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Extension Workers' Attitude towards e-Agriculture: A case study from Bangladesh

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Abstract

E-Agriculture is being the utmost desire for the sustainable development world over. The research was designed to assess extension workers' attitude towards e-Agriculture in general. The methodology of this study is an integration of quantitative and qualitative methods based on primary data collection. The study was conducted in two upazilas (sub-districts) of Mymensingh district, namely Mymensingh Sadar and Fulbaria. Data were collected from 78 Sub-Assistant Agriculture Officers (SAAOs) out of total population of 78, following whole population sampling. The empirical data for the study were collected by using distributed questionnaire during weekly conference day at their respective sub-district headquarters. Extreme majorities (94.9 percent)of the extension workers were found to have moderately favourable attitude and 3.8 percent had highly favourable attitude towards e-Agriculture. On the other hand, only 1.3 percent of the SAAOs had slightly favourable attitude towards e-Agriculture. The findings also revealed that, annual income, knowledge on e-Agriculture, access to ICT facilities and use of media associate with e-Agriculture of the SAAOs had positive and significant relationships with their attitude while age and service tenure of the SAAOs were found to have significant negative relationships with their attitude towards e-Agriculture. However, level of education, family size, information sources regarding e-Agriculture, training received on e-Agriculture and job satisfaction of the SAAOs did not show any significant relationship with their attitude towards e-Agriculture.

Keywords: Attitude, E-Agriculture, Extension Workers, Farm Information

1. Introduction

1.1 Background of the Study

Bangladesh is a small agrarian country in the South Asia having 170 million people (BBS, 2017). It has stepped into new era of "Digital World" with a spectacular vision for making "Digital Bangladesh". This vision would be saddled by e-Agriculture involving multidisciplinary initiatives of agricultural informatics, agricultural development and entrepreneurship towards building a hunger-free, efficient and resourceful Bangladesh. e-Agriculture is an emerging field in the crossroads of agricultural informatics, agricultural advancement, and entrepreneurship, referring to agricultural services, technology dissemination, and information delivered through the internet and related technologies (FAO, 2005). More specifically, e-Agriculture involves the conceptualization, design, development, evaluation and application of novel ways to use information and communication technologies (ICTs) in the rural areas, with a primary focus on agricultural growth and development. e-Agriculture as well as ICT can be broadly understood as the technologies that facilitate communication, processing and transmission of information by electronic means (Zijp, 2004). The application of e-Agriculture is still in its basic stage, evolving around the enormous multiplier impacts that can significantly change the farmers' economic and social empowerment. It ensures the effective and efficient use of information and communication

technologies for analyzing, designing and implementing existing and innovative applications to help the agricultural sector. In 2008, Bangladesh Institute of ICT in Development (BIID), in collaboration with Catalyst (A partner of Swiss Contact and a local agro-based NGO) and Grameenphone launched the e-krishok initiative (New Agriculturist, 2015). The purpose of these projects was to diminish the information shortage in the agriculture sector and thus enabling the farmers with up-to-date knowledge and advisory services which they often required. After that, Bangladesh government came up with the idea of "Digital Bangladesh" with a vision to influence the power of ICT in each and every public sector and service (a2i Program., 2014). Keeping that in mind, Government launched several projects to digitalize the agricultural services as well in empowering the farmers. By using e-Agriculture as well as ICT, particularly the internet, mobile phones, e-mails and SMS, agricultural information is accessed more easily and the coverage also expands (Woods et al., 2002). It was found that use of ICT on e-learning in particular is a valuable alternative in addressing the continuing educational needs of agricultural (Abdon et al., 2014). The benefits of utilizing e-learning tool for agricultural extension and training purposes are also well documented (Hafkin et al., 2006; Asenso-Okyere and Mekonnen, 2012). It is also confirmed by a study that ICT use for extension activities will ultimately transform extension workers into catalysts who will play roles of empowering community people and organizations, human resource development, problem solving and educating farmers (Chamala, 2010). The role of extension workers in bridging the technological gap between existing and evolving scientific knowledge and farmers' knowledge cannot be glossed over. It is therefore appropriate to state that the most critical target learners of ICT initiatives are knowledgeable, skilled and committed extension workers. Therefore, this idea of extension workers' attitude towards e-Agriculture has been studied to find out whether the initial wave of e-Agriculture attempts made some productive impacts or not.

1.2 e-Agriculture Initiatives in Bangladesh

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 programme 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 and weather information) of rural people and to provide the appropriate information (Raihan et al., 2005). The current government's vision of Digital Bangladesh by 2021 proposes to mainstream ICTs as a pro-poor tool to eradicate poverty, establish good governance, ensure social equity through quality education, health care and law enforcement for all, and prepare the people for climate change. Given that Bangladesh as an agrarian economy with almost 50% of the labour force still employed and more than 70% of the population engaged directly or indirectlyin the agriculture sector and that the country has set a course for self-sufficiency in food production and end hunger by 2030 (GoB, 2012). Thus, agriculture sector naturally gets the highest emphasis on the Digital Bangladesh e-services strategy. Some areas of focus are:

Strengthening the existing information channels and developing new ones to provide farmers with real time information related to integrated crop management, input availability and dosage, irrigation, soil quality, etc. at the community level.

Building capacity of farmers and extension workers through distance learning and by using locally relevant multimedia content.

Fostering market access with necessary information and training to promote support and enhance farmers' income.

