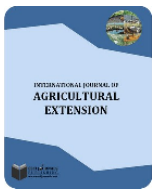

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DOES e-AGRICULTURE IMPACT ON FARMERS' EMPOWERMENT IN BANGLADESH?

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A B S T R A C T

Empowerment is the utmost desire for the sustainable development all over the world. Present research was designed to investigate the impact of e-Agriculture on empowerment stratified as economic, family and social, political, knowledge and psychological empowerment. The methodology of this study is an integration of quantitative and qualitative methods based on data collection in Bhatbour Block of Dhighi union under Sadar Upazila of Minikganj District. Data were collected from 133 e-Agriculture users and 45 controls. Descriptive statistics, t-test, Multiple regression (B) were used for analysis. Most of the farmers (53.4 percent) gained low empowerment through e-Agriculture, while 46.6 percent of them had medium empowerment. The results showed that e-Agriculture had significant impact on the empowerment of farmers in Bangladesh. Based on the findings, it is recommended that government should implement and popularize e-Agriculture based projects on a massive scale for the empowerment of the farmers.

Keywords: e-Agriculture, Empowerment. Information, Extension services.

INTRODUCTION

e-Agriculture as an emerging field in the intersection of agricultural informatics, agricultural development, and entrepreneurship, referring to agricultural services, technology dissemination, and information delivered or enhanced through the Internet and related technologies (FAO, 2005).The application of e-Agriculture is still in its elementary stage, evolving around the immense multiplier impact tendency that can significantly change the farmer's economic and social condition i.e. empowerment. This ensures the effective and efficient use of information and communication technologies for analysing, designing and implementing existing and innovative applications to help the agricultural stakeholders and uplift of agricultural sector. In 2008, Bangladesh Institute of ICT in Development (BIID), in collaboration with Katalyst (Partner of Swiss Contact & a local agro-based NGO) and Grameenphone launched the e-krishok initiative (New Agriculturist, 2015). The purpose of these project was to lessen the information gap in the agriculture sector thus making up-to-date knowledge and advisory services accessible to farmers which they often required. Later on, Bangladesh government came up with the idea of "Digital Bangladesh" with a vision to leverage the power of ICT in each and every public sector and service (a2i, 2014). In this context, Government Launched several projects to digitalize the agricultural services as well in empowering the farmers. Empowerment is a process of change by which individuals or groups gain the power and ability to take control of their lives (World bank, 2011). Therefore, this idea of farmer's empowerment by the means of e-Agriculture has been studied to find out whether the initial wave of e-Agriculture attempts made some productive impacts or not. The idea of e-Agriculture is still in the nascent stage in Bangladesh context, so does it in the academic arena. In 2003, under the "Support to ICT" taskforce program the ministry of agriculture of Bangladesh did set up an agricultural information system. (MoA, 2003). In 2005, a group of researchers of D.Net (Development Research Network, Bangladesh) proposed the idea of "Pallitathya Help Center" and conducted a project on it. The idea centered on the use of relatively less fashionable ICT, the mobile phone, as an effective 'last mile solution' to improve access to livelihood information for the rural people. They found it most challenging to understand the problems (related to health, agricultural,

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weather information) of rural people and to provide the appropriate information (Raihan *et al,* 2005). Since this idea is brand new, this researcher has not come across any local literature that has made any qualitative attempt to measure the impact of e- Agriculture in the empowerment process. Hence, the quest for previous quantitative approached literature has been shifted to South Asian literatures as because these countries share the similar socio-economic context. Ironically, this attempt has turned into a futile one also, as there are numerous literatures that have examined the women empowerment, economic empowerment through micro-finance but nothing in the field of farmer empowerment or impact of e-Agriculture. Out of all the literatures that have been reviewed, the researcher has found the literature of Sendilkumar (2012) from Kerala Agricultural University which has close match to the purpose of this literature analysing the empowerment dynamics of kerala farmers who joined the grouped approached farming of Paddy introduced by the kerala local government. In this regard, he developed an Empowerment Dynamics Index (EDI) and computed the index for the before and after joining situation of these farmers. The result showed that this program had significant role to set up sustainable development of the farmers in this state. So, this literature has been attempted in this Greenfield segment and perhaps the first of its kind in Bangladeshi context. Not to mention, the researcher has thoroughly gone through the other empowerment literatures from which statistical model used in the context, has been applied.

