

Access and Usage of ICTs for Agriculture and Rural Development by the tribal farmers in Meghalaya State of North-East India

Rebekka Syiem¹, Saravanan Raj²

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Received: 5 June 2015

Accepted: 21 Aug 2015

Available on-line: 12 Oct 2015

Responsible Editor: M. Herdon

Keywords:

ICTs, accessibility, usage, mobile phones, Meghalaya

ABSTRACT

A study was conducted to find out the level of access and usage of ICTs among farmers of Meghalaya state of India. A total of 120 farmers were randomly selected for the study during November 2013 to May 2014. The results showed that majority of the farmers owned mobile phones as well as television and radio. The most frequently used ICT was mobile phone. Mobile phones were widely used by the farmers for social communication, contacting middle men for the marketing of produce and contacting experts on real time basis for getting agricultural advisories. Farmers also reported that mobile phones proved to be useful during health emergencies. Information services on availability of inputs, quality of inputs, and pest and disease management of crops were also used by the farmers through ICTs. Major problems in the use of ICTs by the farmers were lack of confidence in operating ICTs, erratic power supply, low network connectivity and lack of awareness of the benefits of ICTs.

1. Introduction

The desire to promote better information access to improve the socio-economic condition of the farmers has always been the top priority of agricultural extensionists and rural advisory service providers. According to FAO (2011), exchanging information is critical for the stakeholders in agriculture value chain in order to reduce the asymmetries in information and communication as well as to reduce the vicious circle of poverty. Further, the role of ICTs in accessing more information in order to enhance food security and support rural livelihoods has also been increasingly recognised and officially endorsed at the World Summit on the Information Society (WSIS) 2003-2005 (ICD, 2007). With agriculture being regarded as the backbone of the Indian economy, having a marked increase of 56.6 per cent of the Indian population dependent on agriculture (GoI, 2011b), agricultural growth is, therefore, essential for fostering economic development and feeding the growing population (Datt and Ravallion, 1996). However, one component which can boost agricultural production is the contribution of information and knowledge. Since agricultural extension depends to a large extent on information exchange on the one hand and a broad range of other actors on the other (Mabe and Oladele, 2012), ICTs therefore can be used as a medium in bridging the information gap. There is also a growing recognition of farmers and members of rural communities realising the importance of knowledge, information and appropriate learning methods (Greenridge 2003, Lightfoot 2003) in order to move towards development. Therefore, in order to benefit the rural people, extensionists are grappling with the question of how to harness ICTs to improve rural livelihoods in order to contribute towards better information exchange and access. In this regard, extension practitioners are also interested in experimenting with innovative e-extension initiatives (Saravanan, 2010).

The role of ICTs as an instrument for progress and development has been widely acknowledged in this 'Global Information age', and it has been observed that people with all walks of life are being impacted by the IT sector directly or indirectly. Among other ICTs, mobile telephony has emerged as the technology of choice of the majority of the urban and even the rural masses (Ansari and Pandey,

¹ Rebekka Syiem

Research Scholar, College of Post-Graduate Studies, Central Agricultural University (CAU), Umiam, Meghalaya, INDIA.

Rebkkasyiem@gmail.com

² Saravanan Raj

Associate Professor (Extension Education and Rural Sociology), College of Horticulture and Forestry, Central Agricultural University (CAU), Pasighat, Arunachal Pradesh, INDIA.

