

Assessing the Extent of ICT Usage by Farmers for Sustainable Agriculture in Sub-Himalayan Region

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ABSTRACT

Information and Communication Technology (ICT) can be a key enabler and a vital component of the new knowledge-based economy and is capable of revolutionizing the process of information dissemination and knowledge management. The present study attempts to assess the extent of ICT usage by farmers for sustainable agricultural development and restoring social sustainability. It was conducted in two northern districts of West Bengal under Sub Himalayan Region namely Cooch Behar and Alipurduar districts. One hundred and twenty farmers were interviewed through a pre-tested structured interview schedule developed to measure the level of ICT tools usage and complementarities between various ICT tools used by the farmers. The variables age, education, experience, social participation, aspiration towards cutting edge technology, annual income, annual expenditure, smart gadgets possessing, sources of agricultural information, achievement motivation, innovativeness, economic motivation, scientific orientation, risk preference, orientation towards ICTs, information management orientation were considered as predictor variables and the variable extent of ICT usage of the farmers was considered as the predicted variable for the study. The data were processed with the help of statistical tools like frequency, percentage, mean, standard deviation, Pearson's coefficient of correlation and weighted mean scores. The results of farmers show that the variables age (X_1), experience (X_4) and family size (X_3) are negatively and significantly associated with the dependent variable 'extent of ICT usage'. The variables education (X_2), smart gadgets possession (X_{11}), innovativeness (X_{14}) and risk preference (X_{17}) are positively and significantly associated with the level of use of ICTs. The result of the weighted mean score (WMS) analysis, on the extent of ICT usage by farmers in the study area have showed that they use mobile phones ($m=4$), TV/LCD ($m=3.4$), internet ($m=1.71$), email ($m=1.39$), radio (0.22), computer ($m=0.15$) in a greater extent.

Key words: ICT tools; ICT for Agricultural development; Sustainability; Sustainable livelihood;

In the changing global scenario, the sustainable agricultural development requires the information endowment through knowledge. In the third world country like India, the communication of appropriate information can pave the way of sustainable agricultural development by making the pro-poor and unreached agricultural society a knowledge and information vibrant. The communication network among the agricultural system actors opens the vista for information and knowledge seeking, sharing and utilisation. Agricultural Extension, in the current scenario is rapidly shifting globally, it has been recognised as an indispensable

mechanism for saving knowledge (information) and advice as an input for modern farming and the use of ICT in actualizing so has made the involvement of practitioners (Richardson, 2003). According to Arkhi *et al.* (2008) considering the role of Extension in the Agricultural Information system as a connector between the farmers and the research centres, but the ground reality is hard-hitting with only one extension worker available for every 2879 farmers in India (Mukherjee and Maity, 2015). The knowledge and information driven agricultural society is in need of an appropriate extension delivery mechanism which will give an impetus towards

developing a knowledge and information sharing platform for strengthening and improving agricultural sector.

In the present scenario farmers can now access ICT tools to manage their farming activities, from crop selection to the monitoring of production. Access to information on inputs and advisory services – By using their mobile phones or the internet, young farmers/agripreneurs are getting information on the availability, location and price of agricultural inputs. Exploring multiple sources of inputs enables them to make better informed decisions about where and when to buy (*World Bank, 2011*). The benefits inherent in the utilization of ICT for agricultural extension and training purposes are well documented (*Hafkin and Odame, 2002; Richardson, 2005; Zijp, 1994*). But it is evinced that the communication association with the development of the agriculture are not still prepared to access the optimum usage of ICT tools in case of accessing and utilising the scientific agricultural production, value addition, supply chain and marketing related information in many areas of rural India.

In such research climate, the present study investigated the extent of ICT tools usage and also complementarities between various ICT tools used by the farmers for effective dissemination of agricultural information among farmers.