METHODOLOGY

Data Collection and Sampling Methodology: The researcher applied purposively selected the location form where the data were collected. The study was conducted at the Bhatbour block of Dighi union under Manikganj Sadar Upazila, Manikganj (One of the major districts of Bangladesh) where the government of Bangladesh has been implementing a numbers of e-Agriculture related development projects with the help of foreign aids through Department of Agricultural Extension (DAE). For the purpose of this study, the farmers (within this block) those who used e-agriculture were considered as the study group and the farmers those who did not use e-agriculture (within this block) were considered as the control group. According to the DAE database (the database was only available for this block), in this area, approximately 1148 farmers used e-agricultural facilities. To determine the sample size out of these 1148 study group farmers, the researcher used Yamane's (1967) formula:

$$n=\frac{z^2P\,(1-P)N}{z^2P\,(1-P)+N\,(e)^2}$$

Where, n = Sample size

N= Population size = 1148

e = The level of precision = 8%

z = the value of the standard normal variable given the chosen confidence level (z = 1.96 with a confidence level of 95 %)

P= The proportion or degree of variability = 50%

According to the formula, the desired sample size (n) was = 133. Thereafter, the desired respondents' size of the control group was determined as 45. As the study group's sample size was one third of its population, this same ratio was applied here to determine the control group sample size. After determining both of the sample sizes for each of the group, a semi-structured questionnaire was developed and printed for conducting one to one interview. To reduce information distortion, one farmer from each of the farming family was included in the survey. Furthermore, to ensure similar socio-economic conditions for both the control and test groups, a two-way stratified random sampling technique was used, in which education and farm size were considered as two individual strata. Education was further categorized into three groups: group 1 (denoted as E1), whether respondents were illiterate or could sign only; group 2 (denoted as E2), whether respondents had primary education or not, and group 3 (denoted as E3), whether respondents had secondary or higher. After that, Farm size was also categorized into three groups: group 1(denoted as F1), small farm group (farm size up to 0.5 hectors); group 2 (denoted as F2), medium-farm group (farm size 0.51 to 1.0 hector), and group 3 (denoted as F3), large farm group (farm size above 1.0 hector). The two-way stratified random table is given as Table 1. With the help of the two-way stratified random sampling procedure, homogeneous/similar categories of control and testing group respondents were selected, and then the proportionate random sampling technique was used to select either study or control group respondents from each village. Data were collected in two phases from the same group of respondents (in August, 2013 and September, 2015). A reserve list was maintained to fill in the gaps if any respondent in the original list was found missing as the same respondent in two interviews (in August, 2013 and September, 2015).

To ensure the same respondents for the two phase interviews, 5% extra respondents were interviewed in the first phase and in the year of 2013 to fill in the gaps in case of any interviewed respondent unavailability in the second phase and in the year of 2015 interview period. Each parameter was developed by the outputs of focused group discussion held with the officials, experts, academicians and experienced/progressive farmers. The impact/change of all the related variables were counted using a numeric value and if required, an equivalence factor was adjusted with the counted score, considering the number of members in study group and control group. The definitions of the variables measured are depicted in the Table 2.

Table 1. Two-way stratified random sampling of respondents based on their level of education and farm size.

Category	% of respondents	No of respondents from the study group	No of respondents from control group (one-third of the study group)
E1 ×F1	10.53	14	5
E1 ×F2	5.26	7	3
E1 ×F3	4.51	6	2
E2 ×F1	21.05	28	9
E2 ×F2	9.02	12	4
E2 ×F3	12.03	16	5
E3 ×F1	22.56	30	10
E3 ×F2	9.02	12	4
E3 ×F3	8.27	11	3
Total	100	133	45

Table 2. Variable measurement techniques.