Agricultural Information Services (AIS) is the leading organization under the ministry of Agriculture which is playing the key role in operating the e-Agriculture programme. Among current e-Agriculture interventions of AIS, the mentionable are Agriculture Information and Communication Centre (AICC); Bangla website; Krishi Call Centre; Multimedia e-book; Touch Screen Kiosk; ICT Lab; and Community Radio (AIS, 2017).

Agriculture Information and Communication Centre (AICC) is the ICT based information service centre. These are established at grass root level and operated by the farmers. AICCs are well equipped with ICT devices like computer, laptop, printer, internet modem and camera. With the facilitation of the SAAOs farmers are giving and receiving information services among them. Moreover farmers and extension workers are receiving expert consultation on agricultural issues through online video conferencing with specialists of AIS which has really created an immense scope of getting better information for the marginal people. There are 245 AICCs countrywide and on an average 40-50 people receive information services from one AICC per day (AIS, 2017).

Bangla Website is one of the important e-Agriculture initiatives of AIS (www.ais.gov.bd).

This is not only a website but also a complete agricultural knowledge bank for the interested people and professionals. As the website has prepared in Bengali so it is understandable to extension workers as well as farmers. It provides complete production technology of different crops like cereals, vegetables, oil seeds, pulses, spices and other cash crops as well as production technologies for common livestock and fisheries. This website updates expert opinions regarding contemporary agricultural issues. In addition various print, electronic and ICT contents of AIS are being uploaded on regular basis. It also provides updated weather forecasting and other news and notices. This is the biggest website developed in Bengali language (AIS, 2017). Krishi Call Centre was established in June 2012 at AIS headquarters under the Ministry of Agriculture to provide agricultural information services to farmers and other stakeholders of agriculture sector in Bangladesh. This centre has been operating by the support of an International NGO Practical Action, Bangladesh since June 2014. It has a short code number "16123". Any person can receive instant expert consultations on crop, livestock and fisheries related issues by calling this number from any mobile operators of Bangladesh spending 0.25 BDT per minute. The service is available from 9:00 am to 5:00 pm except Friday and other government holidays (AIS, 2017).

Touch Screen Kiosk is the easy medium of getting agricultural information which is loaded with agricultural information along with audio and video contents. It is enriched with e-book, audio content, video content, AICC database etc by AIS on a regular basis and connected with high speed internet. There are 12 touch screen Kiosks placed in AIS headquarters as well as other regional offices from those interested farmers and others can get agricultural information without help of any personsonly touching the screen (AIS, 2017). Community Radio is the only government operated Community Radio FM 98.8 belongs to Ministry of Agriculture is working in the South-west coastal regions of Bangladesh. This community radio was established by the financial support of FAO and started to broadcast agricultural and rural development programmes since January 01, 2012.

At present the community radio broadcast various programmes for 8 hours in a day (9:00 am to 11:00 am and 3:00 pm to 9:00 pm) based on audiences' need. Its programmes cover crop, livestock, fisheries, forestry, environment, education, nutrition, health, rural entertainment, ICT, local news, women and children, rural development, climate change and disaster management issues. Local people are involved in planning, preparing and broadcasting community radio programmes. There are about 25 audience clubs of community radio and they have around 75000 audiences (AIS, 2017).

ICT Lab is a lab for year round ICT training for farmers, extension workers and other concerned persons. Agricultural Information Service (AIS) has established 10 modern ICT labs in 10 agricultural regions of the country with financial support of its development project named DKI. Each of the labs is used as ideal training venue and is equipped with 25 desktop computers, multi-media projector andinternet connection with air-conditioned facilities (AIS, 2017). Rather than AIS, Department of Agricultural Marketing (DAM) has a web-based price information dissemination system for the farmers and Soil Resources Development Institute (SRDI) has been operating web-based soil testing database (Karim, 2010). In addition to GOs few Non-Government Organizations like D.Net, m-Power and BIID also has their own e-Agriculture programmes jointly with Department of Agriculture (DAE) and few donor organizations. Since this idea is brand new, this researcher has not come across any local literature that has made any qualitative attempt to measure the attitude of e-Agriculture among the extension workers. So, this literature has been attempted in this Greenfield segment and perhaps the very beginning of its kind in Bangladeshi context. Not to mention, the researcher has thoroughly gone through the other countries extension workers' attitude towards e-Agriculture from which statistical the model used in the context, has been applied.

1.3 Theoretical Framework of the Study

Agricultural extension is the function of scientific research and innovative knowledge to agricultural practices all the way through farmers' education. The exposure of 'extension' now includes a wider range of communication and learning activities organized for the people living in the farming community by the educators from different disciplines, including agriculture, agricultural marketing, health, and business studies. The Department of Agricultural Extension (DAE) is the leading agricultural extension organization in Bangladesh which is primarily and mostly responsible for carrying out agricultural extension services to the farmers. In Bangladesh, the goal of agricultural extension is to encourage the various partners and agencies within the national agricultural extension system to provide efficient and effective services which complement and reinforce each other, in an effort to increase the efficiency and productivity of agriculture in Bangladesh (NAEP, 2012).

