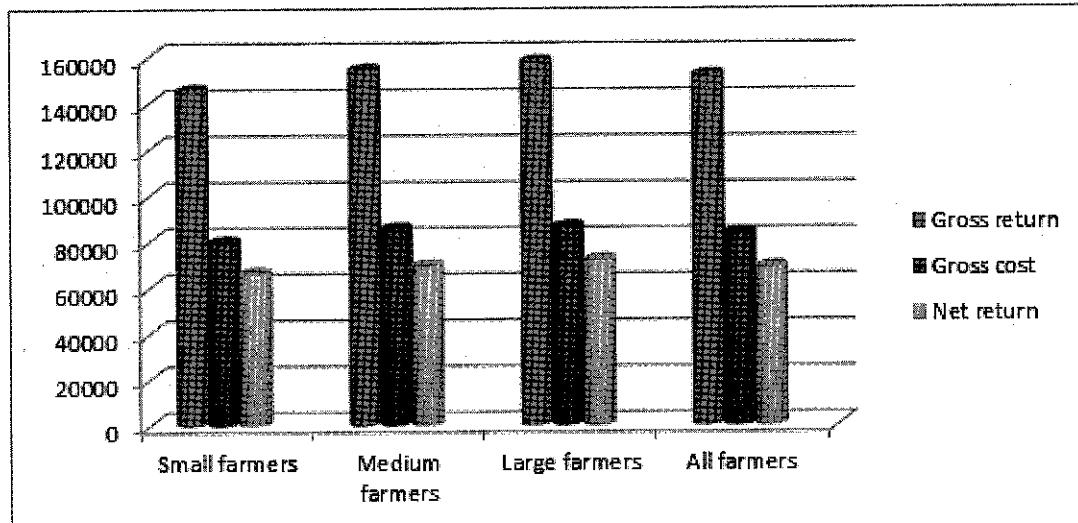


Figure 3: Gross returns, Gross cost and Net return for small, medium, large and all farmers

From the above discussion, it is clear that cost incurred by the small farmers are less than medium and large farmers i.e. small farmers used less input than medium and large farmers. This comprehensive study reveals that large farmers get higher return than small and medium farmers. Per hectare net return for small, medium and large farmers were Tk. 65942.45, Tk. 69062.39 and Tk. 71487.95 and BCR were 1.831, 1.811 and 1.830 respectively. However, the study concluded that BCR is higher in small farmers than medium and large farmers and BCRs of all farmers' categories are satisfactory for all categories of farmers. The study also reveals that average benefit cost ratio of all farmers in the study area is 1.82 that means maize cultivation is profitable in the study area. The costs and returns of maize production will have strong effect of inputs on maize production which will be analyzed in the next chapter.

Functional Analysis

Production function is a relation (or mathematical relationship) specifying the maximum output that can be produced with given inputs for a given level of technology. It applies to a farm or as an aggregate production function to the economy as a whole (Samuelson and Nordhans, 1995). Considering the effects of explanatory variables on gross return of maize crops, nine explanatory variables namely seed cost (X_1), human labour cost (X_2), power tiller cost (X_3), irrigation cost (X_4), urea cost (X_5), DAP cost (X_6), MoP cost (X_7), zinc cost and insecticides cost (X_8) were chosen as key independent factors to estimate the quantitative effect of inputs on gross return of maize production. All these variables have been estimated as per hectare monetary values. However, other important variables such as management, land quality, soil type, sowing time and weather etc., were excluded in the analysis due to paucity of reliable data. To explore the input output relationships production function was fitted in all the locations. Of possible statistical forms, Cobb-Douglas production function, most popular in farm-firm analysis, was used as this algebraic model which provides a compromise (a) adequate fit of the data, (b) computation feasibility, and (c) sufficient degrees of freedom unused to allow for statistical testing. In other words, the Cobb-Douglas is a relatively "efficient user" of degrees of freedom (Heady and Dillon, 1961).

Interpretations of the Results

Estimated values of co-efficient and related statistics of Cobb-Douglas production function model for maize production for all farmers are shown in Table 2. Nine explanatory variables were taken into consideration for production function analysis of the farmers' efficiency in maize production. These are interpreted below:

Seed cost (X_1)

It can be seen from Table 7.1 that regression coefficient of seed cost was 0.235 for maize. It was positive and was significant at ten percent probability level. The coefficient indicated that an increase in one percent of seed cost, remaining other factors constant, would result in an increase in the gross return by 0.235 percent.

Human labour cost (X_2)

The regression coefficient of human labour cost was 0.266 with a positive sign. It was significant at one percent level of significance. It implies that one percent increase of human labour cost, keeping other factors constant, would lead to an increase in the gross return by 0.266 percent for maize (Table 2).

Power tiller cost (X_3)

It can be seen from Table 7.1 that regression coefficient of power tiller cost was 0.409 for maize. It was positive and significant at five percent level of significance. This indicates that an increase in one percent of power tiller cost, remaining other factors constant, would result in an increase in the gross return by 0.409 percent.

Irrigation water cost (X_4)

It can be seen from Table 7.1 that the magnitude of the regression coefficient of irrigation water cost was -0.121 for maize. It was negative and can't significant statistically. This indicates that an increase one percent of irrigation water cost, remaining other factors constant, would result in an decrease in the gross return by 0.121 percent. It is also stated that use of additional irrigation water would be harmful for maize production.

Urea cost (X_5)

The regression coefficient of urea cost indicates that there was insignificant but positive relationship between urea cost and gross margin from maize production for farmer. The coefficient of urea cost was 0.141 indicates that an increase in one percent of urea cost, remaining other factors constant, would result in an increase in the gross return by 0.141 percent. So use of additional urea cost is appreciable to maize producing farmers.

DAP cost (X_6)

The regression co-efficient of DAP cost was -0.068 which was negative and insignificant, which indicates an inverse relationship between gross return and DAP cost. That means, in response to one percent increase of DAP cost, on an average, decreases gross return by 0.068 percent for maize production (Table 2).

MoP cost (X_7)

The regression co-efficient of MOP cost was 0.130 which was significant at ten percent probability level. It indicates that one percent increase of MoP cost, on an average, significantly increased gross return by 0.130 percent for maize production keeping all other factors constant (Table 2).

Zinc cost (X_8)

The regression co-efficient of zinc cost for maize production was positive and significant for the farmers at ten percent level of significance and the coefficient was 0.010. It indicates that holding others factors constant one percent increase in cost of zinc would increase the gross return by 0.010 percent (Table 2).

Insecticides cost (X_9)

It can be seen from Table 2 that the regression co-efficient of insecticides cost for maize production was 0.012 with positive sign and the relationship between insecticides and gross return from maize production for farmers was not significant. It indicates that holding others factors constant, one percent increase in insecticides cost would increase the gross return by 0.012 percent.

Table 2: Estimated values of co-efficient and related statistics of Cobb-Douglas production function model for maize production

Explanatory variables	Unstandardized coefficient		Standardized coefficient Beta	t-value	Significance level
	B	Standard error			
Intercept/Coefficient	2.957	0.342		8.634	.000
Seed cost (X_1)	0.235***	0.141	.219	1.664	.100
Human labour cost (X_2)	0.266*	0.100	.244	2.645	.010
Power tiller cost (X_3)	0.409**	0.151	.401	2.707	.008
Irrigation cost (X_4)	-0.121	0.119	-.121	-1.021	.311
Urea cost (X_5)	0.141	0.123	.138	1.151	.253
DAP cost (X_6)	-0.068	0.087	-.077	-0.780	.438
MoP cost (X_7)	0.130***	0.069	.149	1.885	.063
Zinc cost(X_8)	0.010***	0.006	.048	1.648	.103
Insecticides cost (X_9)	0.012	0.008	.052	1.506	.136
R^2			.94		
Adjusted R^2			.93		
F-value			141.38		
Returns to scale $\Sigma(b_i)$			1.01		

Note: * = Significant at 1% level

** = Significant at 5% level

*** = Significant at 10% level

Overall Performance of Model

Coefficient of Multiple Determinations (R^2)

The value of the coefficient of multiple determinations (R^2) was 0.94 for farmers in maize production. It indicates that about 94 percent of the variations of the gross returns are explained by the explanatory variables included in the model.

Goodness of Fit (F-value)

The F-values of the estimated production was significant at one percent level of significance for maize farmers, (Table 2), which implies goodness of fit of the model. That is, all the explanatory variables included in the model were important for explaining the variations of maize production.

Returns to Scale ($\sum bi$)

The summation of all the regression coefficients or production elasticity of the estimated model gives information about the returns to scale, that is, in response of output to a proportionate change in all inputs. The sum of all the production coefficients of the equations for maize production was 1.013 (Table 2). These indicate that the production function exhibited increasing returns to scale for the maize production. It means there is scope to increase gross return by increasing inputs in maize production in the study areas.

The regression coefficient of irrigation water and DAP cost was negative, which implied that holding others factors constant, if irrigation water and DAP cost would increase then production of maize would decrease. The other explanatory variables indicated that holding others factors constant, one percent increase in cost of one variable would increase the gross return for the cases of all farmers. Cobb-Douglas production function model revealed that the key variables included in the model were individually or jointly responsible for the variations in gross return of maize.

The present study also reveals socioeconomic characteristics as like as age, educational status, occupation, farm size and land ownership pattern, etc. The study also indicated that agriculture was the main occupation in the study area. About 94.50 percent people involved in agricultural activities. Some were also involved in small business and services. The study also reported that, most of the farmers (63.73 percent) were illiterate in the study area, although 15.38 percent received primary education. Moreover, 15.38 percent received secondary education and only 5.49 percent got education above secondary level. It is also clear that, large farmers were more illiterate compare to other two groups.

The present study calculated cost and return of maize production and compared the income earning under different farmers category such as small, medium and large farmers. Cost items in the study were seeds, human labour, power tiller, irrigation, fertilizers, pesticides, interest on operating capital cost and leased value cost considering one production period of maize production.

Per hectare gross return of output of maize for small, medium and large farmers were 9041.928, 11336.32, and 13126.14 kg respectively and products values were Tk. 145276.70, Tk. 154156.20 and Tk. 157559.20 respectively and average per hectare output was 10923.30 kg and its value was Tk. 151736.40.

Per hectare gross cost for maize production in the study area were calculated Tk. 79334.23, Tk. 85093.83 and Tk. 86071.25 for small, medium and large farmers respectively and average gross cost was Tk. 83237.57.

The values of adjusted R² was 0.934 indicating that after taking into account the degree of freedom (df), about 93 percent of the variations of dependent variable explained by the explanatory variables included in the model. The F-values of the estimated production was significant at one percent level of significance for maize farmers, (Table 7.1), which implies goodness of fit of the model. That is, all the explanatory variables included in the model were important for explaining variations of the gross return of maize production.

The summation of all the regression coefficients of the estimated model was 1.013 which exhibited increasing returns to scale for the maize production.

In the study area most of the farmers faced some major problems i.e. lack of capital, lack of technological knowledge, high prices of quality seed and fertilizers, lack of improved variety of seeds, stealing of maize cobs, maize plants damaged by domestic animal, low price of output, high price of input, etc.

Conclusions

The study revealed that maize production is profitable in the study area. Large farmers received higher profit compared to medium and small farmers. Maize is considered as the third most important cereal crops and it has more versatile uses in Bangladesh. Maize production helps in increasing the income of the farmers and creates employment opportunity of the farmers. But most of the farmers did not know about the application of input uses with right does in right time. The study will help farmers to solve their problems, needs and resource uses that can lead them to grow viable production practices and sustainable income from maize production.

Policy Recommendations

It has been proved that maize production is profitable in terms of yields, gross return and net return. Educational status of the respondents is very poor. Maize production is profitable but they need to get reasonable prices during harvesting time. Maize is being used as human food, fish feed, livestock and poultry feed and so on. So policy makers should concern about the increase of maize production. Farmers need loan facilities and proper training for having better management practices. GOs and NGOs should come forward with better education facilities, loan facilities and short term training programs for the maize producers in future.

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Impact of Electronic Media on Rural Livelihood: A Micro Level Study on Two villages of Bogra District of Bangladesh

Nusrat Jahan ¹

Abstract

Electronic media is a powerful communication tool. It has proved to be the most effective media in promoting livelihood improvement and development in rural areas as a tool for disseminating information to the mass people. This study was aimed to determine the impact of electronic media on rural livelihood. A total of 100 respondents were selected randomly from two village of two different upazila of Bogra district of Bangladesh. The result indicates that the majority of the respondents have access to electricity as well as electronic media. The findings of the study also shares that the respondents get agricultural and health related information frequently from their enjoyed programs meanwhile education and weather related information availability was found low. The result clearly indicates the effectiveness of electronic media and their impact upon all the arenas of rural livelihood. Moreover, two FGD were also conducted to collect the information on various aspects of the impact of electronic media on rural livelihood.

Key Word: Television, Radio, Impact on Rural Livelihood

Introduction

Bangladesh, often better known to the outside world as a country of natural calamities, is one of the most densely populated countries in the world. Despite rapid urbanization, more than 66% of the people still live in rural areas (World Bank, 2015). The density of the rural population is also one of the highest in the world.

Many people live in rural areas that lack services such as education, health clinics, and adequate roads, particularly road links to markets. An estimated 36 percent of the populations in rural areas live below the poverty line. They suffer from persistent food insecurity, own no land and assets, are often uneducated, and may also suffer serious illnesses or disabilities. Another 29 percent of the rural population is considered moderately poor. Though they may own a small plot of land and some livestock and generally have enough to eat, their diets lack nutritional value. As a result of health problems or natural disasters, they are at risk of sliding deeper into poverty. Women are among the poorest of the rural poor, especially when they are the sole heads of their households. They suffer from discrimination and have few earning opportunities, and their nutritional intake is often inadequate ("Rural poverty in Bangladesh", Rural Recovery Portal).

