THE FARMERS' VIEW TOWARDS THE USE OF INFORMATION AND COMMUNICATION TECHNOLOGY IN AGRICULTURE: A STUDY AMONG FARMERS IN THE NER (NORTH-EASTERN REGION) OF INDIA

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Abstract: In the present century, Information and Communication Technology (ICT) has found multiple applications in the field of agriculture. In fact, the use of ICT in agriculture has established itself as an important pillar for the effective delivery of extension services owing to its cost-effective, time-effective, and speedy dissemination of information to farmers. This is especially true for the complex Indian agricultural scenario which is still riddled by problems such as small land holdings, absence of sound marketing facilities, scarcity of capital, poor connectivity, erratic and delayed information to the farmers, non-adoption or a lesser amount of adoption of improved technology, among others. It is seen that ICT has tremendous potential for application in agricultural extension. E-Agriculture initiatives like Agrisnet, Digital Green, eSagu, Agmarknet, iKisan, Digital Mandi, e-Arik, aqua, Fisher Friend Programme (FFP), are but a few examples of ICT services that have taken the agricultural scenario by storm. Recent developments of ICT have facilitated flow of information to various stakeholders in agriculture, especially farmers; however, factors such as lack of awareness, not enough ICT infrastructure, non-strategic location of information centers, and lackluster attitude towards ICT use continue to inhibit the potential of ICT for agricultural development. Moreover, there is a burning concern that most of the e-Agriculture projects in India are seen to have been implemented in the socio-economically developed states of northern and southern India while the disadvantaged states continue to be technology deprived. This is especially true of the north-eastern states of India, namely, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, where agricultural development is still in its most primitive stages. Here, the use of ICT is still limited to medium such as Television, Radio, and mobile phones. Thus, there is a need to look closely at the factors that govern the use of ICT in this region of the country. This paper makes an attempt to study the same.

Index Terms **- ICT (Information and Communication Technology), Agriculture, North-Eastern Region, Farmers**

I. INTRODUCTION

Agriculture continues to be an important segment of the Indian economy with its share to gross domestic product at almost 17 per cent. However, the stagnated growth of the agricultural sector is a matter of rising concern for the country; the most affected of all are the small and marginal farmers and the agricultural laborers, who constitute the vast majority of the Indian population (Kakarlapudi, K.K., 2010).

Coined by Stevenson in 1997, the phrase ICT (Information and communication technology) encompasses a wide range of services, applications, and technologies that facilitate communication, processing, and transmission of communication. It includes an array of technologies, namely radio, television, telephone, mobile phone, multimedia, internet, and satellite-based communication systems, among others.

Information and communication technology (ICT) have enormous potential for increasing quantity and accessibility of information in fields such as agriculture, health, education, human resources and environmental management; this is especially true for furthering sustainable development in developing countries (Annan, 1997; Avgerou, 2000). Studies show that the economic growth of many countries, over the past decade, has been supported by the contribution of information and communication technologies (ICTs) (Jorgenson, 2001).

Through the dynamic changes taking place in the agricultural industry, it is seen that extension and advisory services continue to be a most significant source of information for smallholder farmers who constitute the core of the agricultural production in developing countries (Francis, 2014).But more often than not, the extension system suffers from the problem of low outreach due to lack of sufficient staff and low operational budgets which restrict the extension staff from visiting farmer fields (Sulaimon and van den Ban 2003). In such cases, integration of ICT in agricultural extension can help bridge the accessibility and information gaps between farmers and extension workers (Mabe and Oladele, 2012).

In the current technological era, it has become indispensable to find effective and cost-efficient ways to keep the farmers updated about modern technologies and relevant information. In this regard, ICT has tremendous potential for application in

agricultural extension (Zijp, 1994; Jones, 1997). If harnessed ICT can bring about a technology revolution among the rural masses (Swaminathan, 2003; Cecchini, 2003). Numerous research studies highlight the many applications of the technology in agricultural extension (Mohan and Singh, 2007; Aker, 2011; Sulaiman, et. al., 2012; Bell, 2015).

In fact, the application of ICT in agriculture has established itself as an important pillar for the effective delivery of extension services owing to its cost-effective, time-effective, and speedy dissemination of information to farmers (Chandrasekhara, P., 2001). Agriculture initiatives like Agrisnet, Digital Green, eSagu, Agmarknet, iKisan, Digital Mandi, e-Arik, aqua, Fisher Friend Programme (FFP), are but a few examples of ICT services that have taken the agricultural scenario by storm (Singh et. al., 2017).