Category	Scoring system				
Age	1 for each complete year of age of the respondent				
Education	1 for each year of school education				
Farm size	1 for each decimal area of land				
Usages of e-Agriculture	Extent of Uses				
	4= frequently	3= regularly	2=occasionally	1= rarely	0 =not at all
Attitude towards e-Agriculture	Extent of Opinion				
	(+2)= strongly agree	(+1)=agree	(0)=undecided	(-1)= disagree	(-2)= strongly disagree
Organizational Participation	Nature of participation (years)				
	4= President	3=secretary	2= executive member	1=ordinary member	0=no participation
Cosmopoliteness	Places of visiting (years)				
	4=frequently	3=regularly	2= occasionally	1=rarely	0=not at all
Availability of e-Agriculture	Availability score				
	4= frequently	3= regularly	2= occasionally	1= rarely	0=not at all

Measurement of farmers' empowerment: Farmers' empowerment is the dependent variable. To reveal this empowerment, the researcher considered five (05) sub-parameters: economic empowerment, family and social empowerment, political empowerment, knowledge empowerment and psychological empowerment. All the

sub- parameters were measured with the help of identified subcomponents. Each sub-parameter was measured against the identified items, collected through the process of review of relevant literature, focused discussion with the officials, experts, experienced farmers. Empowerment of Farmers (EoF) was calculated by using the formula:

EoF =Eeco + Efs+ Epol+ Ekno+ Epsy

Where, EoF = Empowerment of farmers, Eeco = Economic empowerment, Efs = Family and social empowerment, Epol = Political empowerment, Ekno = Knowledge empowerment and Epsy = Psychological empowerment.

Empowerment Condition Index: The empowerment was measured by determining the empowerment conditions, presented as the Empowerment Condition Index (ECI), with the variables being (a) changes in economic empowerment, consisting of income due to yield obtaining, saving money, investments, availing agriculture loans and purchase of inputs of farming, (b) changes in family and social empowerment, considered by measuring changes in a respondent's developing institutional contact, linkage with development departments, team spirit, leadership quality, group consensus to solve problem, (c) changes in political empowerment, where political empowerment was considered through changes in level of social well-being activities, membership in the social organization, freedom of expression and conflict management. (d) changes in knowledge empowerment, considered by measuring changes in a respondent's use of machineries & equipment, knowledge on value addition, adoption of IPM, INM, IWM practices and (e) changes in psychological empowerment, considered by measuring changes in a respondent's motivation in farming, self-esteem, risk taking ability, confidence and decision making ability. The respondents' responses variable were counted by providing a score based on a response scale. Each respondent's total change (unit free score) was considered as the 'condition index'.

Minimizing spill-over effects: The study used a quasi-experimental survey design to resolve the problems of endogeneity at both village/group and participant levels. The selected villages were exclusively served by the study programs, where no other organization(s) implemented a similar program within the villages, or even outside the villages within a considerable surrounding area: a large distance (about 3–5 km) was maintained between the study and control group villages (Hulme, 2000). The study and control group respondents were also selected to represent both the Muslim and Hindu communities; between the nearest two groups, if one group contained a Muslim community, the other contained a Hindu community (Duvendack *et al.,* 2011). To avoid downward bias, all control respondents were selected from those villages where non e-Agriculture users had yet introduced.

Statistical analysis: Data collected from the respondents were analyzed and interpreted in accordance with the objectives of the study. The analysis of data was performed using statistical treatment with SPSS (Statistical Package for Social Sciences) computer program, version 20. Statistical measures as a number, range, mean, standard deviation were used in describing the variables whenever applicable. In order to estimate the contribution of the selected characteristics of farmers in empowering them through e- Agriculture, Multiple regression analysis (B) analysis was used. Throughout the study, ten percent (0.1) level of significance was used as the basis for rejecting any null hypothesis. If the computed value of (B) was equal to or greater than the designated level of significance (p), the null hypothesis was rejected and it was concluded that there was a significant contribution between the concerned variable. Whenever the computed value of (B) was found to be smaller at the designated level of significance (p), the null hypothesis could not be rejected. Hence, it was concluded that there was no contribution of the concerned variables. Changes in economic empowerment, changes in family and social empowerment, changes in political empowerment, changes in knowledge empowerment and changes in psychological empowerment were considered as the sub-parameters of dependent variable against respondents' empowerment condition. The model used for this analysis can be explained as follows:

$$Y= a + b1x1 + b2x2 + b3x3 + b4x4 + b5x5 + b6x6 + b7x7 + b8x8 + e;$$

Where, Y= Empowerment of farmers of the independent variables, x1 is the respondent's age, x2 is education, x3 is farm size, x4 is usages of e-Agriculture, x5 is the attitude towards e-Agriculture, x6 is organizational participation, x7 is cosmopoliteness, x8 is the availability of e-Agriculture. b1, b2, b3, b4, b5, b6, b7 and b8 are regression coefficients of the corresponding independent variables, and e is random error, which is normally and independently distributed with zero mean and constant variance.