Being a low-income country, its main challenge is to eradicate poverty through increasing equitable income. Bangladesh has achieved the Millennium Development Goal (MDG) of eliminating gender disparity in primary and secondary school enrollment. A sharp decline in child and infant mortality rates, increased per capita income, and improved food security have placed Bangladesh on the track to achieving in the near future the status of a middle-income country.

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Mass media of Bangladesh particularly electronic media plays a vital role in disseminating information to the rural people. It has proven a powerful medium for appealing to mass audiences; it reaches people regardless of age, sex, income, or educational level. Mass media approaches in agricultural information dissemination generally, are useful in reaching a wider audience at a very faster rate. They are useful as sources of agricultural information to farmers and as well constitute methods of notifying farmers of new developments and emergencies. On the other hand, they are important tools in advancing public health goals.

Objectives

The major objective of the study was to understand the impacts of electronic media on rural livelihood in two villages of Shahjahanpur and Sherpur upazila under Bogra district. The specific objectives of the study were:

- a. To know the impact of electronic media on rural livelihood.
- b. To find out the present status of information sourcing of the rural people.
- c. To know the opinion of rural people towards electronic media.

Literature Review

Electronic media like radio and television have been serving as one of the most important media for diffusing the technical, systematic and scientific information to the people. In countries where literacy level is low especially in rural areas the choice of mass media is very important. In this context, television and radio play major role in transferring modern agricultural technology to educated and uneducated farmers within a short time for farmer communities (Nazari, & Hasbullah, 2008).

Television offers sight and sound, and it makes dramatic and lifelike representations of people and products. Mass media are the methods of communication such as, language, design, facial expression, print, radio, television, mobile phone, billboards and musical instruments etc to dig up large number of people at the same time. For example, television, when it broadcasts, it goes elsewhere and the people of different places can watch it (Berger, 2002).

The interaction between media messages and interpersonal communication was first described by Elihu Katz and Paul Lazarsfeld in their two-step flow hypothesis. They argued that media effects were moderated principally by interpersonal encounters. Community opinion leaders scan the media for information, and then communicate that information to others in interpersonal contexts. It is in this second step, interpersonal interaction that opinion leaders wield enormous power, influencing others not only by what they choose to reveal but also the slant that they use in conveying the message (Berger, 2002).

Electronic media are tools for the transfer of information, concepts, and ideas to both general and specific audiences. They are important tools in advancing public health goals. Communicating about health through mass media is complex, however, and challenges professionals in diverse disciplines (winnet and wallok, 1996).

The mass media particularly electronic media has increased spreading knowledge and information similarly has provided good output in recent years. The main reason of popularity of television among masses is that it's simple. It is the easiest way for getting information and learning in a

simplest way. Educational programs about health, education as well as agriculture development can be found in television (Buren, 2000).

We are living in a world that is saturated by mass media with our environment brimming with data and information (Hutchings and Matthews, 2008). In recent decades, the widespread use of the mass media has resulted in heightening the level of public knowledge in different fields (Buren, 2000). Among the diverse mass media, radio and television, due to their wide and vast range of viewers, have had an outstanding position particularly with regard to informal teaching, and are considered as the best cultural and educational media (Tancard and Verner, 2005).

Nowadays, access to education, information, knowledge, and communication plays a vital role in the individual and social life as well as human development and inclination towards growth. As a pre-requisite of knowledge, information, recognition and awareness are among the most efficient factors in reaching human development (WSIS, 2005).

Radio and television are the most effective tools in communication for the support of development (Hussain, 1997). Radio is acknowledged as the most important medium for communicating with the rural populations of developing countries (FAO, 2001).

Methodology

The study was conducted in two selected villages of Shahjanpur and Sherpur upazila under Bogra district were selected purposively. The number of sample population was 50 in each village and all together it was 100. The sample was selected by applying random sampling technique.

Data were collected by using both qualitative and quantitative methods. Under the quantitative method, data were collected using both close and open ended questionnaire at the household level from each village. To know the opinion of villagers regarding impact of electronic media on their livelihood, Focus Group Discussion (FGD) was conducted with the help of a guideline. Some related information was collected from the upazila and union parishad offices. Data were processed using Microsoft Office Excel Package.

Results and Discussions

General Information of the study villages

The village Kamarpara, under Chupinogor union of Shahjanpur Upazila is situated 18 km South-east and Atail village under Bhobanipur union of Sherpur upazila is situated 33 km south of Bogra district. The area of Kamarpara is about 5.3 km and Atail is about 1.0 km. The household number of Kamarpara is 520 and in Atail it's 200. In both of the two villages, some non-government organization like Grameen Bank, BRAC, Thangamara, Asha, are working for the development of the villagers.

Educational status of the Respondents

The literacy rate was found to be excellent (76%) among the respondents of Kamarpara, whereas it was 68% in Atail. The rate is a little bit low in Atail than Kamarpara because of having less access in education. But both of literacy rate is higher than the national literacy rate of 61.5% (UNESCO, 2015). Most of the people of selected villages have basic education. The details of educational qualification of the respondents are shown in Fig.-1.

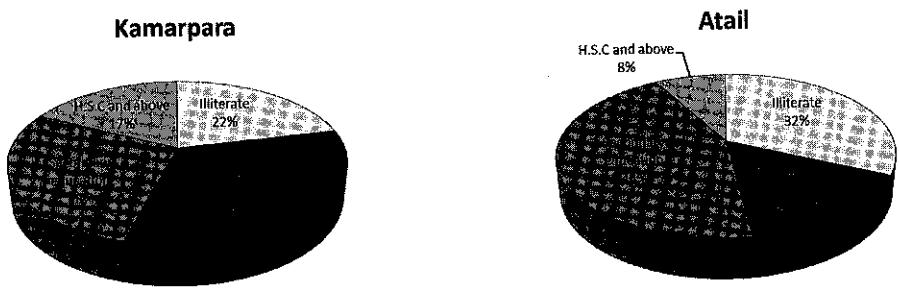


Figure 1: Educational qualification of the Respondents

Respondents Access in Electricity

Table –1 shows that, in the village Kamarpara 74 percent of the respondents have access in Electricity on their own house and the scenario is 80 percents in village Atail. But the respondents who have no access in electricity on their own, they used to enjoy programmers of television and radio in their neighbours home or in the tea stall of nearby market.

Table-1: Access of of Respondents Household

Access in Electricity Electricity	Percentage of respondents	
	Kamarpara	Atail
Yes	74	80
No	26	20

Occupational Status of the Respondents

It is evident from the bar chart that the main occupation of both of the village respondents of Kamarpara and Atail is agriculture (36% & 32%) significantly. Among the Respondents of that two village, 32 percent of the respondents of Atail was house wife whereas it was only 16% in village Kamarpara. In Kamarpara 34% resplendent occupied with some different occupation like rickshaw pulling, plumbing and day labour. (Fig-2)

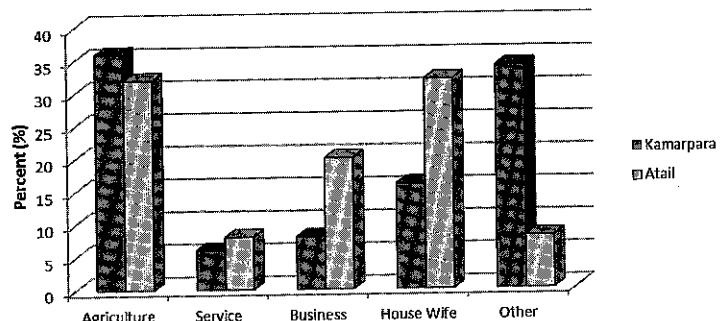


Figure: 2 Category of the respondents according to occupation

Availability of Electronic Media in Respondents Household

The bar graph below gives information on the ownership of television and radio at home, the result of the study shows that in village Kamarpara majority(50%) of the respondents have their own TV set and on the other hand only 36% respondents have TV in village Atail. However a small number (14%) of the respondents from village Kamarpara have radio where as it was only a few (8%) in village Atail. (Fig-3)

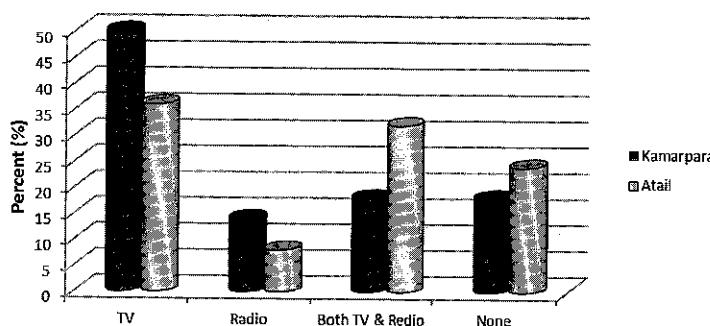


Figure-3: Availability of radio and television in the respondents' household

Exposure of Electronic Media and Impact

I. Exposure of Agricultural Program and Impact

In village Atail the highest percentage (73%) of respondents enjoyed agriculture related programs on television and radio as they are mostly occupied in farm activities. They said that they got different information about seed, fertilizers, pesticides and livestock from the agriculture related programs shown in television and listened the radio programs. They knew very important information regarding harvesting, crops, storage system and also marketing of the products from the programs. They use the information and have surprising impact on their livelihood. The same scenario was found in village Kamarpara. 74 percent of the respondents enjoyed agricultural program on TV & radio and have the impact on their daily life.(Fig-4)

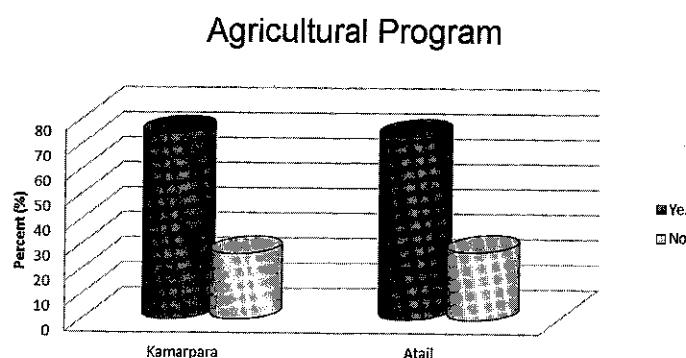


Figure-4: Percentage of agricultural program viewed by the respondents

II. Exposure of Health Related Programs and Impact

Figure-4 elaborated that the highest percentage (80%) of respondents of village Kamarpara enjoyed health related programs on television and radio especially the women. This has visible impact on them as they know what to do in the time of pregnancy, nutrition of their child and prevention of different seasonal diseases like fever, catching cold and so on. At the same time, a large number (71%) of the respondent of village Atail enjoyed health related program and use the information on their daily life. (Fig-5)

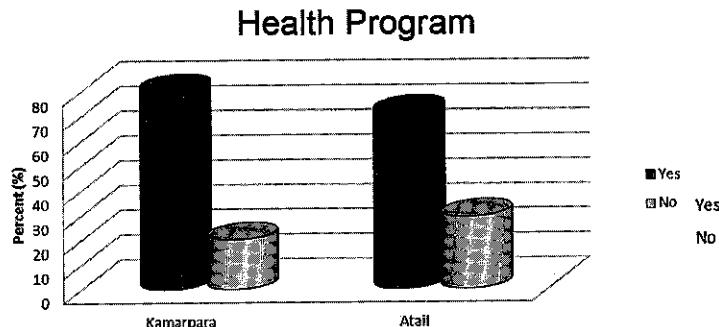


Figure-5: Percentage of health program viewed by the respondents

III. Exposure of Education Related Programs and Impact

In education sector Bangladesh is improving day by day. In this sector electronic media has a huge impact, in this study it shows that 78 percent of the respondents of village Kamarpara watch education related programs on television where as 48 percent of respondents of village Atail enjoy that on television and radio. But both of the respondents admit, they learn a lot of important things like child education, female education, various government initiatives regarding education from their viewed program. (Fig-6)

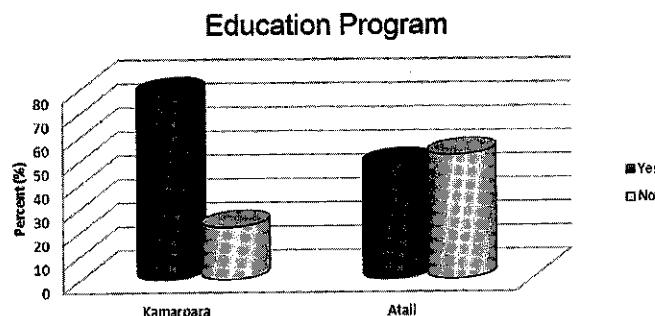


Figure-6: Percentage of education related program viewed by the respondents

IV. Exposure of Weather Related Programs and Impact

In case of weather related programs a negative scenario found in village Atail. Only a few (17%) respondents watch weather related programs. On the other hand, it is 66 percent of the respondents of village Kamarpara watch weather programs. All of the respondents needs more information as they said, they want to know what to do if sudden flood occurs due to heavy rainfall or if the

coming winter pleasant and productive for them or not. They also mentioned that they need regular weather forecast in television and radio. (Fig-7)

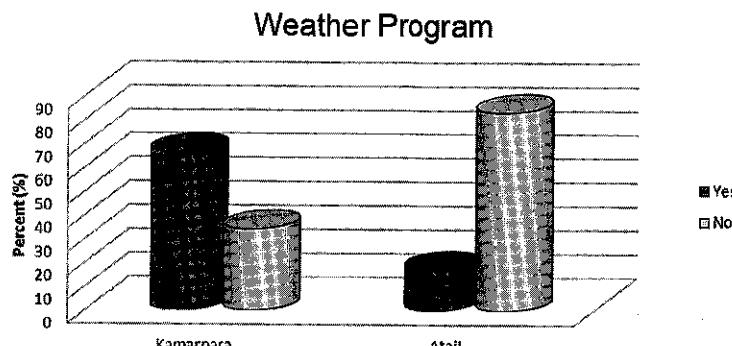


Figure-7: Percentage of weather related program viewed by the respondents

Opinions from Focus Group Discussion (FGD)

From the Focus Group Discussion, some significant additional information both positive and negative impact of electronic media came out as follows:

Positive Impact

Programs related to agriculture play quietly a positive role among villagers. They apply some to the techniques in growing crops and vegetables and also learn the uses of fertilizers, pesticide and preservation of seed. At the same time watching educational program, parents are encouraged to send their daughter to school. Moreover, most of the villagers watch live health care related programs. They inspired to use sanitary latrine after viewing the program in the TV, at the same time learnt how to maintain personal hygiene like hand washing and tooth brushing etc. Pregnant women were benefitted by telemedicine.