ICT has tremendous potential in improving the livelihood of farmers via positive impact on factors such as farming efficiency, farm productivity, and farmers' income (Sangeetha et al., 2015 as cited in Sunil Kumar et al., 2017). Furthermore, agricultural services leveraged by ICT have been seen to provide a greater scope for incorporating the farmers' feedback into the agricultural knowledge system (Glendenning, 2010). Although the recent developments in ICT have facilitated flow of information to various stakeholders in agriculture, especially farmers; however, factors such as lack of awareness, not enough ICT infrastructure, non-strategic location of information centers and lackluster attitude towards ICT use continue to inhibit the potential of ICT for agricultural development (Maningas, 2006).

In the 2004 Global ICT Summit it was brought to light that 45% of the world's ICT projects are implemented in India (Manzar, 2004 as cited in Saravanan, 2013). But most of these projects are started in the socio-economically developed states of southern and northern India (Paul et al., 2004 as cited Singh et al., 2017), while north-eastern region (NER) of the country continues to lag behind in ICT-led agricultural extension programs.

The few projects in ICT integration into extension services have shown promising scope in the region, such as Intelligent Advisory System for Farmers (IASF) (Yengkhom, 2015) implemented in the states of Meghalaya and Manipur and the e-Village project implemented in ten remote tribal villages of Arunachal Pradesh (Saravanan R., 2010).In spite of the evident benefits of ICT integration into traditional extension services, problems such as lack of awareness of the benefits of ICTs, lack of skill in handling ICTs, lack of training and practical exposure to ICTs, financial handicap, erratic power supply, and poor network connectivity continue to handicap the agricultural growth in the region (Syiem and Saravanan, 2015). Also, the adoption of ICT is seen to be limited to mediasuch as mobile phones, television, and radio (ICT in Agriculture e-Sourcebook, 2011).

Presently, the accessibility of farmers to information as well as the information sources and their respective relevance in agricultural development poses a challenge in the way of agricultural development (Sharma, 2002). It is required to improve the farmers' ability to use information technology through various education programs responsive to the information age of the 21st century (Rasouliazar S., 2011). For increasing the scope of ICT media penetration in agricultural extension services as well as raising the interest of farmers in adopting ICT, there is a need to look closely at factors the constraints the farmers currently face with the use of ICT as well as study their perception regarding the use of ICT in agriculture. This research paper makes an attempt to explore the same.

II OBJECTIVES OF THE STUDY:

a) To study the personal characteristics of the respondent farmers
b) To study the ICT adoption pattern (namely ownership, accessibility, skills and usage in gathering agricultural information) among farmers
c) To identify the constraints to adoption of ICT among farmers
d) To study the perception towards adoption of ICT among farmers

2.1 RESEARCH METHODOLOGY:

The study was carried out via a survey of farmers in the three states of NER of India, namely, Assam, Meghalaya, and Manipur. The total sample size was 115. The respondents were identified through the extension workers of the respective states. Data was collected through informal interviews and by administering apre-tested structured interview schedule to the farmers. A dichotomous scale was used to study the ICT adoption pattern among farmers and a 5-point Likert scale with the options No Extent (1); Little Extent (2); To Some Extent (3); Moderate Extent (4); Large Extent (5) was used to determine the factors impacting ICT use. The data collected was analyzed using statistical tests such as frequency, percentage, mean, and Garrett Ranking. The data was analyzed using Statistical Package for the Social Sciences (SPSS).

III RESULTS AND DISCUSSION:

a) Personal characteristics of the respondents:

Table 1 presents the personal characteristics of the surveyed population and their exposure to extension. The majority of respondents were in the age category 31-50. 60 of the farmers belonged to the tribal community while 55 hailed from non-tribal communities. 68% of the sample population was male respondents while 32% was female. A majority of the farmers (58%) had primary school education, the second largest fraction (26%) had never been to school, and 17% and 6% of the population had secondary school and college education respectively; this which implies that over half the population of farmers have has exposure to formal education and maybe given training in the use of ICT for agricultural purposes, notwithstanding the fact that even the uneducated farmers can benefit from vocational training on the use of ICT for agriculture. A bulk of the respondents had work experience ranging in between 11-20 years which means that the population is aware of the agricultural scenario before and after the advent of ICT for agricultural use and can thus, weigh the benefits of adoption of the same. Majority of the interviewed were small farmers, landless and marginal farmers, and only 13 out of the 115 farmers fell in the medium and large farmers' category as per land ownership pattern. The annual family income was in the bracket 50000-100000 for 40% of the surveyed population, and of the remaining 32% fell in the 0-50000 income category bracket and 28% fell in the 100000 and above income category bracket. 58% of the surveyed population had never partaken in any training programme and only 42% of the population had participated in 1 or more training programs. As far as the extension exposure was concerned, majority of the respondents

(73%) reported that they had Low Contact with extension (up to 17 days), 25% reported Medium Contact (18-34 days), and only 2% reported High Contact (above 34 days).