METHODOLOGY

The two Sub-Himalayan districts of West Bengal namely Cooch Behar and Alipurduar districts were purposively selected for the present research study. To gain a deep insight into the topic, the *ex-post-facto* and exploratory type of research design is adopted for this present investigation. Purposive, multi-stage and random sampling procedures were followed in the present study. An exhaustive list of farmers who are using ICTs is prepared with the help of the local people, local administrators (Panchayat Pradhan), block-level agriculture extension officials and Krishi Vigyan Kendra (KVK), Cooch Behar. From the exhaustive list of ICT users, one hundred and twenty farmers were randomly selected as respondents for the research study as per the sampling scheme. These one hundred and twenty farmers were interviewed through a pre-tested structured interview schedule developed to measure the complementarities between various ICT tools used by the farmers with the help of Google forms on tablets and hard copies where ever there was a connectivity

issues. Around 40 per cent of the data was collected through online Google forms. The variables age, education, experience, social participation, aspiration towards cutting edge technology, annual income, annual expenditure, smart gadgets possessing, sources of agricultural information, achievement motivation, innovativeness, economic motivation, scientific orientation, risk preference, orientation towards ICTs, information management orientation were considered as predictor variables and the 'extent of ICT usage' of the farmers was considered as the predicted variable for the study. The data were processed with the help of statistical tools like frequency, percentage, mean, standard deviation, Pearson's coefficient of correlation and weighted mean scores.

RESULTS AND DISCUSSION

Personal profile of the respondents: Table 1 presents that the majority of the respondents belongs to the category of young aged farmers *i.e.* 21-37 years (49.17) followed by age group 48-75 years old aged respondents (28.33%) and 38-47 years middle-aged group (22.50%). Among the respondents 30% had high school education, followed by graduates (28.3%), middle schooling (20%) and post graduates (15%) and it is also found that very few farmers with primary education (4.2%), only read (1.7%) and farmers who can read and write (0.8%). It is observed that the majority were possessing 3-8 years *i.e.* low level of experience (45.8%) followed by 14-31 years of experience *i.e.* high level of experience (38.4%) and 7-12 years medium level experience (15.8%). It is evident from the present study that even though most of the farmers have shown a low social participation (81.7%) and a low source of agricultural information (43.3%), they have shown a higher level of aspiration towards ICTs (43.3%) and higher level in possession of smart gadgets (66.7%).

Table 2 presents the Pearson's coefficient of correlation among the dependent variable *i.e.* extent of ICT usage and 17 predictor variables. The result shows that the variables age (X_1), experience (X_4) and family size (X_5) were negatively and significantly associated with the dependent variable 'extent of ICT usage'. The variables education (X_2), smart gadgets possession (X_{11}), innovativeness (X_{14}) and risk preference (X_{17}) are positively and significantly associated with the 'extent of ICT usage'.

Table 1. Personal profile of the Farmers (N=120)

Category	No.	%	
<i>Age</i>			
Young Aged (21-37)	59	49.17	Range =21-75 Mean =42.72
Middle Aged (38-47)	27	22.50	SD=13.31
Old Aged (48-75)	34	28.33	CV=31.16%
<i>Education</i>			
Can read only	2	1.7	Range=1-7 Mean = 4.51
Can read and write	1	0.8	SD= 1.00
Primary	5	4.2	CV= 22.27%
Middle	24	20.0	
High School	36	30.0	
Graduate	34	28.3	
Post Graduate	18	15.0	
<i>Experience</i>			
Low (3-8 years)	55	45.8	Range =3-31 Mean =11.14
Medium (9-13 years)	19	15.8	SD=6.99
High (14-31 years)	46	38.4	CV=62.77%
<i>Social participation</i>			
Low (1)	98	81.7	Range =1-6 Mean =1.05
Medium (2-3)	8.0	6.7	SD=0.95
High (4-6)	14	11.6	CV=62.80%
<i>Aspiration towards technologies</i>			
Low (20-25)	38	31.7	Range =20-30 Mean =26.98
Medium (26-27)	30	25.0	SD=2.58
High (28-30)	52	43.3	CV=9.55%
<i>Smart gadgets possessing</i>			
Low (1-4)	32	26.7	Range =1-10 Mean =5.43
Medium (5-6)	8	6.7	SD=3.17
High (7-10)	80	66.6	CV=58.47%
<i>Source of information</i>			
Low (1-3)	52	43.3	Range =1-7 Mean =3.66
Medium (4-5)	47	39.2	SD=1.25
High (6-7)	21	17.5	CV=34.08%