Negative Impact

Female members of the family mostly prefer to watch entertainment based programs like daily drama serial or movies in Indian Bengali channels. The respondents specially the villagers from elder generation think that, this is occurring bad impact on their family life. And from this cross-culture, our native culture is in threat as the women of the home try to follow the things which are shows on the Indian drama serial. Besides, the impact of cartoon channels is not always positive because children spend more time watching TV rather than study. Moreover, as most of the cartoon shows are in Hindi language, parents want their child to watch those in Bengali language because their child are getting familiar to different culture and language instead of their own one.

Recommendation

- There is need to produce more rural livelihood related program on electronic media.
- Electronic media has the potential role to reach large audiences at low cost. So, rural livelihood related program should be broadcasted on TV and radio more frequently
- The time schedule of on-air programs should be fixed in different channels regarding the availability of rural audience

- The electronic media authority should make more and more special program for the rural people.
- Electronic media should be more dedicated to disseminate necessary information regarding agriculture, health, education and weather.

Conclusion

Mass media offers effective channels for communicating agricultural messages, which can increase knowledge and influence behavior of the intended audience. Broadcast media have the ability to disseminate information to large audiences efficiently; the radio can be a particularly important channel. Since the radio plays a more important role in public education, producers should be familiar with the latest and newest program structures to be able to meet the needs of people by employing appealing methods. Based on the research findings, the farmer's literacy level plays an influential role in the extent of his/her use of available media. The relevant institutes and organizations should provide appropriate opportunities for the development of formal and informal education in a move to decrease illiteracy levels in rural communities.

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Dehydration Behavior of Summer Onion in Solar cum Mechanical Dryer

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Abstract

Experiment was carried out on dehydration behavior of most perishable summer onion in solar cum mechanical dryer with temperature variation of solar energy and electrical energy separately or combinedly. Dehydration was done with one kilowatt one fan (1 kW 1F), two kilowatt one fan (2 kW 1F), two kilowatt two fan (2 kW 2F) and solar dehydration with no fan/one fan/two fan (S1F/S2F) respectively. Dehydration behavior of onion slices having thickness 3, 5 and 7mm in upper and lower shelf's of dryer were also investigated. It was observed that 3mm thick onion slices become wrinkled during dehydration. On the other hand 5 and 7mm thick onion slices were chosen as good dried product. It was also found that, for a specific moisture ratio (MR), faster dehydration was achieved for thin samples compared to thicker ones. Activation energy (Ea) for diffusion of water from onion was 4.25 kcal/g -mole and 12.02 kcal/g-mole for mechanical and solar dehydration respectively at upper shelf for 7mm thick slices indicating that the solar dried samples are more temperature dependent than those dried in mechanical mode.

Key words: Dehydration behavior, Summer onion, Activation energy

Introduction

Onion is also important commercial vegetable crop as well as spice crop all over the world (Bose et al., 1993). It may be grown in most of the districts of Bangladesh. The cultivable area and production of onion in Bangladesh are increasing every year. The imported cost of onion in 2009-10 was about 1516 crore taka (Bangladesh Bank).

Normally, onion is cultivated during the winter/robi season (October-February) in Bangladesh. Spices Research Center (SRC) of Bangladesh Agriculture Research Institute (BARI) developed three varieties known as BARI piaz -2, BARI piaz -3

and BARI piaz -5 which are being grown in summer season. The yield of these varieties is 4-5 times more than that of winter onion, but their keeping quality is very poor.

In developed countries about 45% of entire output of fresh onion is dehydrated and sold to the food processors for use in several meal preparations (Pruthi, 1998). Furthermore, onion powder, onion chip, onion fry, onion bread, onion bacon etc. can be produced by processing onion, which are being increasingly available in the American and Asian market. It is also being used in different food preparation notably in chutney, pickles, curried vegetables, meat preparation, tomato ketchup

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and the like (Pruthi, 1998). Onion is useful in fever, dropsy, catarrh and chronic bronchitis and mitigate cough in phthisis (Singh, 2003).

Onions are available in large quantity during the harvesting season. Most of them are not utilized properly due to huge supply in peak season, lack of adequate processing and preservation technology. As a result about 50 percent post-harvest loss is observed in winter onion during storage and the summer onion which can not be kept more than 15-30 days (BARI, 2010).

Onion can be preserved for long duration using chilling/freezing, dehydration and osmotic dehydration. However, chilling/freezing is a costly method and requires availability of cold storage. For long term preservation dehydration is considered to be the best option for developing countries like Bangladesh. Dehydration can be done in sun or solar/mechanical dryer. But summer onion produces more in rainy season. Sunshine is not available in rainy season. Due to low temperature in sun drying, it takes more time. Furthermore, other dust or inert material may includes in dehydrated products when dehydration is done in open threshing floor. In solar/mechanical/solar cum mechanical dryer temperature becomes more which enhanced dehydration rate. The main advantage of combined solar cum mechanical dryer is, it can run when sunshine is not available or in raining season even night using electrical energy. Thus dehydration of onion would reduce wide fluctuation of prices in peak harvesting period and the off season. Dehydration also can reduce the volume of products and minimize transportation cost so that consumer will get good quality product at minimum price. The overall objective of this research work was to know dehydration behavior of summer onion in a combined solar cum mechanical cabinet dryer with variable temperature.

Materials and method

To analyze the experimental data, Fick's 2nd law of diffusion was used (Brooker et al. 1974 and Islam, 1980). Thickness dependence of dehydration rate was analyzed by plotting "log" of dehydration rate constant (m) against "log" of sample thickness (L); the relationship is derived from the solution of Fick's 2nd law of diffusion (Islam, 1980). To determine the temperature dependence of diffusion co-efficient, (Dc) was plotted against inverse absolute temperature (Tabs-1) as per Arrhenius equation (Brooker et al. 1974 and Islam, 1980).

Description of dryer and operational conditions:

The developed dryer (Fig. 1) can be used in 3 mode such as mechanical, solar and combined solar and mechanical mode (combined mode). In the mechanical mode, heated air at different velocities can be used for drying. For solar drying, the surrounding air comes into the air heating chamber and becomes hot as it collects heat from black collector as well as from direct sunlight. The heated air passes through the duct as a result of density variation. For the combined mode, both the solar and mechanical arrangement runs together providing heated air for air drying. As reported by Bhuiyan et al. (2011) the highest temperature (700C) was achieved in the upper shelf by 2 kW -1F and was successively followed by 600C by 2 kW-2F, 56.7°C by 1 kW -1F and 47°C 1 kW-2F and for lower shelf the highest temperature (500 C) was given by 2 kW -1F, while the lowest temperature (42°C) was given by 1 kW -2F, and 47°C was given by either 2 kW -2F or 1 kW -1F. The velocity of air for system with 1 fan was 0.35 m/sec. and that system with 2 fan was 0.7 m/sec as recorded by an Anemometer.

Dehydration of onion

For both the solar and mechanical drying, the peeled and cleaned onion slices of different thickness (3, 5 and 7mm) were placed on each shelf in single layer and hot air passed through the shelf and the products were dried for desired periods. The weight of slices was noted at a regular interval of 1hr from the known initial

moisture content and the moisture content at any time interval was calculated. To investigate influence of temperature on dehydration rate at constant air velocity, sample with constant thickness was dried at variable temperature using various fan-heater combinations.



Fig 1: Solar cum mechanical dryer

Results and Discussion

An experiment was conducted to determine the effects of thickness of onion slices on dehydration rate using the mechanical mode of the designed drier at constant temperature (1 kW 1F, 56.70C). Another experiment using the same dryer was conducted by using 7mm thick onion slices at different temperature to investigate the effect of temperature on dehydration rate. Comparative dehydration studies were undertaken to determine effectiveness of dehydration using upper shelf, lower shelf and solar or mechanical mode of the designed dryer. Diffusion co-efficient and activation energy for different fan-heater configuration in mechanical and solar mode and thickness dependency of dehydration rate constant were also investigated with respect to 1 kW 1F and 1 kW 2F, respectively.

Effect of thickness and temperature on dehydration

Experiments were conducted to determine dehydration time in the designed combined mode dryer for 3, 5 and 7mm thick onion slices in mechanical mode (1 kW 1F, 56.70C) and also to determine dehydration time for 7 mm onion slices at different temperature such as 70, 56.7, 47 and 38.5 0C given by 2 kW 1F, 1 kW 1F, 1 kW 2F and solar with one fan (S1F) mode respectively. The moisture ratio (MR) versus dehydration time (hr) was plotted in semi-log paper and regression lines were drawn (Fig.2-3) and the following equations were developed.

$$MR = 1.2436e^{-0.612t}, R^2 = 0.980 \text{ (for 3mm, } t=\text{hr)} \quad 1 \text{ kW 1F (56.70C)} \quad \text{---} \quad (1)$$

$$MR = 1.0791e^{-0.409t}, R^2 = 0.993 \text{ (for 5mm, } t=\text{hr)} \quad 1 \text{ kW 1F (56.70C)} \quad \text{---} \quad (2)$$

$$MR = 1.0188e^{-0.295t}, R^2 = 0.998 \text{ (for 7mm, } t=\text{hr)} \quad 1 \text{ kW 1F (56.70C)} \quad \text{---} \quad (3)$$

$$MR = 0.9239e^{-0.395t}, R^2 = 0.995 \text{ (for 700C, } t=\text{hr)} \quad 2 \text{ kW 1F, 7mm} \quad \text{---} \quad (4)$$

$$MR = 1.0576e^{-0.236t}, R^2 = 0.992 \text{ (for 470C, } t=\text{hr)} \quad 1 \text{ kW 2F, 7mm} \quad \text{---} \quad (5)$$

$$MR = 1.0309e^{-0.217t}, R^2 = 0.990 \text{ (for 38.50C, } t=\text{hr)} \quad S1F, 7mm \quad \text{---} \quad (6)$$

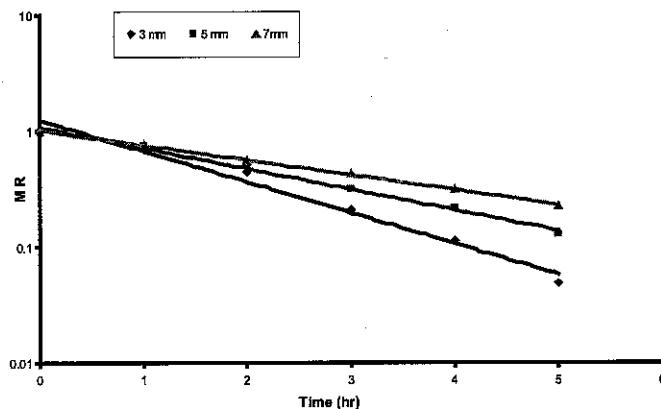


Fig. 2 Effect of thickness on dehydration rate of onion slice using 1 kW 1F (56.70C)

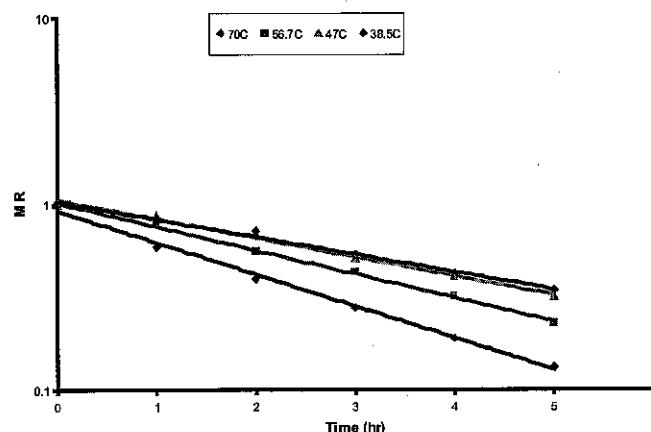


Fig. 3 Effect of temperature on dehydration rate of onion slice using 2 kW 1F, 1 kW 1F, 1 kW 2F and S1F

Table 1: Time required to dry for various temperature and thickness

Mode	Dehydration time (hr) at different thickness at 56.7 (1 kW 1F)			Dehydration time (hr) for 7mm thick onion slices at different temperature			
	3mm	5mm	7mm	70°C (2 kW 1F)	56.7°C (1 kW 1F)	47°C (1 kW 2F)	38.5°C (S1F)
MR=0.1	4.12	5.81	7.88	5.63	7.88	9.98	10.75
$a_w = 0.65$	6.45	9.29	12.72	9.24	12.72	16.03	17.33

From Fig. 2 and equations 1-3 it is seen that for a given thickness MR or mc (db) decreases with time and that the higher is the thickness the longer is the dehydration time and consequently the lower is the rate constant. But the dehydration time does not increase proportionately as thickness increases and dehydration with thicker products would result in efficient drying. For example, at moisture content (19.5% db) corresponding to 0.65 aw, dehydration time of 3mm onion slice is 6.45 hr. Accordingly dehydration time for 5 and 7mm should be 11 and 15 hr but is 9.3 and 12.7 hr (Table 1) respectively with 15 to 16 % increased efficiency.