This clearly reflects the accessibility and communication gap between extension and farmers. This is line with the findings of Purcell and Anderson (1997), Swanson and Mathur (2003), Planning Commission (2008), Birner and Anderson (2007), Raabe (2008).

TABLE 1: PERSONAL PROFILE OF RESPONDENTS

		Frequency	% of sample population
CASTE	Tribal	60	52
	Non-tribal	55	48
	Total	115	100.00
AGE	Less than 30	36	31
	31-50	60	52
	50 and above	19	17
	Total	115	100.00
GENDER	Male	78	68
	Female	37	32
	Total	115	100.00
EDUCATION	Illiterate	30	26
	Primary Education	59	51
	Secondary Education	19	17
	Higher Education	07	6
	Total	115	100.00
FARMING EXPERIENCE	1-10	42	37
	11-20	53	46
	20 and above	20	17
	Total	115	100.00
FARM SIZE (ha)	Landless (0.02 ha)	23	20
	Marginal (0.02-0.2 ha)	20	17
	Small (0.21-1.0 ha)	57	50
	Medium (1.01-3.0 ha)	10	09
	Large (above 3 ha)	05	04
	Total	115	100.00
ANNUAL FAMILY INCOME	0-50000	37	32
	50000-100000	46	40
	100000 and above	32	28
	Total	115	100.00
TRAINING PARTICIPATION	0	67	58
	1 or more	48	42
	Total	115	100.00
EXTENSION CONTACT	Low Contact (up to 17 days)	84	73
	Medium Contact (18-34 days)	29	25
	High Contact (above 34 days)	02	2
	Total	115	100.00

b) To study the ICT adoption pattern (namely ownership, accessibility, skills and usage in gathering agricultural information) among farmers:

Table 2 highlights the ICT adoption pattern among the surveyed farmer population. The ICT tools considered for the survey are Television, Radio, Mobile Phone, Print Media (Newspaper, Magazine, Brochures, Pamphlets etc.), Video Player/ Video cassette/DVD, Digital Camera, Computer, and Internet. A majority of the farmers were seen to own and operate ICT modes such as Television, Radio, Mobile Phones, and Print media. However, modern age ICT medium such as Video Players, Digital Cameras, Computer, Internet have yet to become popular among the rural farming communities. This may be related to the fact that only one fourth of the surveyed population comprises of young famers, not all of who have had access to higher education, and hence the awareness and usage of modern technologies is still low. This is in line with the findings of Batte et al., (1990), Nazari and Hasbullah (2008), Mtega and Msungu (2013), and Syiem and Raj (2015). A point to be noted here is that even farmers, who have accessed the common modes of ICT such as Television, Radio, Mobile Phones, and Print media, do not seem to utilize them for gathering agricultural information. This may suggest a lack of awareness among the farmers and thereby highlight an urgent need to create awareness of agricultural information programs available/accessible through such medium.

TABLE 2: ICT ADOPTION PATTERN (OWNERSHIP, ACCESSIBILITY, SKILLS AND USAGE IN GATHERING AGRICULTURAL INFORMATION)

ICT	Ownership		Accessibility		Skills to operate		Use to gather agricultural information	
	YES	NO	YES	NO	YES	NO	YES	NO
Television	88	27	115	0	115	0	58	57
Radio	99	16	115	0	115	0	69	46
Mobile Phone	115	0	115	0	115	0	60	55
Newspaper, Magazine, Brochures, Pamphlets etc.	83	32	115	0	85	30	36	79
Video Player/ Video cassette/DVD	33	82	72	43	29	86	15	100
Digital Camera	15	100	35	80	44	71	10	105
Computer	13	102	60	55	13	102	09	106
Internet	50	65	78	37	43	72	30	85

c) To identify the constraints to adoption of ICT by farmers:

Table 3draws attention to constraints as faced by farmers in adoption of ICT for agricultural purposes. Lack of training on using ICT tools for improving agricultural practices was the item with the highest mean score (4.00), closely followed by inadequate power supply (3.80), and affiliation of the farmers in less important topics (3.76). The other constraints listed in the interview schedule also saw a mean score leaning towards 4, with factors such as ICT tools are complicated to use, Poor internet/phone connectivity, Inadequate availability of ICT services to rural farmers, Insufficient financial resources showing up as inhibitors in adoption of ICT by farmers. Factors such as Low levels of faith/trust on ICT tools; trust personal knowledge over modern methods, High cost of ICT tools, Poor support from extension agents and other institutional agriculture service providers, Lack of formal education among farmers had mean scores between 3 and 3.5 implying they are other factors that obstruct, although slightly, the adoption of ICT by farmers. Social barriers of using the internet (2.67) ranked as the least severe of all constraints. This implies that the respondents do not face social restrictions in adoption of modern technology as may be the common notion when one considers factors inhibiting development of backward communities, but on the contrary lack an able support system of more regular awareness programs, training and skill development programs, and stable financial and infrastructural support systems for an increased adoption of ICT tools in agriculture. This is in line with the findings of Lawal-Adebowale (2009) as cited in Albert C.O. (2014), Albert C.O. (2014), Syiem and Saravanan (2015), and Cynthia and Nwabugwu (2016).