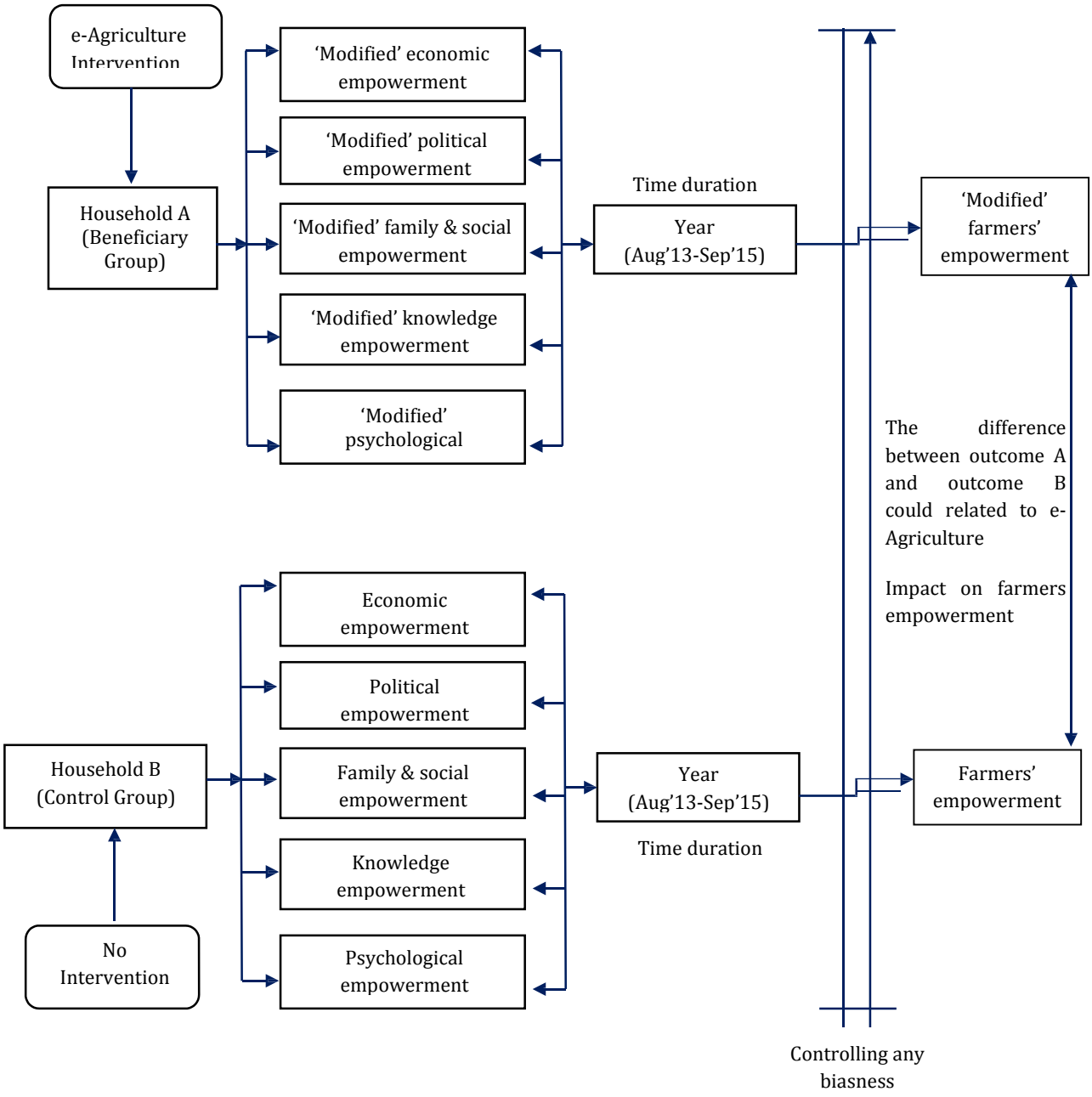

Figure 1. A schematic diagram of the proposed study: What is the impact of e-Agriculture on farmers' empowerment?.