Here moisture content corresponding to aw 0.65 is considered for calculation of MR as it is regarded as stable one for preservation up to 1 year from the viewpoint of microbial growth (Nickerson and Sinskey, 1977). MR 0.1 is another important value as in most commercial plant, the product leaves the installation for thin layer dehydration and enters bin dryer for completion of dehydration (Van Arsdel et al, 1972). Dehydration time to MR =0.1 is quite low for a given thickness (Table 1) compared to that required to attain lower moisture content corresponding to aw 0.65. However 15-16% efficiency will be increased when sample thickness is increased from 3 to 5 or 7mm in thin layer dehydration.

From Fig (2) and the developed equation (3 to 6) it is clearly seen that when temperature is increased, dehydration rate constant is also increased and the dehydration time to moisture content corresponding to MR= 0.1 or aw=0.65 decreases at constant sample thickness. The least dehydration time was achieved by 2 kW 1F at 70°C, followed by 1 kW 1F at 56.7°C and 1 kW 2F at 47°C, while the highest dehydration time (almost twice that of 2 kW 1F) was required at 38.5°C by S1F to dry 7 mm onion slice.

From the data (Table 1) it can be shown that time to dry to moisture content corresponding to aw=0.65 is 61 to 64% higher than that required to dry to MR=0.1 for the different configurations.

Comparison of dehydration behavior at constant thickness among upper shelf, lower shelf and natural convection

For a particular thickness and dehydration condition upper shelf showed higher dehydration rate constant compared to lower shelf due to temperature difference (from equation 3 vs 8 and 7 vs 9).

The experimental dehydration data were analyzed and plots of moisture ratio versus dehydration time were made on semi log scale and regression lines were drawn and the developed equations are given below:

For 7mm thick slice (Upper shelf)

$$MR = 0.899e - 0.24x \text{ (At 600C), } R^2 = 0.970 \quad (2 \text{ kW 2Fan}) \quad (7)$$

For 7mm thick slice (Lower shelf)

$$MR = 1.009e - 0.21x \text{ (At 470C), } R^2 = 0.994 \quad (1 \text{ kW 1Fan}) \quad (8)$$

$$MR = 0.919e - 0.23x \text{ (At 470C), } R^2 = 0.975 \quad (2 \text{ kW 2Fan}) \quad (9)$$

For 7mm thick slice (For natural convection, Solar mode)

$$MR = 1.010e - 0.22x, R^2 = 0.980 \text{ (at 40.10, 0C Upper shelf)} \quad (10)$$

$$MR = 1.026e - 0.20x, R^2 = 0.981 \text{ (at 37.71C, 0C Lower shelf)} \quad (11)$$

$$MR = 1.045e - 0.21x, R^2 = 0.990 \text{ (at 38.5, 0C Upper shelf with one fan, 0.35m/sec)} \quad (12)$$

$$MR = 1.031e - 0.18x, R^2 = 0.992 \text{ (at 37.4, 0C Upper shelf, with 2 fan, 0.7m/sec)} \quad (13)$$

X = Time in hr.

From equations 3-9 it is seen that the highest dehydration rate constant (0.395 hr⁻¹) was obtained at 70 0C (2 kW 1F) successively followed by 0.295 hr⁻¹ at 56.7 0C (1 kW 1F), 0.24 hr⁻¹ at 60 0C (2 kW 2F) and at 47 0C (1 kW 2 fan) in the upper shelf, while lowest dehydration rate constant (0.21 hr⁻¹) was given at 47 0C (1 kW 1F) in the lower shelf.

Again from equations 10-11 it is seen that natural convection in the upper shelf gave highest dehydration rate constant (0.22 hr⁻¹) at 40.100C which was closely followed by 0.20 hr⁻¹ that is found in the lower shelf for natural convection, particularly for thin layer dehydration. It is also seen that from equations 12 and 13 that the rate constant for dehydration onion in upper shelf decreases as air flow increases as is evident from lower temperature condition with resultant lower rate constant such as 0.21 hr⁻¹ at 38.50C and 0.18 at 37.40C at air velocity 0.35 m/s (1 Fan) and 0.7m/s (2 Fan) respectively.

The observation that upper shelf gives higher rate constant at identical conditions than lower shelf is evidently due to higher temperature in the upper shelf. For forced solar dehydration the observed lower dehydration rate by doubling air flow is again attributable to lower temperature condition possibly due to higher heat loss. A simple energy and mass balance (Heldman,1977) will show that higher air flow with constant heater power would give lower temperature condition and higher energy loss in the process of dehydration, particularly in thin layer dehydration(Islam,1980). It is expected that in deep bed dehydration the energy will be more efficiently utilized with resultant higher dryer throughput.

Diffusion co-efficient and activation energy

From the dehydration rate constant in equations 3-13, diffusion coefficients were determined (Table 2). It is seen that for 7 mm onion slice, 2 kW 1F gave the highest diffusion coefficient and was successively followed by 1 kW 1Fan, while 1 kW 2 Fan and 2 kW 2 Fan configurations gave the lowest diffusion coefficient. Again for solar operation, natural convection gave the highest diffusion coefficient and was followed by single fan configuration while double fan

configuration gave the lowest diffusion coefficient and is related to successively lower temperature attained in the dryer due to respective configuration. It has been noted that diffusion coefficient is related to inverse absolute temperature by Arrhenius type of equation (Islam, 1980 and Heldman, 1977) and the diffusion coefficient is also related to sample thickness (Rahman & Kumar, 2007).

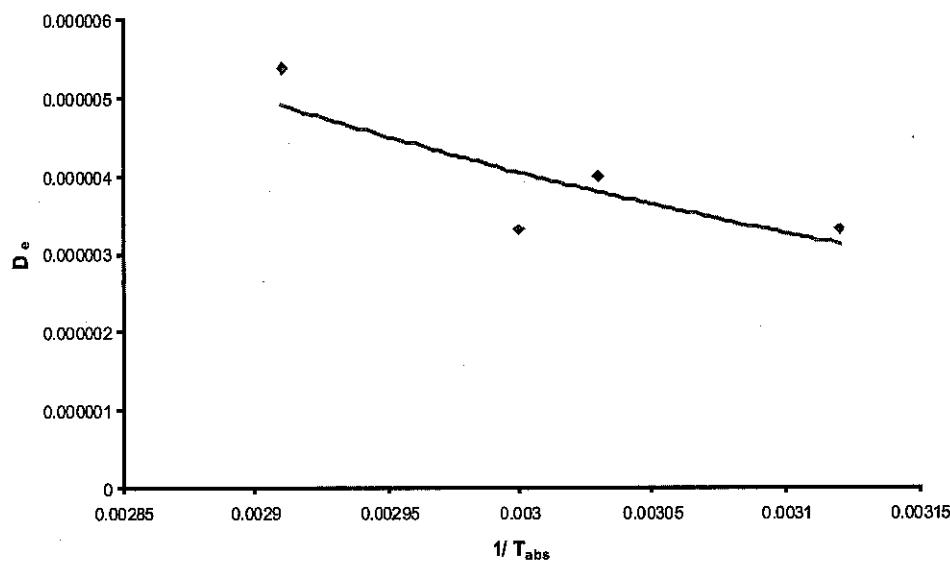


Fig. 3 Effect of temperature on diffusion co-efficient of onion at upper shelf (mechanical)

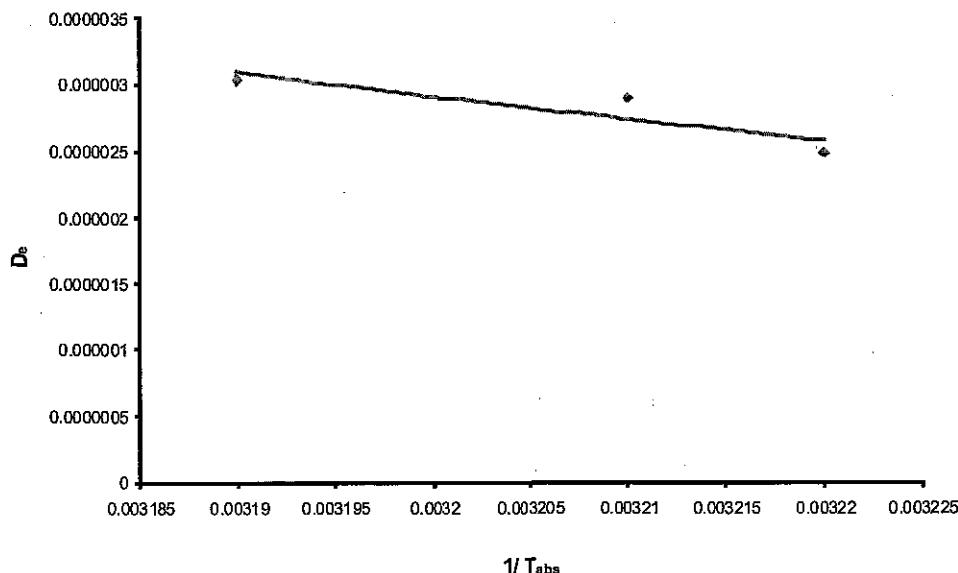


Fig. 4 Effect of temperature on diffusion co-efficient of onion at upper shelf (solar)

Table 2 Relationship between temperature and diffusion coefficient (Dc) for 7mm thick onion slices at upper shelf for various condition

Dehydration method	Condition	1/T _{abs}	D _e (cm ² /Sec)	Activation Energy, E _a (kcal/g - mole)
Mechanical	1 kW 1 Fan (56.7 °C)	0.00303	0.000003999	4.25
	1 kW 2 Fan(47 °C)	0.00312	0.000003309	
	2 kW 1 Fan (70 °C)	0.00291	0.000005378	
	2 kW 2 Fan (60 °C)	0.00300	0.000003309	
Solar	2F (37.4 °C)	0.00322	0.000002482	12.02
	1F (38.5 °C)	0.00321	0.000002896	
	Convection(40.10 °C)	0.00319	0.000003034	

Thus diffusion coefficient and corresponding inverse absolute temperature data were used to develop exponential type popularly known as Arrhenius equation was developed by regression analysis. The equations are as follows:

$$D_c = 0.0025 e^{-2140.2 T_{abs} - 1}, R^2 = 0.887 \text{ 7mm slice (Upper shelf, Mechanical type)} \text{--(14)}$$

$$D_c = 793.81 e^{-6070.1 T_{abs} - 1}, R^2 = 0.955 \text{ 7mm slice (Upper shelf, Solar type)} \text{-----(15)}$$

Where, D_c = Diffusion coefficient (cm²/S) and T_{abs} = Absolute temperature (0K)

From the developed equation (14 and 15) it is seen that activation energy for diffusion of water from onion using mechanical and solar type configurations are respectively 4.25 kcal/g -mole and 12.02 kcal/g -mole. These values are within the activation energy values reported by a number of authors such as 26.83 kcal/g -mole for onion by Afzal Babu et al. (1997), 18.16 kcal/g-mole for carrot by Eim et al. (2013), 5.25 kcal/g -mole for Stevia leaves by Syduzzaman and Sharmin (2009). The difference in activation energy (E_a) might result from differences in product characteristics, temperature range employed for processing as reported by Islam (1980), Charm (1971) and Villota and Hawkes (1992).

Thickness dependency of dehydration rate constant

To investigate the effect of thickness (3, 5 and 7mm) on dehydration rate constant , the thickness and the corresponding dehydration rate constant were plotted in log-log coordinate (Fig 5 and 6). And it was found that dehydration rate constant decreases as the thickness increases thus the dehydration rate constant is inversely related with the thickness. The following power law equations were developed:

$$Y = 1.606x^{-0.869}, R^2 = 0.994 \text{ (1 kW 1F, 56.70C)} \text{-----(16)}$$

$$Y = 0.619x^{-0.448}, R^2 = 0.761 \text{ (1 kW 2F, 47 0C)} \text{----- (17)}$$

$$Y = 0.6671x^{-0.635}, R^2 = 0.989 \text{ (S1F, 38.50C)} \text{----- (18)}$$

$$Y = 2.2157x^{-1.320}, R^2 = 0.903 \text{ (S2F, 37.40C)} \text{----- (19)}$$

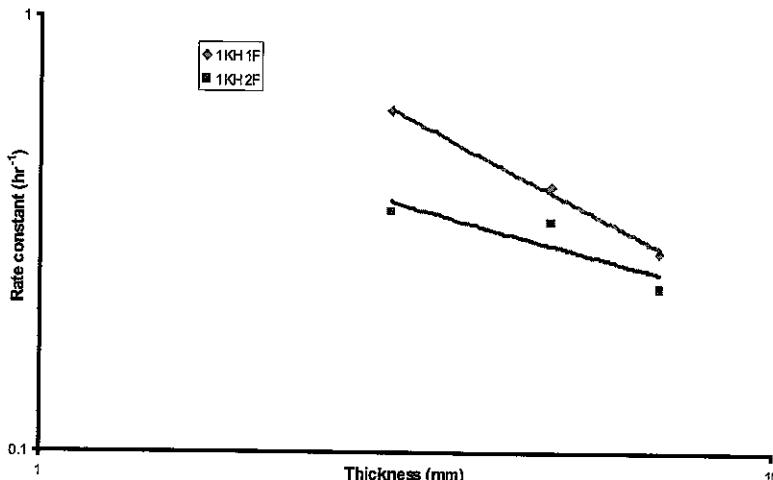


Fig. 5 Effect of thickness on dehydration rate constant in mechanical mode

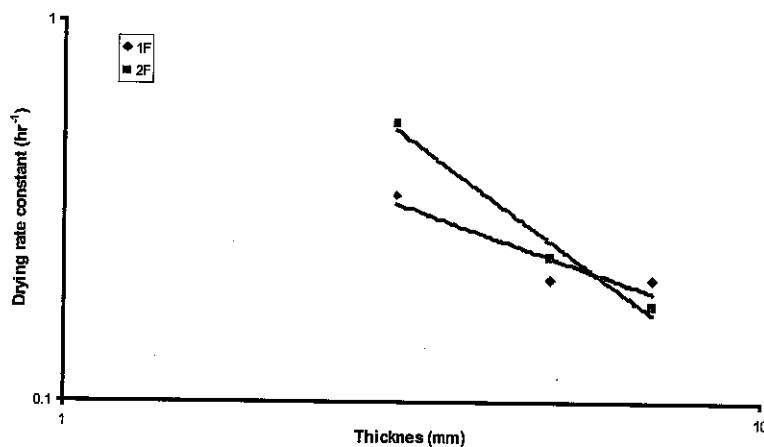


Fig. 6 Effect of thickness on dehydration rate constant in solar mode

From the developed equations (16-19) the 'n' values or power law indexes were found less than 2 and these values were lower than that predicted by the theoretical dehydration equation. The low value of 'n' is attributed to presence of significant external resistance to mass transfer (Islam, 1980) and lower value was attributed to simultaneous heat and mass transfer effects offered by the samples, under going drying.