Age and Extent of ICT usage: The variable ‘age’ in case of farmers is found to be negatively and significantly associated with the dependent variable ‘extent of ICT usage’. Age is the chronological experience gathering indicator of a human being. It evicts that age-old person are much more traditional in nature and susceptible to changes, always old aged people try to believe that, whatever they know that is worthwhile and need not know new experience gaining environment. In the present study young farmers are mostly using ICT tools as it has the immense potentiality to provider farm advisory services to the large amount of people in a short period of time, as a result, this young generation has shown a high level of ICT tools usage than the old aged farmers.

Table 2. Correlation Coefficient of Extent of ICT usage of farmers with 17 predictor variables (N=120)

Variables	(r)
Age (X ₁)	-0.269**
Education (X ₂)	0.301**
Occupation (X ₃)	0.056
Experience (X ₄)	-0.267**
Family Size (X ₅)	-0.197*
Social Participation (X ₆)	-0.004
Aspiration towards cutting edge techn.(X ₇)	-0.033
Annual Income (X ₈)	0.078
Annual Expenditure (X ₉)	0.047
Land holding (X ₁₀)	0.042
Smart gadgets possession (X ₁₁)	0.467**
Sources of Agricultural Information (X ₁₂)	0.021
Achievement Motivation (X ₁₃)	0.151
Innovativeness (X ₁₄)	0.200*
Economic Motivation (X ₁₅)	0.177
Scientific Orientation (X ₁₆)	-0.066
Risk Preference (X ₁₇)	0.250**

** Significant at 1% level *Significant at 5% level

This may be the plausible reason for negatively and significantly associated between age and level of ICT usage. Similar findings were also observed by *Kafura (2016)* and *Kumar et.al (2017)*.

Education and Level of ICT usage: The variable ‘education’ in case of farmers is found to be positively and significantly associated with the dependent variable ‘extent of ICT usage’. Formal education brings about the behavioural change in the individual. It gives farmers’ exposure to accesses various ICT tools and technologies during their education. Higher the education level, an individual gets more opportunity to know about technological advances. This may be the possible reason that the variable ‘education’ has shown a significant association with the dependent variable ‘extent of ICT usage’ in a positive direction. The findings are similar to the observations made by *Kafura (2016)* and *Kumar et.al (2017)*.

Experience and Level of ICT usage: The variable ‘experience’ in case of farmers is found to be negatively and significantly associated with the dependent variable ‘extent of ICT usage’. *Experience* is the knowledge gain or number of years of farming. Individuals with higher experience are found to be more traditional and sceptic in nature and have a negative attitude towards advanced technologies. It observed from the present study that young

farmers with less experience, especially farmers who entered into farming recently with an entrepreneurial view are using ICTs compare to the old aged farmers with high experience. This is why the variable 'experience' significantly associated with the dependent variable 'extent of ICT usage' in a negative direction. These observations are in line with findings of *Kafura et.al. (2016)*.

Family size and Level of ICT usage: The variable 'family size' in case of farmers is found to be negatively and significantly associated with the dependent variable 'extent of ICT usage'. Family size is an indicator of societal structure, an implication for family development and social relations in a different society. Smaller the family size has a higher affinity among the members of the family and has a controlled behaviour of the members. It has been observed from the present study that small families are into invest in ICT tools and technologies for better education and also as the status symbol in the society, on the other hand, larger families are unable to spend on these ICTs tools because of the more family members. That is why the variable 'family size' has shown significantly associated with the dependent variable 'extent of ICT usage' in the negative direction.