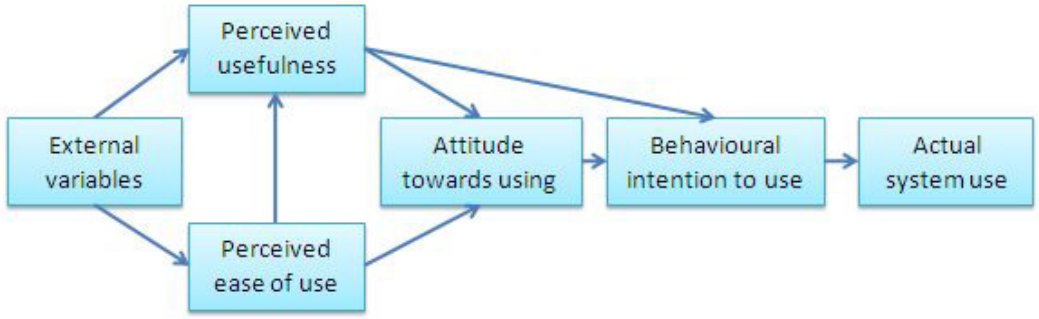

Figure1. Technology Acceptance Model (TAM)

The organizational levels for the management of the extension services of DAE are: i) The headquarters (national level); ii) Region (regional level); iii) Zone (district level); iv)Upazila (sub-district level) and v) Block (field level). Block level is the most vital level as this level directly provides extension services to its clientele. There are about 12,000 agricultural blocks in Bangladesh. Each block is managed by one Sub-Assistant Agriculture Officer (SAAO). The SAAOs are the front-line extension worker in Bangladesh and they are directly linked with the farming community. Usually a SAAO has to look after 900-1200 farm families depending on population density and cropping intensity of the block. However, with given the working hours, the logistic constraints, the geographical context and the available resources this really a massive task for a SAAO to provide adequate extension support to all the assigned farmers of the concerned blocks (Sadek, 2016). Thus, farmers are forced to take advice from illiterate or non-expert input dealers and are prone to be misled or exploited, which affects the overall productivity of the country and hampers farmers' livelihoods. Considering this reality, e-Agriculture was introduced in Bangladesh in 2003. As the SAAOs are the front line fighters in the extension system of Bangladesh so their active participation in the e-Agriculture progamme is very important for getting the benefits of the novel approach of e-Agriculture. Thus, it is essential to verify their attitude towards e-Agriculture programme after a decade. To assess their attitude towards e-Agriculture the Technology Acceptance Model (TAM) was used. TAM is an information systems theory that models how the users come to admit and use a technology. The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it, notably:

Perceived usefulness (PU) – This was defined by Fred Davis as "the degree to which a person believes that using a particular system would enhance his or her job performance".

Perceived ease-of-use (PEOU) – Davis defined this as "the degree to which a person believes that using a particular system would be free from effort".

TAM is one of the most influential extensions of Ajzen and Fishbein's theory of reasoned action (TRA) in the literature. Having few criticisms Davis's technology acceptance model (Davis, 1989; Bagozzi et al., 1992) is the most widely applied model of users' acceptance and usage of technology (Venkatesh, 2000). Thus, the model was used to assess extension workers' attitude towards the new idea of e-Agriculture.

2. Materials and methods

2.1 Area and Sampling

Mymensingh is one of the leading districts among the 64 districts in Bangladesh. It has agricultural importance for its fertile alluvial soil, moderate average temperature (21-300C) and handsome average rainfall (2294mm) (Wikipedia, 2017). Thus Mymensingh district was selected purposively for the study (Figure 2).