Conclusion

Temperature variation was found between upper shelf and lower shelf of the drier due to dryer's shelf location from heating sources. While this study was limited to mechanical fan assisted solar drying. Combined mechanical and solar dehydration is possible with this drier thus eliminating the risk of weather uncertainty. To cope with this uncertainty, an alternative approach will be to have an osmotic pretreatment especially using salt solution or sugar-salt mixed solution to have breathing time and to obtain higher dryer throughput.

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Problems and Prospects of Cattle Rearing: A Study in Ghordour Village of Sherpur Upazila

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Abstract

A village study was conducted on "Problem and Prospects of Cattle Rearing". The study area was Ghordour village under Khamarkandi union of Sherpur Upazilla of Bogra district. It was observed that most of the respondents were 35-44 years of age (32.14%), farmer (57.14%), illiterate (28.57%) and almost every family rearing cattle. Data was collected through direct interview and using through structured questionnaire. It was found that none of the farmers cultivate grass as fodder for their cattle due to lack of land. Most of the respondents (58.33%) were rearing native cattle. Majority (60.17%) of them used native bull for breeding cattle and it was observed that 21.43% of them know about cross breeding. For breeding cattle about 60.71% of total respondents used natural breeding whereas only 32.29% used artificial insemination method. It was observed that among the farmers who used artificial insemination for breeding, faced problem like repeat breeding, long distance of artificial insemination centre, frequent outbreak of diseases, lack of knowledge about management, vaccination, veterinary services are also found in the study. But it was found that farmers who have cross-bred cattle got more benefit compared to the farmers having native types of cattle in terms of milk production, early reproduction and income. Through focus group discussion (FGD) the issues like practical training, availability of pasture land, credit facilities with lower a rate of interest, availability of artificial insemination, reduced price of feed and treatment support were raised to bring this sector as highly profitable.

1. Introduction

Bangladesh is an agricultural country which is one of the most densely populated in the World. About 77% population are directly or indirectly dependant on agriculture (BBS, 2006). Per capital Gross National Product is US \$240 (World Bank 1996). Livestock is one of the most important parts of agriculture. It provides food and nutrition to the nation and at the same time contributing to growth of national economy. The total labor force is estimated at 322 million of which 21 million are women (Harun-Ar-Rashid, 1989) and about 61% of the labor is engaged in agriculture (BBS, 1992). The agriculture sector cannot absorb surplus manpower. Many landless labors find it hard to obtain employment. It is tremendously contributing towards poverty alleviation, nutritional enhancement, self employment and agricultural development of the country. Approximately, 70%

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of the landless women are directly or indirectly involved in traditional cattle rearing activities. The domestic production of milk and meat are much lower than the national demand. Statistics shows that the domestic production of milk stood at 3.46 million tons in 2011-2012 falling far short of the demand of 13.50 million tons. It also showed that the total domestic production of meat (beef, mutton and poultry) stood at 2.33 million tons in the scope fiscal against the demand of 6.48 million tons. So, to improve the nutritional standard of the people of the country, there is no alternative to give emphasis on cattle development sector. The Study on "The Problems and Prospects of Cattle Rearing" was conducted in Ghourdour village of Sherpur Upazilla of Bogra district was undertaken with the following objectives:

Objectives of the Study

The main objective of the study was to find out the problems and prospects of cattle rearing in a selected village. The specific objectives were

1. to make out the problems of cattle rearing in the selected area.
2. to locate the potentiality of cattle rearing.
3. to recommend about identified problems in cattle rearing.

Methodology

To fulfill the objectives of the study a field survey method was followed to collect the information.

Study Area:

The study area was Ghourdour village of Khamarkandi Union of Sherpur Upazilla under Bogra District.

Population and Sample:

A total of 28 cattle rearing farmers were randomly selected from the 502 households for collecting data.

Method of Data collection:

Both primary and secondary data were collected from the selected study area. Primary data were collected by direct interview through a structured questionnaire, and secondary data were collected through FGD.

Findings and Discussion

Socio-demographic characteristics of the study village

The studied village named Ghordour of Khamarkandi union under Sherpur upazilla in Bogra district. The radius of the village is about 1.5 sq Km. On the north side of the village is Shajahanpur, on the south Magura-hair, on the west Par-Vhabanipur and on the east bank of the Bangali river. The village is situated 8 km far from the Sherpur upazilla parishad and the roads are kacha and pacca. A total population was 2520 including 502 families. Male was 1292 and female was 1228. The male female ratio of the village is shown in figure-1.

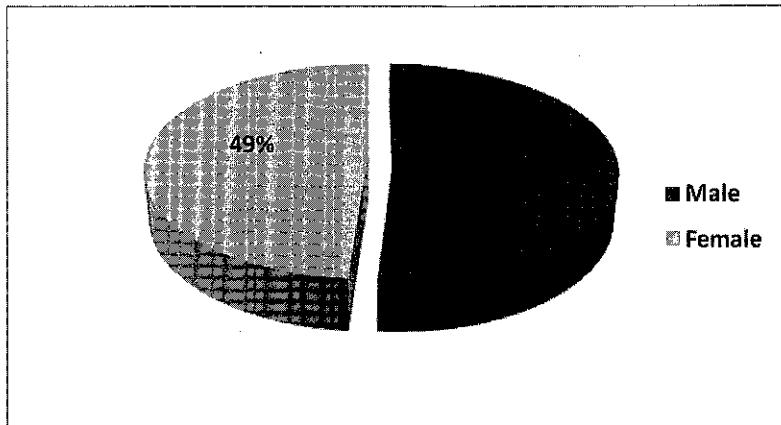


Figure-1: Male-female ratio of the study village

Out of total population 40% are educated. There is only one primary school, one moktab and one madrasa. There was no high school and college. There are five mosques and two markets in the village. It was found that 70% of families used electricity facility. Regarding occupation of the villagers 1764 people are engaged in agriculture which is about 70%, laborers are 378 which is 15%, rickshaw and van pullers are 252 which is 10% and others are 126 which is 5% of the total population. Occupations of the villagers are shown in figure-2.

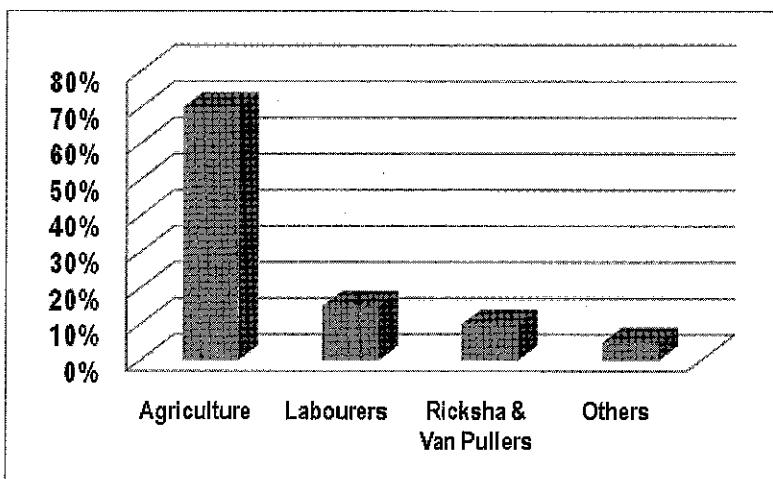


Figure 2: Occupation of villagers

Three non-government (NGO) organizations namely BRAC, ASA and BHP were found to work in the village. Among them, BRAC has organized 1200 members under three groups which now involved in microcredit, health and family welfare activity. ASA operates 6 groups including 1000 members are now involved in microcredit program. BHP operates 7 groups which includes 500 members those are involved in microcredit program and credit for household furniture improvement. There is a community health clinic situated about 3 km far from the village. The number of fertile couple was found around 295; among them about 50% was using family planning methods. Sanitation coverage was found about 95%.

Age of Respondents

The maximum respondents were belonging to 35-44 age group comprising 32.14% of the total respondents (table-1).

Table-1: Age of the respondents

Age (year)	No of Respondents	%
15-24	4	14.29
25-34	6	21.43
35-44	9	32.14
45-54	6	21.43
55-64	3	10.71
Total	28	100

Educational Status of Respondents

Out of 28 respondents 8 (28.57%) were found illiterate and 2 (7.14%) have graduation/master degree (table-2).

Table-2: Educational status of the respondents

Educational status	No of Respondents	%
Illiterate	8	28.57
Can Sign only	5	17.86
up to class-V	6	21.43
Class VI-X	5	17.86
SSC/HSC	2	7.14
Graduation/Masters	2	7.14
Total	28	100

Population of Cattle

The total cattle population was 72 among them 42 was native breed and 30 was cross breed. So, most of the respondents (58.33%) were rearing native cattle (table-3).

Table-3: Population of cattle of the respondents

Types of Cattle	Breeds		
	Native	Crossbred	Total
Milch Cows	15	12	27
Bull	11	3	14
Bull Calf	4	5	9
Heifer	11	9	20
Heifer calf	1	1	2
Total	42	30	72

Method of Breeding of Cows

About 39.29% of the respondents used artificial insemination, 25% of the respondents used their own bull and 35.71% used their neighbor's bull for breeding their cattle (figure 3).

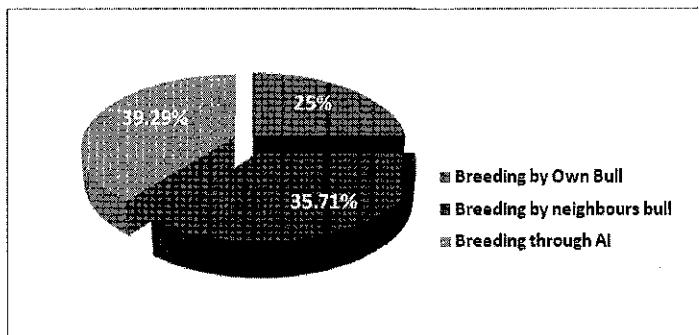


Figure 3: Source of breeding the cows

Type of bull used for breeding purpose

Among 28 respondents 60.71% used native breed for insemination, 21.43% used cross breed and only 17.86% used both type of bull for breeding their cows (figure 4).

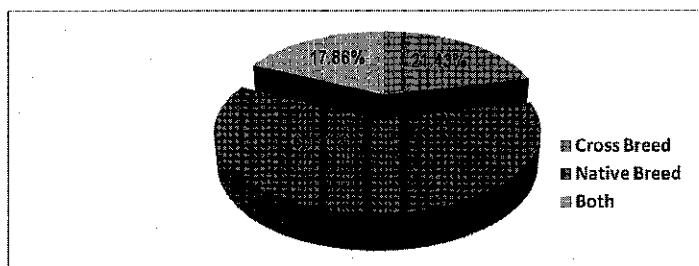


Figure 4: Type of bull used for breeding purpose

Duration of using artificial insemination

About 33.33% of the respondents have been using artificial insemination from 11-15 years in the study area (table-4).

Table-4: Duration of using artificial insemination (AI)

Duration (year)	Respondents	%
0 to 5	2	33.33
6 to 10	1	16.67
11 to 15	2	33.33
16+	1	16.67
Total	6	100

Problems and remedies of AI

Out of 11 respondents 4 (36.36%) did not mentioned any problem regarding artificial insemination. Seven (63.64%) persons mentioned that they face problems with artificial

insemination. A total of 63.64% of the respondents opined that due to use of artificial insemination repeat breeding syndrome occurs. To overcome this problem 57.14% of the respondents mentioned that they used natural service.

Cost of breeding the cows

In case of artificial insemination the cost range was Tk. 200-300 and for natural service was Tk. 100-200 (table-5).

Table-5: Cost of breeding the cows

Cost (Tk.)	For using A.I.	For using direct bull
100-200	3	6
200-300	7	-
300+	1	1
Total	11	7

Age of first pregnancy

It was observed that in case of native breed, first conceived age range was found between 2.5 - 3.0 years and 1.5 - 2.0 years in case of cross bred, that is duration of first calving is less in case of cross breed than native breed (table-6).

Table-6: Age of first pregnancy

Age of first pregnancy (year)	Breed Types			
	Native	%	Crossbreed	%
1.5 to 2.0	5	23.81	4	57.14
2.0 to 2.5	5	23.81	1	14.29
2.5 to 3.0	8	38.10	1	14.29
3.0 to 3.5	3	14.29	1	14.29
Total	21	100	7	100

Use of milk

It was noted that around 43.75% of the respondents used milk for themselves and for selling. A total of 22% consumed milk in home or 9% sale at local market and only 3% sale among neighbors (figure 5).

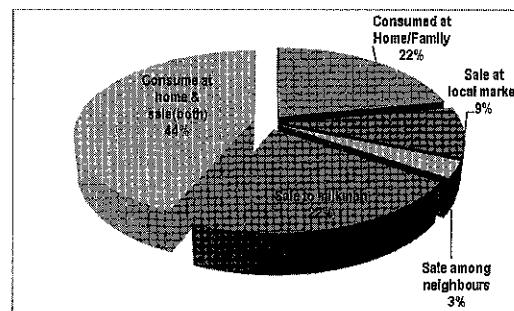


Figure 5: Use of milk produced in study area

Disease Infestation and Vaccination

Above 50% of the total respondents opined that disease infestation occurs once or twice a year (table-7). A total of 39.29% respondents stated that they vaccinate their cattle against Foot and Mouth Disease (FMD) and 17.86% vaccinate against Anthrax and about 42.86% do not give any vaccine (table-7).