RESULTS AND DISCUSSION

A comparison empowerment condition index for Study Group and Control Group: A comparison between Study Group (SG) and Control Group (CG) was done to find out the e- Agriculture impact on farmers. e-Agriculture users had mentionable improvement in empowerment. Study group mean score of empowerment was 26.569 while the control group gained only 19.411. The distributions of changed empowerment and with respect to study group and control group respondents' are shown in table 3 along with t-test (1% level of significance) value. The score of empowerment impact found 7.158. Finally, there was a significant difference between study group and control group respondents' level of empowerment based on t-test statistics (1% level of significance) value. So, there was a positive impact of e-Agriculture.

Empowerment of farmers: The empowerment score of the farmers varied from 38 to 75 against the possible range 0-120. The average empowerment score was 20.25.

Based on their overall empowerment score, the farmers were classified into three categories highly empowered (>50), moderately empowered (26-50) and little empowered (<25). Empowerment of farmers through e-Agriculture ranged from 9 to 48. The average and standard deviation were 26.55 and 5.89 respectively.

Table 3. Distribution of study group and control group respondents' level of empowerment based on their changed value.

Sub-parameter of empowerment (scoring method)	Empowerment indicators	Study Group (changed mean value differences)	Control Group (changed mean value differences)	-test value
Economic empowerment	Increased income due to yield obtaining	0.955	0.674	3.728**
	Saving money	1.271	0.891	6.080**
	Investments	1.271	0.717	5.295**
	Availing agriculture loans	1.459	0.891	4.347**
	Purchase of farming inputs	1.248	1.217	3.162**
	Sub total	6.203	4.391	-
Family and social empowerment	Developing institutional contact	0.977	0.717	2.789**
	Linkage with developing departments	0.895	0.652	1.848
	Team spirit	1.105	0.761	6.514**
	Leadership quality	1.218	0.869	3.919**
	Group consensus to solve problem	1.293	0.783	5.449**
	Sub total	5.488	3.781	-
Political empowerment	Participation in social well-being activities	0.744	0.608	2.874**
	Membership in the social organization	0.406	0.456	0.724
	Freedom of expression	1.188	0.761	4.023**
	Conflict management	1.218	0.826	2.874**
	Sub total	3.556	2.652	-
Knowledge empowerment	Use of machineries & equipment's	0.939	0.522	4.933**
	Knowledge on value addition	1.195	0.783	4.739**
	Adoption of IPM practices	1.316	0.848	4.392**
	Adoption of INM practices	1.188	1.217	2.031
	Adoption of IWM practices	1.226	0.957	3.511**
	Sub total	5.864	4.326	-
Psychological empowerment	Motivation in farming	0.939	0.587	3.697**
	Self esteem	1.015	0.739	4.057**
	Risk taking ability	1.181	0.935	3.500**
	Confidence	1.218	0.869	3.748**
	Decision making ability	1.105	1.131	0.553
	Sub total	5.458	4.261	-
Total		26.569	19.411	-

Empowerment impact= Mean score of study group empowerment (26.569) - Mean score of study group empowerment (19.411) = 7.158

On the basis of empowerment of farmers through e-Agriculture, the respondents were categorized into three categories namely poor, medium and high empowerment (positive). The most of the farmers (53.4 percent) had low empowerment through e-Agriculture while 46.6 percent of them had the medium empowerment which is the highest percentage. None of the farmers were highly empowered.

Variables related in empowering of farmers: In order to estimate the empowerment from the independent variables, multiple regression analysis was used which is shown in the Table 4.

Table 4. Multiple regression coefficients of contributing variables related in empowering of farmers through e-Agriculture.