Smart gadgets possession and Level of ICT usage: The variable 'smart gadgets possession' in case of farmers is found to be positively and significantly associated with the dependent variable 'extent of ICT usage'. In the present research study, it is noticed that even though the majority of the farmers are in the lower side of annual income and expenditure, but still they are managing to buy smart gadgets like smart phones in the family is a noticeable thing. This is the reason why the variable 'smart gadgets possession' is found to be significantly associated with the dependent variable 'extent of ICT usage' in a positive direction.

Innovativeness and Level of ICT usage: The variable 'innovativeness' in case of farmers is found to be positively and significantly associated with the dependent variable 'extent of ICT usage'. Innovativeness is one of the major key instruments in society for economic development; especially, when it comes to agriculture innovations for increasing production and productivity through advanced technology like ICTs. In the case of the present study, the majority of the farmers have shown high innovativeness on farming and especially on advanced technologies through ICT tools. This may be the possible reason that the variable 'innovativeness' is

found to be significantly associated with the dependent variable 'extent of ICT usage' in a positive direction. Similar findings were also published by *Kafura et.al. (2016)* and *Roy et.al. (2018)*.

Risk preference and Level of ICT usage: The variable 'risk preference' in the case of farmers is found to be positively and significantly associated with the dependent variable 'extent of ICT usage'. The farmers in the research area are willing to bare the risk related the climate change, market price by the information through ICTs for better income generation. It is also noticed they are accessing ICT tools for weather and market information. That is why the variable 'risk preference' is found to be significantly associated with the dependent variable 'extent of ICT usage' in a positive direction. Similar finds were also published by *Kumar et.al (2017)*.

Weighted mean scores of different ICT tools used as a source of information by farmers: Every ICT tool has its own advantages and disadvantages. Some of the studies have also revealed radio, television and mobile phone have distinct strength and weaknesses. In a recent survey conducted across 23 cities in the country covered over 7,000 respondents revealed that increasing mobile phone penetration, almost 76 per cent of consumers listen to FM radio using their mobile phones, according to a study. An average of 22.5 per cent of them listened to the radio while driving, while another 36 per cent used the radio at home. With mobile phone penetration growing in rural India, radio as a medium of mass communication is now reaching the remotest corners of the country via the mobile phone" (DNA India). For this reason, the complementarities between them is very much encouraged so as to make sure that the information brought to farmers is adequate and of high quality. Here in the present study to studies the extent of ICT usage and complementarities between different ICT tools used by farmers are analysed with the help of weighted mean score.

$$x = \frac{\sum_{i=1}^n (x_i \times w_i)}{\sum_{i=1}^n w_i}$$

Weighted mean score: The result of the weighted mean score (WMS) analysis in table 3, on the extent of ICT usage by farmers in the study area have shown that they use mobile phones (m=4), TV/LCD (m=3.4), internet (m=1.71), email (m=1.39), radio (0.22), computer (m=0.15) in greater extent.

Mobile Phones: Mobile phone was found to be more

Table 3. Weighted mean scores of different ICT tools used as a source of information by farmers (N=120)

ICT Tools	Not available	Once in less than fortnightly	Using fortnight	Using weekly	Using daily	WMS
Mobile Phones	0.0	0.0	0.0	0.0	100.0	4.00
TV/LCD	15.0	0.0	0.0	0.0	85.0	3.40
Internet	37.5	12.5	20.0	1.7	28.3	1.71
Email	54.2	3.3	13.3	7.5	21.7	1.39
Radio	80.0	18.3	1.7	0.0	0.0	0.22
Computer	95.8	0.0	0.0	1.7	2.5	0.15