Table-7: Number of Disease Infestation per year and Vaccination of Cattle

Disease infestation per year			Vaccination of Cattle		
Diseases per year	Respondents	%	Name of Vaccine	Respondents	%
One - Two times	15	53.57	Foot and Mouth Disease	11	39.29
Two - Three times	8	28.57	Anthrax	5	17.86
Could not mention	5	17.86	No Vaccination	12	42.86
Total	28	100		28	100

Source of Receiving Treatment

Majority (66.67%) of the respondents go to village veterinary practitioners for treatment of their cattle (table-8). Upazilla livestock office serves 13.33%.

Table-8: Sources of receiving treatment for their animals

Sources of Treatment	Respondents	%
Local Medicine Shop	2	6.67
Rural Doctor (Palli Chikitshok)	2	6.67
Village Veterinary Practitioner (VVP)	20	66.67
Local Livestock Treatment Center (Union level VFA)	2	6.67
Upazilla Livestock Office	4	13.33
Total	30	100

Treatment Cost of Cattle

More than 50% of the respondents informed that the cost of treatment was from Tk. 100/- to -Tk. 500/- per cattle per year which is minimum for treating their cattle. (Table-9)

Table-9: Treatment cost of cattle (Per head/Year)

Cost (TK)	Respondents	%
100-500	15	55.56
501-1000	4	14.81
1001-2000	5	18.52
2001-3000	3	11.11
Total	27	100

Material used as Cattle Feed

Data shows that more than 40% of the respondents use roadside field grass and straw for their cattle (table-10). None of them cultivate green grass as commercially fodder.

Table-10: Material used as cattle feed

Feeding materials	Respondents	%
Only Straw	14	37.84
Straw and Concentrates	7	18.92
Grass and straw	16	43.24
Total	37	100

Problems Regarding Cattle Rearing

About 43.18% of the total respondents stated that the price of cattle feed is costly so that they cannot afford to buy the cattle feed (table-11).

Table-11: Problems regarding cattle rearing

Problems	Respondents	%
High feed price	19	43.18
Non-profitable	1	2.27
Housing problem	6	13.64
Cattle stolen	7	15.91
High treatment cost	6	13.64
Diseases	5	11.36
Total	44	100

Remedies of Cattle Rearing Problems

Majority (40%) of them suggested to reduce the cost of cattle feed for cattle rearing smoothly (table-12).

Table-12: Remedies of cattle rearing problems

Remedies	Respondents	%
Reduce feed cost	8	40
Reduce cattle price	2	10
Loan facility	4	20
Improve security	3	15
Reduce treatment cost	3	15
Total	20	100

Focus group discussion (FGD)

But it was observed that through focus group discussion (FGD), the issues like practical training, availability of pasture land, credit facilities with lower rate of interest, availability of artificial insemination with quality semen, reduce price of cattle feed and treatment supports were raised to bring this sector as highly profitable.

Conclusion and Recommendations

Cattle's rearing is an important part of agriculture, can create income and employment opportunities. From the study, it was found that there are many constraints lying in cattle rearing. But there are many prospects in this sector also. If proper measures and steps are taken in this sector it can highly contribute in improving the national economy of the country. Cattle rearing will be more benefited for the farmers. It will not only provide food and nutrition, it will also increase the family income and savings for future. Therefore improvement of cattle rearing can change the livelihood of rural people.

According to the findings of the study following recommendations may be suggested:

- Government should create awareness and encourage among the farmers for improving the housing condition of cattle.
- Department Livestock Services should ensure availability of facilities for the farmers.
- Introduction of silage technology and non-traditional cattle feed will help in reducing feed cost.
- Reduce the cost of cattle feeds, introduction of silage, use of non-traditional cattle feed, milk replacer etc.
- Provide proper marketing facilities for selling and purchasing of cattle.
- Arrange cattle rearing and primary treatment training for cattle owners.

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Socio-economic Impact Study of Micro Credit on Vulnerable Rural Poor at Sherpur Pouroshava: Experience from RDA-Credit Programme

Md. Mazharul Anowar¹

Abstract

The present study examined the socio-economic impact of Micro-credit on vulnerable rural poor at Sherpur pouroshava under RDA-Credit Programme. RDA-Credit Programme has started micro-credit activities in 2003 through Center for Irrigation and Water Management (CIWM). The respondents were the vulnerable rural poor credit recipients under RDA-Credit Programme at Sherpur pouroshava in Bogra district. The data for the present study were collected May, 2010 to June, 2010. The total respondents for the present study were 110. Fifty two credit recipients were selected randomly using random number table from one sub-project of RDA-Credit Programme under Sherper Upazila in Bogra district. Findings show that middle aged persons (both male and female) received credit whose age groups were 26-30 and 31-35. Among all the selected respondents it was found that 58% credit recipient's educational status was below S.S.C and the remaining respondents were in various educational levels like Illiterate, Literate, S.S.C, H.S.C, Graduation and Post-graduation. All the respondents could increase their assets like cultivable land, homeland, domestic animals and instant cash after taking credit under RDA-Credit Programme and also the value of assets has increased. Most of the credit recipients received less amount of credit from the very beginning that was on an average of Tk. 6000 and the range of amount i.e. minimum amount was Tk. 5000 and the maximum was Tk. 15000. 48% respondents had been able to pay water charges after taking credit under RDA-Credit Programme. Among all the selected respondents' it was found that those who had received credit under RDA-Credit programme, their economic condition became better after receiving credit than that of before. 97% of the credit recipients provided positive opinion regarding changes in socio-economic condition after receiving more credit under RDA-Credit programme. Respondents' socio-economic condition has improved as relates to the parameters of housing, health and sanitation, safe drinking water and living standard.

1. Introduction

1.1 Background of the study

Bangladesh is an agro-based developing country where 80 per cent of the population lives in rural areas. The people of this country are suffering from widespread unemployment and poverty. The situation is more alarming in the case of landless and assetless people who constitute more than 50 per cent of the rural population. In view of these socio-economic realities, alleviation of poverty has been given the main thrust in the five year plans. Bangladesh is a country with one of the lowest per capita GDP (US \$ 818 in 2011) in the world. Considering the size of the population

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(around 142 million in 2011 est.), the magnitude and the depth of deprivation are extremely high with the majority living in poverty. The main cause of poverty in Bangladesh is the lack of productive employment opportunities for the huge number of unemployed and underemployed workforce, which is tremendously increasing and posing serious problem for the country. The employment opportunity in agriculture is seriously constrained by the scarcity of land. Therefore, self-employment creation through micro credit led strategy in the rural area can play a significant role in reducing the rural unemployment and acute poverty. In this backdrop, the Government and Non-government Organizations are trying to involve the rural poor in different types of income generating activities, so that they can create their own employment and generate sufficient income for bearing the cost related to food, sanitation, education, and other necessities of life. Since the poor are embedded in vicious circle they are not in a position to make investment by them in income generating activities. They need micro credit for income generating activities to be undertaken by them.

Credit has always been used as a key element in the development strategy of Bangladesh. It is also an important input which enables the rural people to buy other inputs necessary for increasing production in the farm and non-farm sectors in the rural areas. Government of Bangladesh initiated some credit programmes in the early 70s to make fund available to the rural people. During the mid 80s a number of Non-Government Organizations (NGOs) like BRAC, ASA, PROSIKA, TMSS and others particularly Grameen Bank (GB) pioneered alternative credit delivery mechanism for the rural poor that consisted of small amount of collateral free affordable loans popularly known as micro credit. Finally Rural Development Academy (RDA), Bogra had started credit programme under its action research activities through Center for Irrigation and Water Management (CIWM) on socio-economic development for vulnerable rural poor those who are the target beneficiaries of different projects related to irrigation and water management. RDA-Credit programme is providing required amount of loan to the vulnerable rural poor of various sub-projects of CIWM. This credit is being distributed on the basis of some selection criteria that are called RDA Credit Policy.

1.2 Objectives of the study

The main objective of the study is to examine the socio-economic impact of Micro-credit on vulnerable rural poor at Sherpur pouroshava through RDA-Credit Programme. The specific objectives of the study are as follows:

1. To examinee the socio-economic background of credit recipients under RDA-Credit Programme;
2. To investigate how and to what extent the credit recipients are involved under RDA-Credit Programme;
3. To assess necessity and accessibility of micro-credit and its utilization; and
4. To examinee the impact of micro-credit on income, increasing household assets, social and economical changes and improving the living standard of credit recipients under RDA-Credit Programme ;

1.3 Justification of the study

In fact, few researches have been conducted regarding micro-credit programmes for poverty reduction in rural Bangladesh. The impact and consequences of micro credit is tremendous and it

is well known to the rest of the world that Bangladesh is the pioneer in introducing micro credit to the rural poor without any collateral. Micro-credit has also been treated as an important factor towards alleviation of poverty. The present study is an attempt to share experience and gathered some new ideas from RDA-Credit Programme (which is a formation of Micro-credit) at Sherpur pouroshava under Bogra District for upgrading the socio-economic conditions of the rural poor. This study will also be useful in preparing the training materials and inspire the researchers to undertake other relevant studies of micro-credit. Finally, the results of the present study will help the government, policy makers, researchers, NGOs professionals, to formulate effective policies regarding micro-credit.

2.Methodology

Methodology plays a vital role in any scientific research. Appropriate methodology enables the researcher to collect valid and reliable information and to analyze the information properly to draw a clear-cut conclusion. The present study had been carried out on the basis of exploratory research design because the study had focused on the activities of micro-credit programmes under RDA-Credit Programme.

The Study was conducted at Sherpur Pouroshava under Bogra District. The universes of the present study are the micro credit recipients (borrowers) of Sub-projects of RDA Credit Programmes at Sherpur Upazila under Bogra District. Only one sub-project of RDA Credit Programmes had been chosen for the present study. At first list of 200 credit recipients under RDA-Credit Programme was prepared from the selected study areas as total population. Then among 200 credit recipients, 52 recipients were selected as a sample size by following simple random sampling method.

Questionnaire and guideline were used to collect primary data for the present study. Beside in depth survey Focus Group Discussion (FGD) was conducted with the credit recipients as well as other non-credit recipients under RDA-Credit Programme.

After collecting primary data the raw data was coded and edited. Data entry was completed by using the latest Statistical Packages for Social Sciences (SPSS17.0). Statistical analysis like frequency table analysis, cross table analysis and regression analysis among some important variables was completed with SPSS 17.0 Software in accordance with the objectives of the study.

3. Major Findings of the Study

Some simple statistical tools were used for analyzing the data on the basis of some selected variables according to the objectives of the study. The simple statistical tools were used for this analysis are presented below:

3.1 Frequency Table Analysis with Different Charts

Socio-economic characteristics of the respondents in terms of age, sex, level of education, marital status, occupation and household assets before and after receiving credit; Involvement of credit recipients; micro-credit utilization and impact of micro-credit under RDA-Credit Programme was explained by frequency table analysis.

3.1.1 Age Distribution of the Respondents

Table-1 explains that respondents age varied from 0-60+ From RDA-Credit programme it was found that, most of the credit recipients i.e, 12 (23.08%) respondents were at the age group 26-30, 11 (21.15%) were 0-25 and the remaining respondents were at various age groups.

Table-1: Age Distribution of the Respondents

Age Group	Percentage (%)
0-25	21.15
26-30	23.08
31-35	17.31
36-40	9.61
41-45	7.69
46-50	17.31
Total	100.00



Figure-1: Age group of the respondents through Bar Chart

3.1.2 Sex Distribution of the Respondents

RDA-Credit run their credit operation for rural poor women. It was found from the table-2 that out of 52 respondents under RDA-Credit programme out of 52 respondents, 27 (51.92%) were male and 25 (48.08%) were female credit recipients.

Table-2: Sex Distribution of the Respondents

Sex Distribution	Percentage (%)
Male	51.92
Female	48.08
Total	100.00

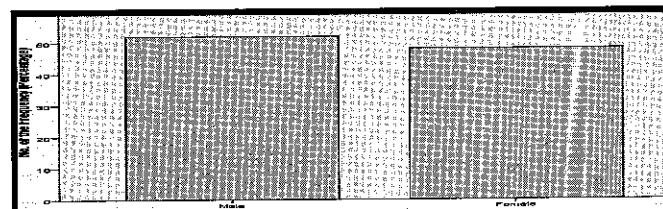


Fig-2: Sex distribution of the Respondents with Bar Chart

3.1.3 Marital Status of the Respondents

Table-3 explains that under RDA-Credit programme 43 (82.68%) respondents were married and the remaining 17.32% were unmarried (Table-3).