Figure 2. Map of Mymensingh district showing the study area

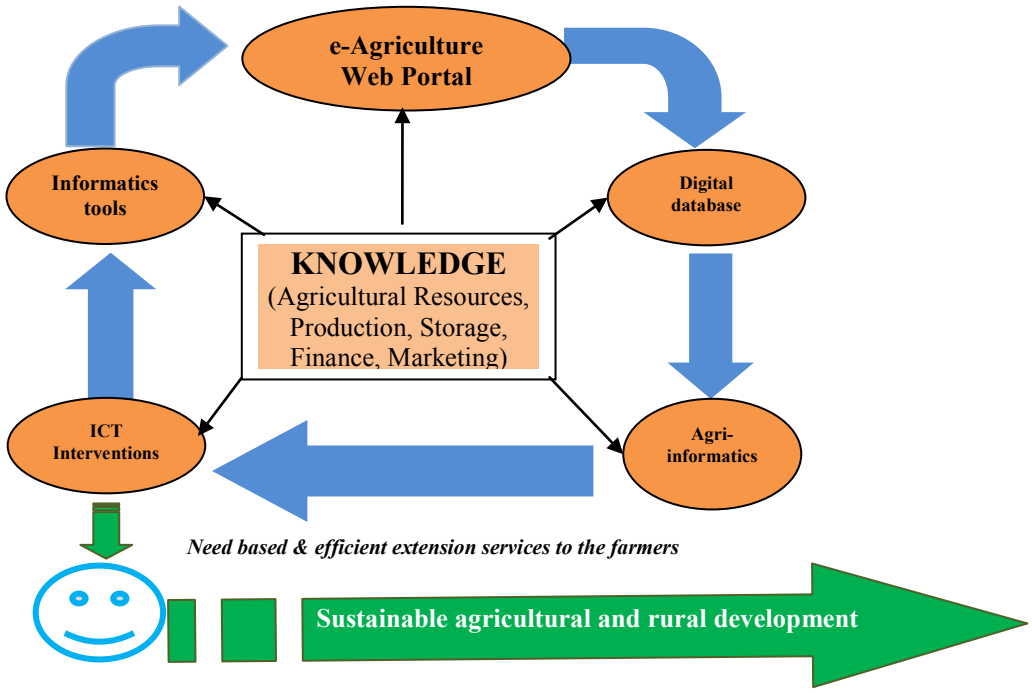

Figure 3. Conceptual framework of study

Sub-Assistant Agriculture Officers (SAAOs) are the field level extension workers in the Department of Agricultural Extension (DAE) under the Ministry of Agriculture and responsible for providing extension services to the farming community. Thus, it is very important to assess their attitude towards e-Agriculture. So, all the 78 Sub-Assistant Agriculture Officers (SAAOs) of the two selected sub-districts constituted the population for the study. As the respondents were educated thus a pre-tested structured distributed questionnaire was used to collect necessary information from the respondents pertinent with the objectives of the study. Simple and direct questions and some scales were included in the schedule to obtain information for independent and dependent variables. The questions were arranged systematically and presented clearly. The distributed questionnaire was pre-tested with 10 extension workers of the both sub-districts. Based on the pre-test experience, necessary corrections and modifications were made prior to finalizing the questionnaire for data collection.

Eleven selected characteristics of the extension workers like age, level of education, family size, service tenure, annual income, information sources regarding e-Agriculture, training received on e-Agriculture, knowledge on e-Agriculture, job satisfaction, access to ICT facilities and use of media associate with e-Agriculture were the independent variables. Extension workers' attitude towards e-Agriculture constituted as the dependent variable of the study.

2.2 Measurement of Focus Variable (Extension Workers' Attitude towards e-Agriculture)

Extension workers' attitude towards e-Agriculture was considered the lone dependent variable of the study. Attitude of a respondent towards e-Agriculture was used to refer her/his feeling, belief, knowledge and action tendency towards various aspects of e-Agriculture. A 5-point Likert type scale was used to determine the attitude. The variable was measured by constructing an attitude scale of 22 statements including11 positive and 11 negative statements. Such arrangement was

made in order to avoid biasness in expressing attitude to e-Agriculture. A statement was considered as positive if it possessed an idea favourable to e-Agriculture. On the other hand, a statement was considered as negative if it was unfavourable to e-Agriculture. The respondents were asked to express their opinion by choosing one suitable option from five alternatives namely, "strongly agree", "agree", "undecided", "disagree" and "strongly disagree". Weightages of corresponding to the five options were given in the following manner:

Options	Score assigned	
	Positive statement	Negative statement
Strongly agree →	5	1
Agree →	4	2
Undecided →	3	3
Disagree →	2	4
Strongly disagree →	1	5

2.3 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. Both descriptive and inferential analyses were used to analyze the collected data. Pearson's product moment correlation analysis was used to predict the nature of relationship between focus variable and exploratory variables. While multiple regression models were used to understand the extent of relationship between exploratory variables and focus variable and identify the important factors affecting the focus variable respectively.

Multiple regression analysis is a powerful technique used for predicting the unknown value of a variable from the known value of two or more variables- also called the predictors.

More precisely, multiple regression analysis helps us to predict the value of Y for given values of X1, X2, …, Xk.

In general, the multiple regression equation of Y on X1, X2, …, Xk is given by:

$Y = b0 + b1\ X1 + b2\ X2 + \ldots\ldots\ldots\ldots + bk\ Xk$

Here b0 is the intercept and b1, b2, b3, …,bk are analogous to the slope in linear regression equation and are also called regression coefficients. They can be interpreted the same way as slope. Thus if bi = 2.5, it would indicates that Y will increase by 2.5 units if Xi increased by 1 unit.

The appropriateness of the multiple regression models as a whole can be tested by the F-test in the ANOVA table. A significant F indicates a linear relationship between Y and at least one of the X's. Once a multiple regression equation has been constructed, one can check how good it is (in terms of predictive ability) by examining the coefficient of determination (R2). R2 always lies between 0 and 1.

R2 - coefficient of determination

SPSS software provides it whenever regression procedure is run. The closer R2 is to 1, the better is the model and its prediction. Besides, stepwise multiple regressions were also used to determine the individual variable contributions to the focus variable.

3. Results and discussion

3.1 Selected Characteristics of the Extension Workers

This is important to understand the socio-economic characteristics of the respondent. Thus, the researchers tried to get detailed information regarding various socio-economic features of the extension workers and are presented in Table 1.

Data in Table 1 reveal that average age of the respondent extension workers were 48.99 years that indicates that majority of them are in middle-aged category. It is also revealed that the mean education level of the extension workers was 13.28 years with the standard deviation of 0.94.

Figure 4 show that the highest proportion of the extension workers (91.0%) had Agricultural Diploma and only 1% of them had bachelor degree. However, this is really very interesting that among the extension workers a significant portion (8%) of them had post-graduation. The findings of the study show that the mean family size of the extension workers was 4.9 that are similar with the national family size. Data also reveal that the majority of the extension workers had an average annual income of 551 thousand BDT (6888 USD). It indicates that their monthly income is only 575 USD which is really belongs to low income category. However, it was shown in Table 1 that their service tenures ranged between 3-39 years with average service tenure of 26 years. The significant proportion of extension workers had low contact about information sources regarding e-Agriculture and average score was 10.9. However, it was really frustrating that majority of the extension workers not yet received any training on ICTs and the mean training score was 0.73 days only. Thus, the average knowledge score of the extension workers on ICTs were poor (5.87 out of the highest score of 20).