utilized by selected farmers with the WMS of 4 and ranked I. The probable reason for having high score is that, irrespective of education, gender and economic status, mobile phone has gained its popularity in terms of utilization across social system. The interesting thing about the mobile phone is that, it is mobile friendly in nature and user friendly even an illiterate can also handle it. This is one best example that irrespective of education farmers with minimum hands-on experience are able to make phone calls, view and sent text messages and the interesting part is that they are able read local language content and are able to share through 'Whats app'. It is also notices that few progressive farmers are also using online video content through 'YouTube' as a source of best management practices. It has been noticed that because of the ICT based projects lead by the State Agricultural University along with the Farmers' Clubs in the research area, some of the active farmers are trained in handling the ICT tools like mobile phone. That is why the ICT tool mobile phone has scored maximum Mean Weighted Score *i.e.* $m=4$ and stood in rank I.

TV/LCD: From the present study it is found that 85 per cent of the farmers are using watching Television as a source of information. In evidence of the advanced technologies in the field video broadcasting and increasing local language TV programmes on best management practices in agriculture, many of the progressive farmers have made TV programmes as a first source of agriculture. That is why the ICT tool LCD/ TVs have scored ($m=3.4$) which has ranked II.

Internet : In the present study, it is found that more than one-third of the farmers are not using the at all. But it is evident that 28.3 per cent are using internet for various means. The probable reason for this may be due to launch of low cost VoLte 4G services in the country. The mean weighted score obtained is 1.71 and is ranked III.

E-mail: E-mail is found to be an electronic mailing service. When it comes to usage by farmers more than half of the farmers is not holding e-mail. But the farmers who are using smart phone have the access to email since most of the smart phones are Android based and Google account is a mandate to run these smart phone, this may be the reason that 21.7 per cent of them are using email daily which is limited to only email checking since notification are pop up on the mobile screen. That is why the email scored a mean weighted score of 1.39 which is less compared to the other ICT tools and ranked IV.

Radio : The role of radio in broadcasting agricultural information was one of the most effective media seen in promoting agriculture development in the country. With the establishment of All India Radio (AIR), it has bought a significant change in broadcasting new agricultural technologies both in agriculture and other allied disciplines. But in the recent times with advancement of satellite technologies and private telecasting companies, people have shifted from radio to TV because of the relative advantage of watching picture. This is the reason why majority of the farmers (80%) not possessing radio and the mean weighted score is 0.22 which is very less compare to other ICT tools and is ranked V.

Computer: In the present scenario it is difficult to find advanced ICT tools in rural communities. But in the present study it is noticed that only 2.5 per cent of them are using computer daily and this is also only because of the fact that families with studying children are possessing the computers. Even though the modern ICT tools like mobile phones have successfully penetrated into rural India, it is difficult for a computer to enter into the doors of the rural communities because of its complicity nature. This is the reason that usage of computers have scored last *i.e.* rank VI with a very low mean weighted score ($m=0.15$).

CONCLUSION

The use of ICT enabled extension services are also picking up the momentum in the country recognising the effectiveness and credibility of knowledge driven delivery mechanism. The benefits of ICTs based services for the improvement and strengthening of agriculture sector in India includes time critical information on weather forecasts and calamities, better and location specific agricultural practices and advices in local language, better exposure to daily market pricing, improved networking and communication, facility of online trading and e-commerce. The present study has identified some of the ICT tools as the most effective tool for sharing agricultural information among the farming community. Among those tools, mobile phone,

television broadcasting and high speed internet through high end smart mobile phones are really impacting upon the society. In such research climate efforts should be made to strengthen ICT initiatives like SMS alerts services from Krishi Vigyan Kendra and State department of agriculture regarding updated on weather information, value addition, supply chain and market prices in this region. For improving the agricultural system efficiency, the appropriate type of ICTs would be chosen on the bases of their handling efficiency by the agricultural system actors for communication and information in a large extent. Due to disparity in ICT tools, especially a single ICT tools should not be used, instead the system should think of using the tools in combination for increasing the access of information by the actors.

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