Table-3: Marital Status of the Respondents

Marital Status	Percentage (%)
Married	82.69
Unmarried	17.31
Total	100.00

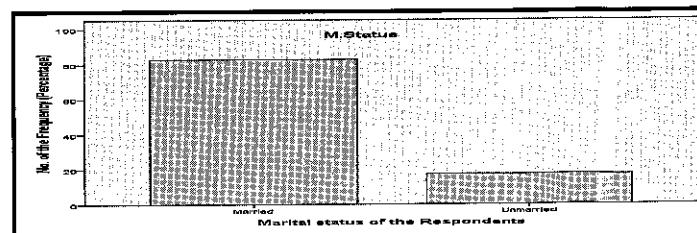


Fig-3: Marital Status of the Respondents With Bar Chart

3.1.4 Occupations of the Respondents

Table-4 shows the occupational status of the respondents. It was found that out of 52 respondents of RDA-Credit Programme 13.46% were service holders, 40.39% were businessmen, 34.62% were housewives. (Table-4)

Table-4: Occupation of the Respondents

Occupations	Percentage (%)
Service	13.46
Business	40.39
House wife	34.62
Land lord	7.69
Driver	1.92
Carpenter	1.92
Total	100.00

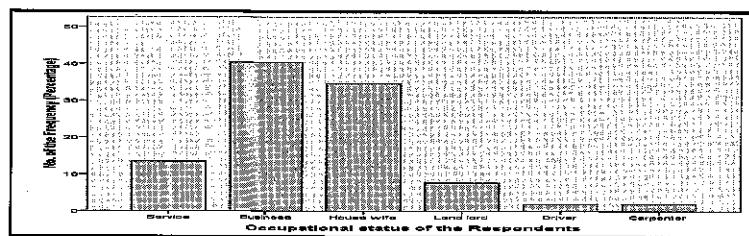


Fig-4: Respondents occupational status with Bar Chart

3.1.5 Educational Status of the Respondents

Education is one of the most important indicators of socio-economic upliftment. Table- 5 explains that out of 52 RDA-Credit recipients 29 (55.77%) had their education level below S.S.C., 3 (05.77%) were literate that is they knew how to write their names and 01 (01.92%) respondent completed Diploma in Engineering degree and the remaining recipients completed their education at various levels like S.S.C., H.S.C., Graduation and Post-graduation (Table-5).

Table-5: Educational Qualification of the Respondents

Educational Qualification	Percentage (%)
Literate	5.77
Below SSC	55.77
SSC	15.38
HSC	11.54
Graduation	5.77
Post	3.85
Graduation	01.92
Total	100.00

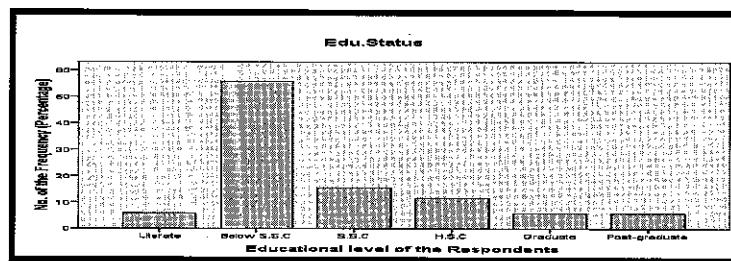


Fig-5: Respondents educational level with Bar Chart

3.1.6 Household Assets of the Respondents both Before and After Receiving Credit.

Table-6 states that Of the 52 recipients of RDA credit programmes 48.1% owned homeland, 32.7% owned cultivable land, 13.5% had domestic animal and 3.8% had no assets. It also shows that the credit recipients could increase their assets slightly after receiving credit. It shows that 21.2% recipients had domestic animal compared to 13.5% before receiving credit. Similarly, 36.5% homestead land than 48.1% before receiving credit. The number of assetless respondents also decreased after receiving credit (Tabl 6).

Table-6: Respondents Household Assets both Before and After Receiving Credit

Respondents household assets	Before receiving credit		After receiving credit	
	No. of respondents	Percentage (%)	No. of respondents	Percentage (%)
Cultivable Land	17	32.7	18	34.6
Home Land	25	48.1	19	36.5
Domestic Animals	7	13.5	11	21.2
Instant Cash	1	1.9	2	3.8
Asset less	2	3.8	2	3.8
Total	52	100.0	52	100.0

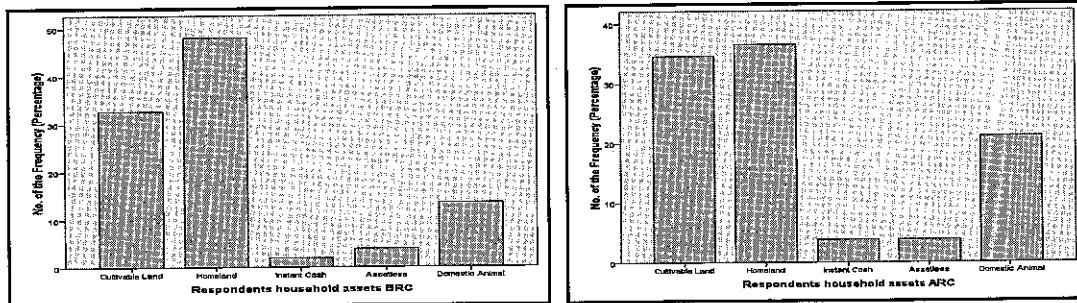


Fig-6: Household assets of the Respondents both Before and After Receiving Credit was shown through Bar Chart

3.1.7 Conditions for Receiving Credit under RDA-Credit Programme

Respondents were asked whether there were any conditions for receiving credit or not. more than half of the respondents 26 (58.18%) from RDA-Credit programmes mentioned that there were some conditions for receiving credit and the remaining 41.82% had given their negative views. Those who provided affirmative answers mentioned as many as several conditions for receiving credit which are as interest rate is 12%, repayment with 46 kisti, receiving credit after repayment of the previous credit, credit was available after deposit of savings within 15 days, interest rate of 11%, deposit of savings, repayment of kisti on a regular manner and repayment in monthly kisti (Table-7).

Table-7: Conditions for Receiving Credit under RDA-Credit Programme

Conditions for Receiving Credit	No. of respondents
Payment in 46 kisti	45
Receiving credit after clearance the previous credit	6
Disbursement of credit after depositing money with in 15 days	4
Interest rate is 11%	18
Deposit of savings with kisti	5
Deposit of kisti on regular basis	12
Total	90

(Respondents have more than one response)

3.1.8 Sources of Fund for Micro-credit under RDA-Credit Programme

RDA Credit programmes are also implementing some development programmes through micro-credit to alleviate poverty for the study area. There are various sources of micro-credit from RDA-Credit Programmes. For the present study, the respondents from RDA-Credit mentioned various sources of micro-credit which are as from govt. development sector, from foreign aid, amount of RDA-Credit (CIWM), own fund of sammittee, own fund of TMSS, govt. and non-govt. development organization, credit from banking sector, own fund of ASA, PKSF and donor agency (Table-8).

Table-8: Sources of Fund of Credit under RDA-Credit Programme

Sources of fund for Credit	Percentage (%)
Govt. Development Sector	9.6
Foreign Aid	19.2
CIWM-RDA	38.5
Credit from Banking Sector	11.5
ASA, NGO	15.4
PKSF	5.8
Total	100.0

(Respondents have more than one response)

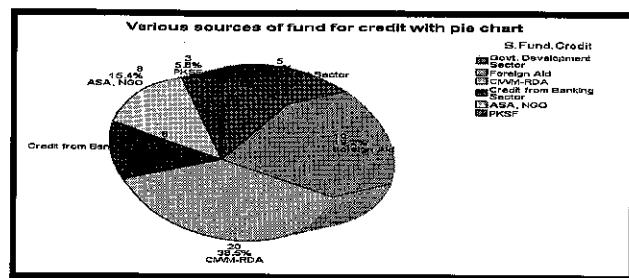


Fig-8: Various sources of fund for Credit was shown by Pie Chart

3.1.9 Amount received at the Beginning as Micro-credit

RDA-Credit programme are operating their micro-credit programmes for the selected study area. Out of the 52 respondents, it was found that under RDA-Credit programmes 67% received Tk.6000 on an average from the very beginning and the remaining respondents' amount were on an average of Tk.2500 and Tk.10,000 respectively and only 1 (1.92%) respondent had received an amount of Tk. 7500 (Table-9).

Table-9: Amount Received as Micro-credit at the Beginning

Receiving amount from the very beginning	Percentage (%)
0-5000	13.46
5001-8000	67.31
8001-11000	17.31
11001-15000	1.92
Total	100.00

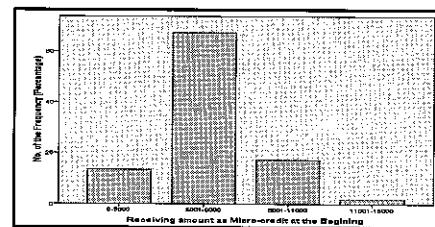


Fig-9: Respondents Receiving amount as micro-credit at the Beginning with Bar Chart

3.1.10 Purpose of Receiving Micro-credit

Most of the credit recipients for the present study were vulnerable rural poor. They received credit for various purposes from RDA-Credit programmes. It was found from table-10 that Out of 52 respondents 92% were for running small business and the remaining 8% for buying cows, goat rearing, and removing poverty from family, for buying poultry birds (Table-10).

Table-10: Purposes of Receiving Credit under RDA-Credit Programme

Credit Receiving Purposes	No. of respondents	Percentage
Credit for small business	48	92.30
Goat rearing	1	1.92
Removing poverty from family	1	1.92
For buying cows	1	1.92
For buying poultry	1	1.92
Total	52	100

3.1.11 Economic Condition of the Respondents before Receiving Credit

Respondents were asked about the economic condition before receiving credit. They provided multiple responses. In the case of RDA-credit 19% were related to pure drinking water, 29% on good sanitation system, 33% on good housing situation, 10% own cultivable land, 6% on taking meals three times daily and 4% were related to live from hand to mouth and not so good condition (Table-11).

Table-11: Economic Condition of the Respondents before Receiving Credit

Economic conditions before receiving credit	Percentage (%)
Good housing condition	32.7
Good sanitation systems	28.8
Drinking pure water	19.2
Own cultivable land	9.6
Taking meals three times daily	5.8
Live from hand to mouth	1.9
Not so good	1.9
Total	100.0

• (Respondents have more than one response)

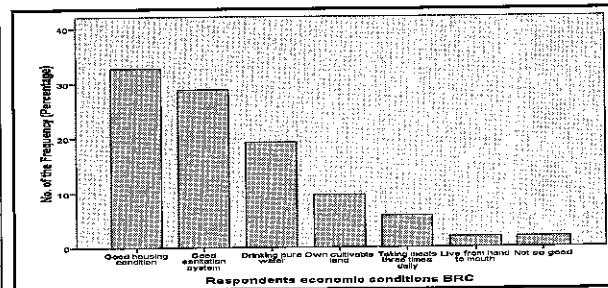


Fig-11: Respondents economic conditions BRC with Bar Chart

3.1.12 Respondents Major Social and Economical Changes after Receiving Credit

Respondents were asked about their opinion regarding socio-economic changes after receiving credit and it was found from table-12 that 98% respondents' provided their positive opinion regarding changes in social and economic conditions after receiving micro credit (Table-12).

Table-12: Respondents Opinion regarding Socio-economic Changes after Receiving Credit

Opinion of the respondents regarding socio-economic changes ARC	No. of respondents	Percentage (%)
Yes	51	98.08
No.	1	1.92
Total	52	100.00

Table-13 Shows the responses related to major social and economic changes after receiving credit. Some of the major social and economical changes are as good economic condition, good housing condition, enjoying entertainment, leading healthy life, good sanitation and safe drinking water.

Table-13: Respondents Major Social and Economic Changes after Receiving Credit

Social and economic changes after receiving credit	Percentage (%)
Good Housing Condition	19.2
Good Economic Condition	48.1
Enjoying Entertainment	9.6
Healthy Life leading	17.3
Good Sanitation	3.8
Safe Drinking Water	1.9
Total	100.0

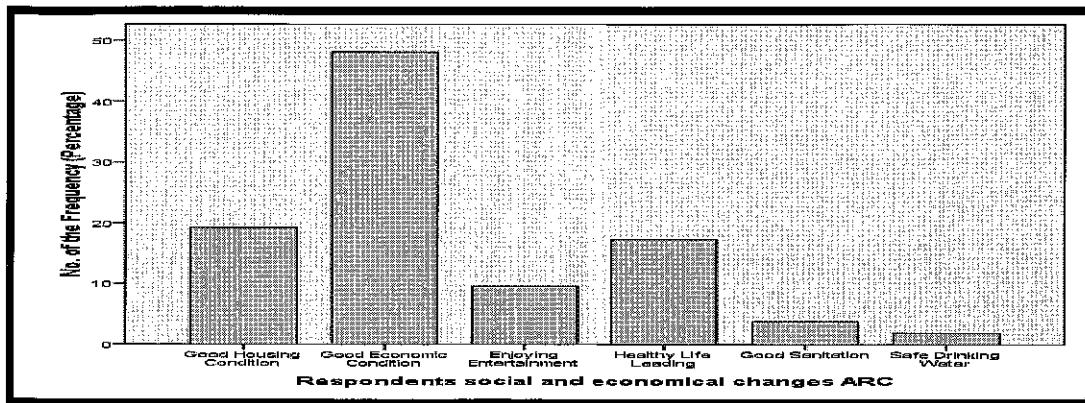


Fig-13: Respondents major social and economical changes has been shown with Bar Chart

3.1.13 Payment of Water Charges after Getting Micro credit

RDA-Credit programme provided micro-credit along with Deep tube well for irrigation and household uses. The respondents were asked whether they were paying the water charges or not. Out of the 52 respondents, it was found that 27 (52%) respondents were not paying water charges where as 48% was paid payment of water charges (Table-14).

Table-14 Payment of Water Charges after Receiving Credit under RDA-Credit Programme

Opinion of the respondents	Percentage (%)
Yes	48.08
No	51.92
Total	100.00

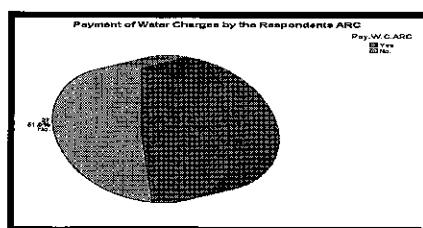


Fig-14: Payment of Water charges by the respondents has been shown through pie chart

3.2 Hypothesis Testing by Cross Table Analysis

The present study is an exploratory research based on primary data. In this section some relationship had been shown between dependent and independent variables. Some dependent and independent variables were selected to show their relationship and also hypothesis testing was used for making comments using 5 percent level of significance.