Table1.Salient features of the extension workers (n=78)

Characteristics	Scoring System	Possible score	Observed score	Mean	Standard Deviation
Age	Actual Years	Unknown	26-58	48.94	8.78
Level of education	Years of schooling	Unknown	13-18	13.28	0.94
Family size	Number	Unknown	2-10	4.90	1.56
Service tenure	Actual years in the job	1-42	3-39	26.70	9.63
Annual Income	'000' BDT*	Unknown	400-850	551.07	134.07
Information sources regarding e-Agriculture	Scale score	0-30	0-26	10.24	6.68
Training received on e-Agriculture	Number of days	Unknown	0-3	0.73	0.38
Knowledge on e-Agriculture	Score	0-20	2-20	5.87	4.43
Job satisfaction	Scale score	0-39	15-46	29.85	6.21
Access to ICT facilities	Scale score	0-20	0-15	5.26	4.57
Use of media associated with e-Agriculture	Scale score	0-20	0-30	3.41	2.64

1 USD=Approx. 80 BDT

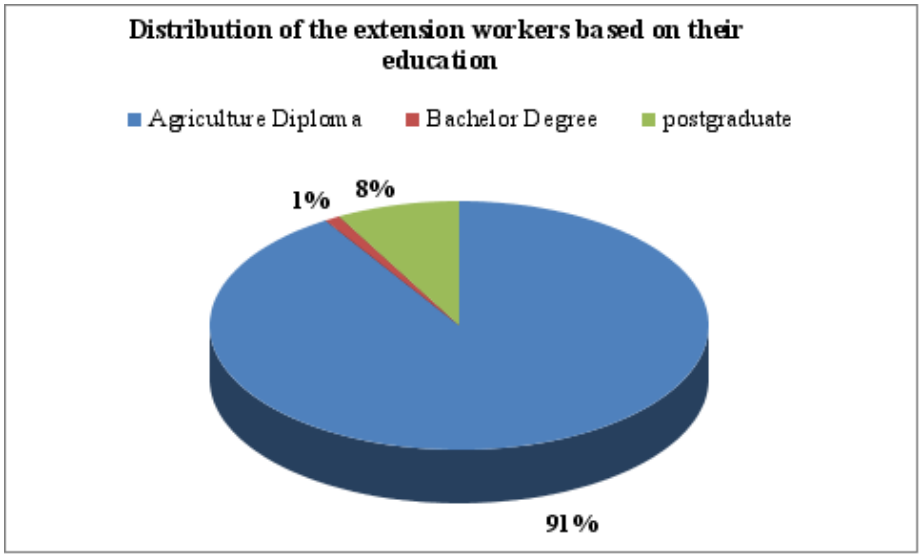

Figure 4. Distribution of the extension workers based on their level of education

Another reason for poor knowledge of the extension workers on ICTs is their low access to ICT facilities. It is revealed from Table 1 that the mean score on access to ICT devices of the extension workers was 5.28 compared to the highest score of 20. Additionally they respondents were asked to mention their access to different ICT Medias and data are presented in Table 2. It is revealed from Table 2 that all of the farmers have cell phone while only one-fourth (25.64%) of them have smart phone through which they can use internet.

Findings of the study also showed that only 3% of the extension workers have personal computer. However, more than a quarter (39%) of them has access to computer at office. On the other hand, less than half (46.15%) of the respondent has internet access. Among them 16% of them use internet through smart phone, 29% at office and rest of them used personal internet modem. However, the overall use of media associated with e-Agriculture by the extension workers was very low (mean score 3.41 against the highest score of 20). It is clearly shown in Figure 5 that highest majority (86%) of the respondent extension workers have used media associated with e-Agriculture up to 7 hours per week.

Table 2. Summary of Access to ICT devices of the extension workers

ICT devices	Respondents (n=78)	
	Frequency	Percentage
Cell phone	78	100.00
Smart phone	20	25.64
Personal computer	03	3.85
Personal laptop	05	6.41
Internet modem	04	5.13
Access to internet	36	46.15
Internet access using smart phone	13	16.67
Computer access at office	31	39.74
Internet access at office	23	29.48
Access to AICC	45	57.69

Figure 5 exhibits that still a significant portion (9%) of the respondents do not have any use of media associated with e-Agriculture. However, only 5% of them have 8 to 15 hours/week use of media associated with e-Agriculture which is really very insignificant.

3.2 Extension Workers' Attitude towards e-Agriculture

Extension workers attitude towards e-Agriculture was considered as the focus variable of the study. Attitude score of the respondents theoretically could range from 22 to 110, where 22 indicates slightly favourable attitude and 110 indicates highly favourable attitude towards e-Agriculture. Attitude score of the respondents ranged from 51 to 84 against the possible range of 22 to 110. The mean attitude score of the respondent was 69.0 with the standard deviation of 7.23 (shown in Table 3). It is established that, the top majority of the extension workers (94%) had moderately favourable attitude towards e-Agriculture. However, it was a bit higher (97%) in Mymensingh Sadar and 90% was in Fulbaria sub-district. While, only 5% of the respondent extension workers had highly favourable attitude towards e-Agriculture and all of them are from Fulbaria sub-district. The study also explored that still more than 1% of the respondent extension workers have slightly favourable attitude towards e-Agriculture and that is reported from Mymensingh Sadar. It helped the researchers to judge or measure the acceptance or rejection of e-Agriculture by the extension workers at grass roots level. To ensure the quick and timely information flow to the people of the farming community it is must to change the attitude of the extension workers towards e-Agriculture while they were used to with traditional extension system for long such time as effective information is pre-requisites to farmers to improve their farm productivity. Thus, a favourable attitude of the extension workers towards e-Agriculture is very important. However, may be due to poor access to training, poor knowledge on e-Agriculture, limited access to ICT facilities and low use of media associate with e-Agriculture; some of the extension workers were shown slightly favourable attitude towards e-Agriculture.