TABLE 3: CONSTRAINTS TO ADOPTION OF ICT

Sl No.	Statement	Mean Score	RANK
1.	Insufficient financial resources	3.51	VII
2.	High cost of ICT tools	3.46	IX
3.	Inadequate power supply	3.80	II
4.	Inadequate availability of ICT services to rural farmers	3.59	VI
5.	Poor internet/phone connectivity	3.66	V
6.	Poor support from extension agents and other institutional agriculture service providers	3.36	X
7.	Lack of training on using ICT tools for improving agricultural practices	4.00	I
8.	Lack of formal education among farmers	3.31	XI
9.	Low levels of faith/trust on ICT tools; trust personal knowledge over modern methods	3.47	VIII
10.	ICT tools are complicated to use	3.66	IV
11.	Affiliation of the farmers in less important topics	3.76	III
12.	Social barriers of using the internet	2.67	XII

d) To study the perception of farmers towards the adoption of ICT in agriculture:

Table 4draws attention to factors that determine the perception of farmers towards adoption of ICT in agriculture. In a sort of contrast to their current pattern of ICT adoption, the respondent farmers were of the opinion that ICT will help in effective and speedy information exchange among farmers (4.06). The farmers seemed to agree on the points that Innovation in agriculture

needs to be documented in multimedia form and shared with farmers (3.92), Mobiles shall serve as the most promising ICT for extension work in India (3.80), Farmers are eager to gain more knowledge in using ICT (3.60), ICT will allow farmers to provide regular feedback to extension (3.58), Use of ICT saves time and effort through quick dissemination of knowledge (3.57), which bodes well for ICT-related programs to be launched for the farming communities in the region. The overall responses lean towards a positive view of ICT applications in agriculture. Lower mean scores on factors such as Use of ICT effectively contributes to extension when compared to traditional methods, ICT strengthens the linkage between farmers, extension and input supply agencies, Farmers need to be more skilled in ICT usage, ICT has played a positive role in transforming conventional agricultural extension, ICT facilitates effective extension activities in India by solving problems, clearly imply that although farmers seem to hold a favorable opinion on the applications of ICT in agriculture, they do not feel a noticeable impact has been made in the field through ICT applications thus far. In this regard, extension agents are required to create/increase awareness on the use of ICT among the farming communities and educate them on the use of modern ICT as the sources of agricultural information. This confirms the findings of Shiro (2008), Aldosariet. al. (2017), Kabir (2015), and Osundu and Ibezim (2015).

TABLE 4: PERCEPTION TOWARDS THE ADOPTION OF ICT

Sl No.	Statement	Mean Score	RANK
1.	Farmers need to be more skilled in ICT usage	3.09	X
2.	ICT strengthens the linkage between farmers, extension and input supply agencies	3.26	IX
3.	ICT will allow farmers to provide regular feedback to extension	3.58	V
4.	Use of ICT effectively contributes to extension when compared to traditional methods	3.46	VII
5.	Use of ICT saves time and effort through quick dissemination of knowledge	3.57	VI
6.	ICT has played a positive role in transforming conventional agricultural extension	3.08	XI
7.	Farmers are eager to gain more knowledge in using ICT	3.60	IV
8.	ICT contributes to creation of effective learning environment	3.33	VIII
9.	ICT facilitates effective extension activities in India by solving problems	3.00	XII
10.	Innovation in agriculture needs to be documented in multimedia form and shared with farmers	3.92	II
11.	Mobiles shall serve as the most promising ICT for extension work in India	3.80	III
12.	ICT will help in effective and speedy information exchange among farmers	4.06	I

IV CONCLUSION

The integration of ICT in agriculture is inevitable in the face of the challenges faced by the agricultural industry in the current day. This study found that farmers in the NER have a mostly favorable opinion of the relevance of ICT in agricultural activities. Of course, there are various constraints that inhibit the effective integration of ICT into agriculture but with planning, policy initiatives, and delivering the required awareness/educational programs these can be addressed. There is an undeniable need for creating awareness about the importance of ICT tools and types of services that can be provided with these tools to the farming community. ICT awareness and training programs if built into the extension delivery packages can help address the existing limitations of ICT adoption by farmers. All in all, ICTs are emerging as a vital medium in providing information on relevant agricultural needs of farmers and this needs to be at the Centre-stage of any agricultural policy planning and extension services made available to farmers in the technologically backward regions such as the NER of India.

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