Dependent variable	Independent variables	B	p	R2	Adj. R2	F	p
Empowering of farmers	Age	-0.011	0.676	0.892	0.884	201.782	0.000***
	Education	0.002	0.986				
	Farm size	0.686	0.032**				
	Usages of e-Agriculture services	1.271	0.000***				
	Attitude towards e-Agriculture	0.369	0.000***				
	Organizational Participation	0.423	0.005***				
	Cosmopoliteness	0.536	0.014**				
	Availability of e-Agriculture	0.902	0.068*				

*** Significant at p<0.01. ** Significant at p<0.05. * Significant at p<0.1.

There is no contribution of the selected characteristics (age, education, farm size, usages of e-Agriculture, attitude towards e-Agriculture, organizational participation, cosmopoliteness, availability of e-Agriculture) of farmers in empowering them through e-Agriculture.

In order to assess which factors contribute to empowerment, multiple regression analysis was used. Table 4. shows that there is a significant contribution of respondents' farm size, usages of e- Agriculture, attitude towards e-Agriculture, organizational participation, cosmopoliteness and availability of e-Agriculture to change their empowerment regarding the sub parameter such as economic, family and social, political, knowledge and psychological empowerment through e-Agriculture. Of these, usages of e-Agriculture, attitude towards e-Agriculture, organizational participation were the most important contributing factors (significant at the 1% level of significance). Farm size and cosmopoliteness were also the important contributing factors (significant at the 5% level of significance) while coefficients of availability of e-Agriculture are also significant at the 10% level of significance.

89.2% (R2 = 0.892) of the variation in the respondents' changed empowerment can be attributed to their farm size, usages of e-Agriculture, attitude towards e-Agriculture, organizational participation, cosmopoliteness and availability of e-Agriculture, making this an excellent model (see table 4). The F value indicates that the model is significant (p<0.000). However, each predictor may explain some of the variance in respondents' empowerment conditions simply by chance. The adjusted R-square value penalizes the addition of extraneous predictors in the model, but values of 0.884 still show that the variance in respondents' empowerment can be attributed to the predictor variables rather than by chance, and that both are suitable models (Table 4.). In summary, the models suggest that the respective authority should consider the respondents' farm size, usages of e-Agriculture, attitude towards e-Agriculture, organizational participation, cosmopoliteness and availability of e- Agriculture.

CONCLUSION AND RECOMMENDATIONS

This study suggested that e-Agriculture had significant impact on the farmers' empowerment of Bangladesh. In addition to that, the study also revealed the factors that changed significantly due to the involvement of e-agriculture towards the empowerment of the study group. Based on these findings, the researcher would like to suggest two policy level implications. 1) The government should implement such e-Agriculture projects on a larger scale all over the country 2) To popularize this service, government should implement integrated marketing communication using the popular print and electronic media so that more and more people get aware of this service.

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REFERENCES

A2i Program. (2014). Digital Bangladesh E-Sheba Sobar Jonno. Access to Information Program. Prime Minister's Office, Dhaka, Bangladesh.

Duvendack, M., Palmer-Jones, R., Copestake, J. G., Hooper, L., Loke, Y., & Rao, N. (2011).What is the Evidence of the Impact of Microfinance on the Well-Being of Poor People?. EPPI-Centre, Social Science Research Unit, Institute of Education, University of London: London.

FAO. (2005). Bridging the Rural Digital Divide. Food and Agriculture Organization. Rome, Italy. p: 1.

Hulme, D. (2000). Impact assessment methodologies for microfinance: theory, experience and better practice. World Development, 28, 79–98.

MoA. (2003). ICT taskforce program. Ministry of Agriculture, Government of the People's Republic of Bangladesh.

New Agriculturist. (2015). e-Krishok: promoting ICTs to farmers in Bangladesh. Retrieved from: http://www.new-ag.info/en/focus/focusItem.php?a=2779

Raihan, A., Hasan, M., Chowdhury, M., & Uddin, F. (2005). Pallitathya Help Line, A Precursor to People's Call Center. A D.Net Publication, November 2005.

Sendilkumar, R. (2012). Empowerment of Farmers through GALASA Programme: A Journey for Sustainable Agriculture Development. Indian Res. J. Ext. Edu., 12 (3).

World Bank. (2011). Promoting Women's Agency in World Development Report 2012: Gender Equality and Development. World Bank, Washington DC.

Yamane, T. (1967). Elementary Sampling Theory. Prentice-Hall: Englewood Cliffs, NJ.