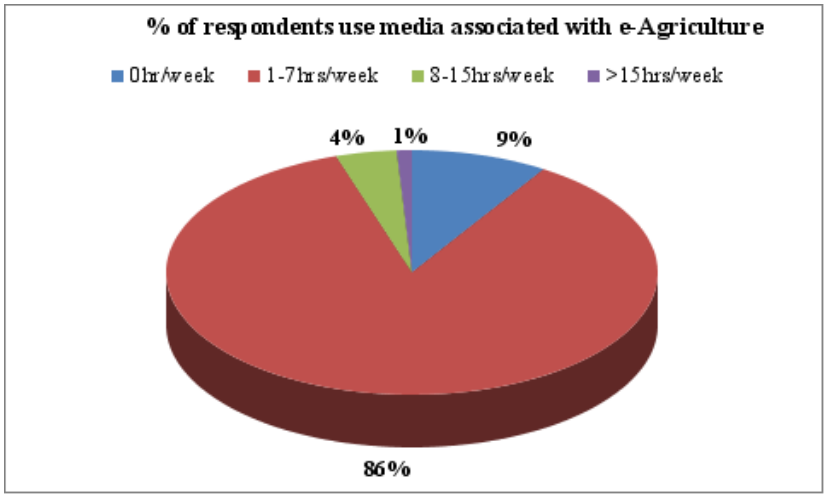

Figure 5. Extension workers' use of media associated with e-Agriculture

Table 3. Distribution of the extension workers according to their attitude towards e- Agriculture

Categories	Number of respondents (n=78)	Mean	Standard

	Mymensingh Sadar		Fulbaria		Combined			deviation
	f	%	*f*	%	*f*	%		
Slightly favourable attitude (22-51)	1	2.56	0	0	1	1.3	69.0	7.23
Moderately favourable attitude(52-80)	38	97.44	35	89.74	73	93.6		
Highly favourable attitude (81-110)	0	0	4	10.26	4	5.1		
Total	39	100	39	100	78	100		

Table 4. Crosstab between extension workers' access to ICT facilities and their attitude towards e-Agriculture

Extension workers' access to ICT facilities	Extension workers' attitude towards e-Agriculture			Total
	Slightly favourble	Moderately favourable	Highly favourable	
No access	0	7	0	7
Limited access	1	4	1	41
Medium access	0	39	4	24
High access	0	20	2	6
Total	1	70	7	78

Table 5. Extension workers' perception about e-Agriculture

Categories	Mymensingh Sadar (n=39)		Fulbaria(n=39)		Combined (n=78)	
	Yes	No	Yes	No	Yes	No
Perceived as useful	24 (61.54)	15 (38.46)	32 (82.00)	7 (18.00)	56 (71.80)	22 (28.20)
Perceived as easy to use	13 (33.33)	26 (66.66)	19 (48.71)	20 (51.29)	32 (41.00)	46 (59.00)

Note: Number in the parentheses indicate percentage

On the other hand, extension workers having better access to ICT facilities and having better knowledge on e-Agriculture were shown moderately to highly favourable attitude towards e-Agriculture. The present findings concur with the findings of two other studies Meera et al., 2014 and Islam et al., 2016.

According to TAM model another intention of the researchers was to verify how the extension workers perceived as the useful and ease about e-Agriculture in their service. Thus, the respondents were asked to mention their perception about the usefulness and how they feel ease to use e-Agriculture in their extension services and data are presented in Table 5. It is evident from Table 5 that about two-third (72%) of the extension workers perceived that e-Agriculture is useful in their job. Among these figures it was extreme (82%) in Fulbabaria sub-district and 60% was in Mymensingh Sadar sub-district. However, though extreme majority had positive perception on e-Agriculture but less than half (41%) of the respondent SAAOs had positive perception regarding the ease of using e-Agriculture.

Still more than half (61%) of the SAAOs have a fear about the use of e-Agriculture. The findings of the study also showed that between the sub-districts SAAOs from Fulbaria sub-district had a bit better (49%) positive perception compared to Mymensing Sadar (33% positive) perception regarding the ease of using e-Agriculture.

However, in order to make a threadbare discussion about extension workers' responses for all attitude statements were also analyzed by creating a rank order of the statements used for measuring their attitude towards e-Agriculture which has been presented in Table 6. It is evident from the Table 4 that the statement 'Dissemination of agricultural information through e-Agriculture is effective' ranked first among all attitude statements to the extension workers having score 290. It indicates that extension workers felt dissemination of farming information through e-Agriculture tools is much more effective than traditional extension system. Accordingly 'e-Agriculture can save time' has ranked second having score 289. It indicates that, dissemination of information is fast through e-Agriculture system. Third one is 'It is very easy to get information from e-Agriculture tools'.