3.2.1 Relationship between Respondents Social and Economical Changes and Payment of Water Charges after Receiving Credit under RDA-Credit Programme

3.2.2 Relationship between Respondents Social and Economical Changes and Household Assets after Receiving Credit under RDA-Credit Programme

3.2.1 Relationship between Respondents Social and Economical Changes and Payment of Water Using Charges after Receiving Credit under RDA-Credit Programme

Hypothesis Testing:

Null hypothesis (Ho) and Alternative hypothesis were considered for testing the Hypothesis between these two variables i.e respondents' social and economical changes and payment water using charges after receiving credit under RDA-Credit programme.

Null hypothesis (Ho): There were no relationship between respondents' social and economical changes and payment of water using charges after receiving credit

Alternative hypothesis (H1): Reject Null hypothesis

Table-15 explains the relationship between two important variables like respondents' social and economical changes after receiving credit and respondents' payment of water using charges after receiving credit both under RDA-Credit programme. The pearson chi-square value was obtained by the cross-table calculation (Table-15).

Table-15: Relationship between Respondents Social and Economical Changes and Payment of Water Charges after Receiving Credit

Respondents social and economical changes after Receiving Credit	Payment of water charges after Receiving Credit		
	Yes	No.	Total
Good Housing Condition	10 (4.8)	0 (5.2)	10 (10.0)
Good Economic Condition	12 (12.0)	13 (13.0)	25 (25.0)
Enjoying Entertainment	0 (2.4)	5 (2.6)	5 (5.0)
Healthy Life Leading	0 (4.3)	9 (4.7)	9 (9.0)
Good Sanitation	2 (1.0)	0 (1.0)	2 (2.0)
Safe Drinking Water	1 (0.5)	0 (0.5)	1 (1.0)
Total	25 (25.0)	27 (27.0)	52 (52.0)

Comment: at 5% level of significance with 5 d.f. the calculated value is 27.0 and tabulated value is 0.0. The calculated value is greater than tabulated value so we may reject our null hypothesis. As a result, it may concluded that there were good relationships between respondents' social and economical changes and payment of using water charges after receiving credit under RDA-Credit programme.

3.2.2 Relationship between Respondents Social and Economical Changes and Household Assets after Receiving Credit under RDA-Credit Programme

Hypothesis Testing:

Null hypothesis (H₀) and Alternative hypothesis (H₁) were considered for testing the Hypothesis between these two variables i.e respondents' social and economical changes and household assets after receiving credit under RDA-Credit programme.

Null hypothesis (H₀): There were no relationships between respondents' social and economical changes and household assets after receiving credit

Alternative hypothesis (H₁): Reject Null hypothesis

Table-16 explain the relationship between two important variables like respondents' social and economical changes after receiving credit and respondents' household assets after receiving credit both under RDA-Credit programme. The pearson chi-squre value was obtained by the cross-table calculation (Table-16).

Table-16 Relationship between Respondents Social and Economical Changes and Household Assets after Receiving Credit under RDA-Credit Programme

Respondents social and economical changes ARC	Respondents household assets ARC					
	Cultivable	Homeland	Instant	Assetless	Domestic	Total
	Land		Cash		Animal	
Good Housing Condition	3 (3.5)	2 (3.7)	1 (0.4)	1 (0.4)	3 (2.1)	10 (10.0)
Good Economic Condition	10 (8.7)	11 (9.1)	0 (1.0)	0 (1.0)	4 (5.3)	25 (25.0)
Enjoying Entertainment	1 (1.7)	1 (1.8)	0 (0.2)	0 (0.2)	3 (1.1)	5 (5.0)
Healthy Life Leading	4 (3.1)	4 (3.3)	0 (0.3)	0 (0.3)	1 (1.9)	9 (9.0)
Good Sanitation	0 (0.7)	1 (0.7)	0 (0.1)	1 (0.1)	0 (0.4)	2 (2.0)
Safe Drinking Water	0 (0.3)	0 (0.4)	1 (0.0)	0 (0.0)	0 (0.2)	1 (1.0)
Total	18 (18.0)	19 (19.0)	2 (2.0)	2 (2.0)	11 (11.0)	52 (52.0)

Comment: at 5% level of significance with 20 d.f. the calculated value is 49.50 and tabulated value is 0.01. The calculated value is greater than tabulated value so we may reject our null hypothesis. As a result, it was concluded that there had been found good relationships between respondents' social and economical changes and household assets after receiving credit under RDA-Credit programme.

3.3 Regression Analysis

The main objective of regression analysis is to discuss the significant relationship between dependent variable and independent variable. This means that the main function of regression

analysis is to measure some changes, hypothesis testing and established the relationship between the dependent and independent variables using mathematical notation. For the present study, a multiple regression model was considered indicating respondents' monthly income after receiving credit as considered dependent variable and respondents' monthly income, savings and household assets value before receiving credit as considered independent variables.

The multiple regression models as

Where

Y = Respondents Monthly income after receiving credit that is Dependent variable

X1 = Respondents monthly income before receiving credit that is independent variable

X2 = Respondents monthly savings before receiving credit that is independent variable

X3 = Respondents household assets value before receiving credit that is independent variable

$\beta_0 = \text{Constant}$

β_1 = Respondents monthly income before receiving credit influence on monthly income after receiving credit that regression coefficient.

β_2 = Respondents monthly savings before receiving credit influence on monthly income after receiving credit

β_3 = Respondents household assets value before receiving credit influence on monthly income after receiving credit

? = Error.

It is assumed that the error term is normally distributed i.e. $\epsilon \sim N(0, \sigma^2)$. The value of b_0, b_0, b_1, b_2 and adjusted R^2 was calculated by using latest SPSS for WINDOS 17.0 version as follows:

$$\beta_0 = 3015.128$$

$$\beta_1 = 840.781$$

$$\beta_2 = 95.479$$

$$\beta_3 = -575.228$$

And Adjusted $R^2 = 0.854$

By putting the value of β_0 , β_1 , β_2 and β_3 in the equation no. (i) it was seen the following multiple regression model as:

$$\hat{Y} = 3015.128 + 840.781x_1 + 95.479x_2 - 575.228$$

So, it can be said that the above multiple regression model indicates that the dependent variable (Y) that is respondents' monthly income after receiving credit is dependent on the independent variables X1, X2, and X3 that is respondents' monthly income before receiving credit and respondents' monthly savings before receiving credit and respondents' household assets value.

before receiving credit. So it was seen that the independent variables X1, X2 has positive influence and X3 has negative influence on dependent variable (Y).

It was seen that the value of adjusted R^2 is 0.854 and it explained that the independent variables are able to explain the 85.4 percent of dependent variable.

Hypothesis Testing:

Null hypothesis (H_0) and Alternative hypothesis (H_1) for testing the significances of the value of regression coefficients.

Null hypothesis (H_0): The value of Regression coefficients was not significant i.e $\beta_1 + \beta_2 + \beta_3 = 0$,

Alternative hypothesis (H_1): Reject the Null Hypothesis

The test statistic

$$F = \frac{\text{Means Sum of Square of Regression}}{\text{Mean Sum of square of Error}} \sim F_{(2, 56)}$$

For the linearity of multiple regressions it was shown the one way analysis of variance (ANOVA) table that presenting below:

Table No. 20 Analysis of Variance (ANOVA) for Multiple Regression Model

Source of Variation	Sum of square	Degrees of Freedom	Mean sum of square	Calculated (F)	Significance
Mean sum of square of regression	348972.06	2	174486.03	14.00	0.000
Mean sum of square of error	697944.12	56	12463.28		
Total	1046916.18	58			

Comment: At 5 percent level of significance with 2 and 56 d.f the calculated value of f is 14.00 and the significant value is 0.000 which is less than the calculated value of F. So the null hypothesis was rejected. Hence it may be concluded that the value of regression coefficient is significant and respondents' monthly income after receiving credit is significantly dependent on respondents' monthly income, savings and household assets value before receiving credit.

4. Conclusion

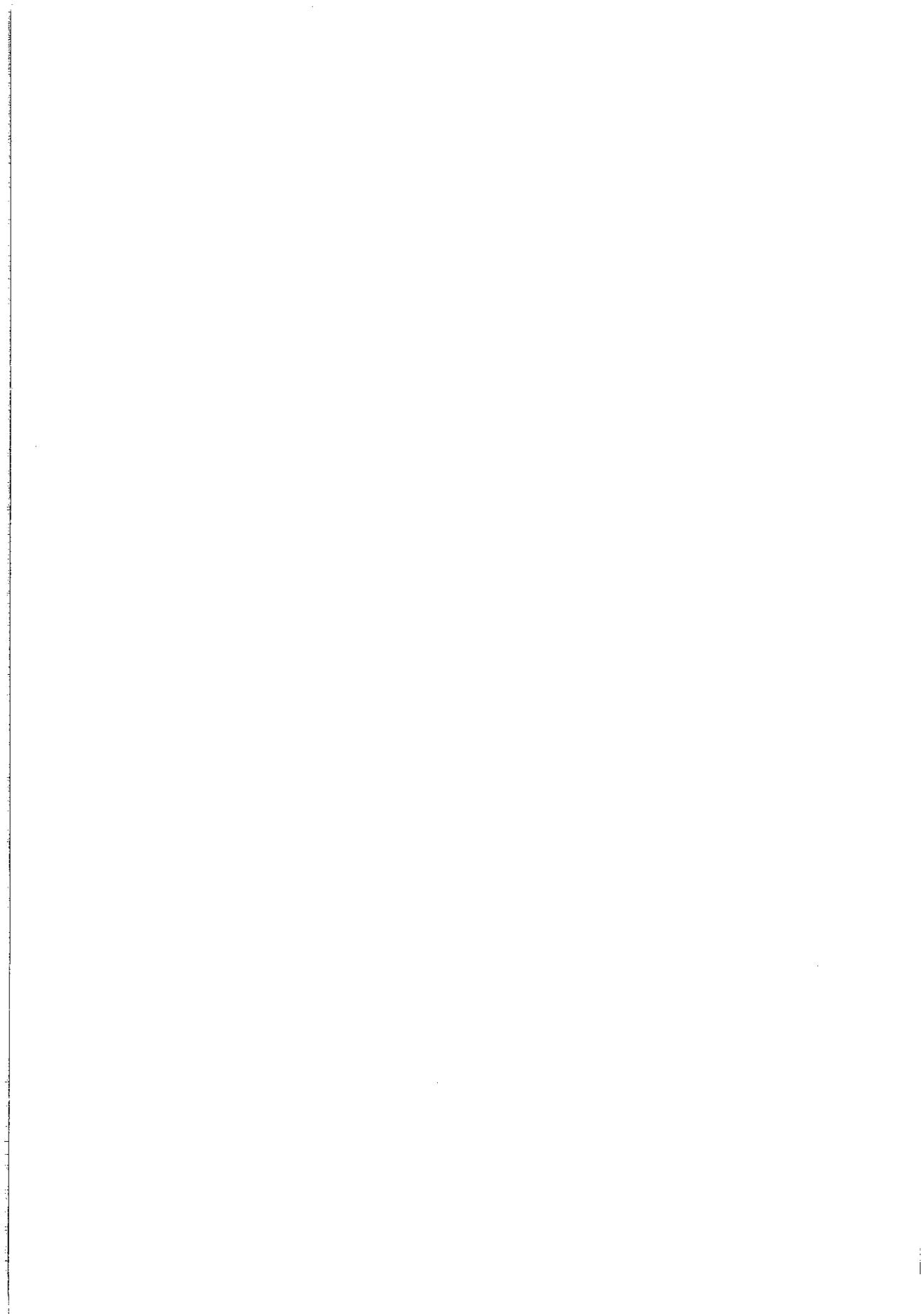
Micro-credit has been introduced to rural communities in Bangladesh as a means of economic and social development of the rural poor. Rural Development Academy, Bogra has been operating many projects having micro-credit facilities since long and finally framed a modified and easy operational design of a micro-credit programme and being implemented by RDA as RDA-credit. The present study was conducted at Sherpur Upazila RDA-credit Programme On the basis of the study the following conclusions can be drawn:

- ” Education is one of the important indicators for the credit recipients to utilize the credit properly. the educational status of the credit recipients of RDA-Credit programme were more educated
- ” This study shows that the credit recipients of RDA-Credit programme had more value of their household assets.
- ” This study shows that household assets had increased after receiving credit than before in the case of credit recipients of RDA-Credit programme.
- ” RDA-Credit workers and neighbors of RDA-Credit programme provided more information to the credits recipients regarding micro-credit operations.
- ” The credit recipients identified the following conditions for receiving credit:
 - o Repayment with 46 kisti
 - o Receiving credit after repayment of the previous credit
 - o Credit was available after deposit of savings with in 15 days
 - o Interest rate of 11%
 - o Deposit of savings
 - o Repayment of kisti on a regular manner
 - o Repayment monthly kisti
- ” The credit recipients mentioned CIWM of RDA, own fund of samittee, own fund of TMSS, own fund of ASA, PKSF etc as the sources of funds for micro-credit.
- ” Regarding receiving amount of credit from the very beginning this study revealed that most of the credit recipients had received less amount from the very beginning that was on an average of Tk.4625
- ” Regarding the purposes of taking credit the recipients of RDA Credit, mentioned the purposes like running of small business, buying goat, cow and poultry feed, running stationary shop, buying rickshaw, transport business etc.
- ” In the study area of Sherpur the economic condition of the credit recipients was better even before taking micro-credit and 97% of the respondents provided positive opinion regarding changes in socio-economic condition after receiving micro-credit. The major social and economic changes after receiving micro-credit were good economic condition, safe drinking water, good housing condition, healthy life leading and good sanitation.
- ” The RDA Credit recipients in the study area were also taking credit from other organizations like Grameen Sakti, PDBF, Bittahin Samity etc.
- ” RDA credit recipients were also provided with irrigation and household water facilities. Out of 52 recipients 52% were not paying water charges.

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