Table 6. Ranking of statements for measuring attitude of extension workers towards e-Agriculture

Sl. no.	Statements	Nature of the responses	Total	Rank

		SA	A	UD	DA	SDA		
1.(+)	Dissemination of agricultural information through e-Agriculture is effective.	14	36	22	4	2	290	1
2. (-)	Cost of e-Agriculture system is higher than others.	9	20	29	16	4	248	15
3.(+)	It is comfortable to use different e-Agriculture tools.	7	18	33	14	6	240	18
4. (-)	Famer's feedback is fast through e-Agriculture than traditional extension methods.	5	25	35	9	4	252	14
5.(+)	e-Agriculture provides possible solutions of agricultural problem.	2	12	39	18	7	218	21
6. (-)	e-Agriculture will never enhance decision making capacity of extension workers.	1	27	29	16	5	237	20
7.(+)	e-Agriculture strengthens the linkage between extension worker and farmers.	8	28	32	7	3	265	8
8. (-)	Only resource rich farmers can get the benefit of e-Agriculture.	3	10	22	33	10	197	22
9.(+)	It is very easy to get information from e-Agriculture tools.	6	44	23	4	1	284	3
10. (-)	I cannot get need based information through e-Agriculture tools in local language.	10	13	34	17	4	242	17
11. (+)	e-Agriculture can save time.	11	38	25	3	1	289	2
12.(-)	e-Agriculture extension services avoid the personal extension contact.	5	19	33	19	2	240	19
13. (+)	Using social websites (Facebook & Twitter) between extension workers and farmers is helpful for establishing better communication.	9	26	23	16	4	254	13
14.(-)	Sometimes it is not possible to use the information received from ICT.	6	37	30	5	0	278	6
15. (+)	e-Agriculture based extension services assist the extension workers in planning and decision making aspects in agriculture.	4	31	34	8	1	263	9
16. (-)	e-Agriculture cannot ensure accuracy of information.	3	21	36	18	0	243	16
17. (+)	I feel comfortable to exchange information with the farmers via E-mail and text SMS	13	31	24	10	0	281	5
18.(-)	Unable to deliver up to date farming information.	8	29	22	18	1	259	12
19. (+)	Extension personnel can easily provide necessary information relating to crop diseases and insect suppression.	12	33	27	4	2	283	4
20.(-)	e-Agriculture based extension services are alternative to the present extension system.	9	24	29	15	1	259	13
21. (+)	Farmers can get remunerative prices to their produce through e-Agriculture based market intelligence.	7	36	23	9	3	269	7
22. (-)	Credibility of ICT based information is sometimes relatively poor.	1	30	42	4	1	260	10

Notes: SA: Strongly agree, A: Agree, UD: Undecided, DA: Disagree, SDA: Strongly disagree

Now-a-day by using e-Agriculture as well as ICT, particularly the internet, mobile phones, e-mails and SMS, farmers and extension workers can access more easily to need based agricultural information and also can use collected information for better productivity.

Fourth statement is 'Extension personnel can easily provide necessary information relating to crop diseases and insect suppression'. The major problem faced by the farmers in our country is disease and insect attack of crops. Extension workers need to provide appropriate solutions to those problems through e-Agriculture. The fifth one is 'e-Agriculture comfortable to exchange information with the farmers via E-mail and text SMS.' So, it indicates that, most of the extension workers felt comfortable while contacting with the farmers through ICT tools rather than traditional extension system. So, it can be said that, most of the extension workers had relatively favourable attitude towards e-Agriculture.

3.3 Differences between Extension Workers of Mymensigh Sadar Fulbaria Sub-district Regarding Their Attitude towards e-Agriculture

To find out the differences between the extension workers of Mymensingh Sadar sub-district and Fulbaria sub-district regarding their attitude towards e-Agriculture't' test was used and findings are presented in Table 7.

Data presented in Table 7 shows that calculated't' value 2.11 was found to be greater than the tabulated 't' value of 1.684, which is statistically significant at 1 percent level of significance. So, from the above results it can be concluded that, there was a significant difference between extension workers of Fulbaria and Mymensingh Sadar sub-district regarding their attitude towards e-Agriculture. It means that, the respondents of Mymensingh Sadar had relatively less favourable attitude towards e-Agriculture compared to the extension workers of Fulbaria sub-district. This was may be due to the reason that most of the extension workers of Mymensingh sadar sub-district had relatively limited access to ICT facilities and have relatively poor knowledge on e-Agriculture. Another important reason may be the more number of AICCs are working in Fulbaria sub-district compared to Mymensingh Sadar.

3.4 Relationship between the Selected Characteristics of the Extension Workers and Their Attitude towards e-Agriculture

To test the relationship between the selected characteristics of the extension workers and their attitude towards e-Agriculture Pearson's correlation coefficients were computed as the results have been presented in Table 8.

The findings revealed that annual income, knowledge on e-Agriculture, access to ICT facilities and use of media associate with e-Agriculture had positive and significant relationship with extension workers' attitude towards e-Agriculture. Hence, age and service tenure showed negative and significant relationship with extension workers' attitude towards e-Agriculture. This is due to the reason that old people have relatively poor interest towards ICTs compared to young.

3.5 Factors Associated with the Attitude of the Extension Workers towards e-Agriculture

To determine the factors associated with the extent of attitude towards e-Agriculture, multiple regression analysis (enter method) was conducted. The findings of the regression analysis are presented in Table 9. The findings of multiple regression analysis show that the model is significant as F-value is 21.39 significant at 1% level of significance. It is Table 9 also revealed that three explanatory variables out of 11 entered into the model and can jointly explain 74.4% variability in the attitude of the extension workers towards e-Agriculture. The significant explanatory variables are annual income, information sources regarding e-Agriculture and extension workers' access to e-Agriculture.

Table7. Differences between extension workers of Mymensingh Sadar and Fulbaria sub-district on their Attitude towards e-Agriculture

Sub-district	Attitude score		Calculated 't' value (at 38 df)
	Mean	Standard Deviation	
Fulbaria	70.56	6.48	2.11
Mymensingh Sadar	67.44	7.68	

Table 8. Relationship between the selected characteristics of the extension workers' and their attitude towards e-Agriculture

Selected personal socioeconomic characteristics	Correlation co-efficient (r) With 76 df	Tabulated values (r) significant at (76 df)	
		0.05	0.01
Age (X1)	-.358**		
Level of education (X2)	.055		
Family size (X3)	-.169		
Service tenure (X4)	-.448**		
Annual income (X5)	.813**		
Information sources regarding e-Agriculture (X6)	.146	0.226	0.295
Training received on e-Agriculture (X7)	.028		
Job satisfaction (X8)	.203		
Knowledge on e-Agriculture (X9)	.771**		
Access to ICT facilities (X10)	.780**		
Use of media associate with e-Agriculture (X11)	.514**		

* Correlation is significant at the 0.05 level (2-tailed), ** Correlation is significant at the 0.01 level (2-tailed).

Table 9. Summary of the linear regression analysis

Explanatory variable	Unstandardized Coefficients		Standardized Coefficients	t	Sig. B
	B	Std. Error	Beta		
(Constant)	43.461	8.531		5.094	.000
Age	-.018	.070	-.021	-.251	.803
Level of education	.749	.483	.097	1.551	.126
Family size	-.007	.304	-.002	-.023	.982
Service tenure	-.030	.067	-.040	-.447	.657
Annual income	.027	.005	.506	5.518	.000
Information sources of e-Agriculture	-.191	.077	-.177	-2.474	.016
Training received on e-Agriculture	.048	.125	.025	.387	.700
Job satisfaction	.007	.082	.006	.092	.927
Knowledge on e-Agriculture	.322	.223	.193	1.441	.154
Access to ICT facilities	.494	.211	.312	2.346	.022
Use of media associate to e-Agriculture	-.162	.234	-.059	-.692	.491
Adjusted R2 = .744 F-value = 21.39					

Table 10. Summaries of the step-wise multiple regression analysis models

Model	Variable entered	Multiple R	Multiple R2	Variation explained (percent)	Significance level
Constant + X5	Annual income (X5)	.813	.661	66.1	.000
Constant + X5 + X10	Access to ICT facilities (X10)	.858	.736	7.5	.000
Constant + X5 + X10 + X6	Information sources regarding e-Agriculture (X6)	.871	.758	2.2	.000

Additionally, step-wise multiple regression analysis was also performed to understand the individual contribution of each of the significant explanatory variables. Table 10 shows the output of the step-wise multiple regression analysis. The findings indicate that three explanatory variables can jointly explain 75.8% variability in the attitude of the extension workers towards e-Agriculture. Among them annual income of the extension workers alone can contribute about 61% variability in the attitude of the extension workers towards e-Agriculture.

This is very natural that the an extension workers having better income can afford the expenses of using ICTs compared to those having relatively lower annual income. Especially in a developing country like Bangladesh the cost for internet use is

really high and difficult to afford by the low income people. It is also demonstrated that next the annual income the extension workers the most significant explanatory variable is access to ICT facilities and it can contribute about 7.5% variability in the attitude of the extension workers towards e-Agriculture. The third variable entered into the model was information sources regarding e-Agriculture and can contribute 2.2% variability in the attitude of the extension workers towards e-Agriculture. This is due to the reason that if an extension workers have adequate access to ICT facilities and get sufficient information on e-Agriculture he/she might have better attitude towards e-Agriculture.

4. Conclusion and recommendations

The findings of the case study on extension workers' attitude towards e-Agriculture revealed that an overwhelming majority of the extension workers in the study areas had moderately favourable attitude towards e-Agriculture. The study also revealed that age, service tenure, annual income, knowledge on e-Agriculture, access to ICT facilities and use of media associate with e-Agriculture had significant contribution on extension workers attitude towards e-Agriculture. However, regression analysis finally explored the three factors as the most contributing factors in influencing the attitude of the extension workers' attitude towards e-Agriculture and these are annual income of the extension workers, access to ICT facilities and information sources regarding e-Agriculture. The case study established that extension workers had positive perception on the usefulness of e-Agriculture programmes in their job. However, majority of them have negative perception regarding the extent of ease of e-Agriculture in use. Finally it can be concluded that considering this positive attitude and perception of the extension workers towards e-Agriculture if the Department of Agricultural Extension and other concerned agencies take initiatives to increase extension workers' access to ICT facilities with institutional support it would be possible to harvest the benefits of e-Agriculture in sustainable agricultural and rural development. However, to let it happened immediate measures need to be taken by the Ministry of Agriculture.

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