saravananraj@hotmail.com

2013). The possession of mobile phones particularly has become a necessity in the contemporary society irrespective of age, status, profession, income groups or place of residence. As such, mobile phones have been regarded as the widely accessed tool among the farmers for communication and also accessing agriculture-related information particularly for the marketing of produce (Chhachar et al., 2014). In this context, mobile technologies can offer the means for development in developing countries (Rashid and Elder, 2009). ICTs, therefore, offer opportunities to reach more people through easy access to local or global information and knowledge. Hence, with the new emerging paradigm of agricultural development, old ways of delivering important services to citizens are being challenged; traditional societies are also being transformed into knowledge societies all over the world which makes people living in the villages think and do things differently (Meera et al., 2004). For instance, Jabir (2011) reported that ICT-based information delivery has helped the livestock farmers of Uttar Pradesh in India in making significantly better quality decisions on various livestock practices as compared to ICT non-users. Further, the application of ICT among farmers of Madhya Pradesh, Uttar Pradesh and Tamil Nadu of India reported that information acquisition and facilitating transactions in input and output markets by ICT-based initiatives have also helped farmers in reducing transaction cost (Adhiguru and Devi, 2012).

2. Statement of the problem

With regard to agriculture and rural development occupying an important place in the economy of Meghalaya, the researcher has attempted to study the level of accessibility, availability, usage of ICTs and also the problems faced by the farmers in accessing ICTs. In fact, there is a need to realize that in order to reach the farming and rural development community in an efficient manner, it is important to study the type of communication media and ICTs owned and accessed by the farmers, their frequency of usage as well as the degree of usefulness of various ICTs as knowledge of the use of different ICTs will be helpful in drawing a suitable extension strategy as well as to provide improved ICT extension services to uplift the socio-economic status of the farmers and the rural people. It is in this context that the objectives of the study were designed as follows:

1. To measure the level of access, availability and usage of ICTs among farmers.
2. To find out the constraints in the use of ICTs among the farmers.
3. To find out the association between accessibility and usage of ICTs with independent variables.

3. Review of literature

3.1. Accessibility of ICTs

Anecdotal evidence of research findings pointed that mobile phones, radio and television are the most important tools of communication which can be accessed by farmers for agricultural related information and knowledge (Olaniyi, 2013; Chhachar et al., 2014). Particularly, telephone facility (including mobile phones) has been reported to increase the opportunity of getting access to the people living in rural areas (Gupta, 2005). Ferris et al., 2008 also reported that 86 per cent of the farmers had access to a mobile phone which therefore contributed towards developing farmer's linkage with other people including extension experts (Gupta, 2005). The presence of e-village centers in East Siang District of Arunachal Pradesh has also helped people from surrounding villages to access IT infrastructure and knowledge (One World Foundation, 2012). Another significant use of new ICTs is also the World Wide Web or the Internet which enables people to access information (Munyua, 2000).

3.2. Availability of ICTs

Mobile phones has been reported to be widely possessed ICT tool among farmers (Hassan et al., 2008; Okello et al., 2010). According to Ansari and Pandey (2011), around 83.34 per cent of the farmers in Uttarakhand, India owned mobile phones for more than two years. Similarly, Sharma et al., (2012) also pointed that about 98.3 per cent of the farmers in Punjab, India possessed mobile phones. This indicated that there is an increased penetration of ICTs among rural populations and therefore if appropriately used it can offer huge scope for development in rural areas.

3.3. Usage of ICTs

The use of mobile phones is setting an unprecedented pace despite the poorly developed rural electrification. Mobile technology has provided multi-dimensional benefits to the rural people. Its importance in usage is clear in sense of urgency and emergency (Sife et al., 2010). For instance, farmers also reported to use ICTs to know the market days, to know where products could be sold and identifying different market location for efficient marketing of produce (Oyeyinka and Bello, 2013). However, traditional ICTs *viz.*, radio and television have also been reported to be used by farmers in accessing agriculture related information (Batte et al., 1990; Nazari and Hasbullah, 2008; Shetto, 2008; Emmanuel, 2010; Nakweya, 2013). However, ICT applications such as calls and Short Messaging Services have been found to be used often by farmers (Mtega and Msungu, 2013). This indicates that the use of mobile phones are increasing and gaining importance in the lives of the people to further contribute to development and better communication. Computers and internet have also been shown to be used for agricultural information and sharing (Shetto, 2008). For instance, Internet kiosks in Tamil Nadu, India were reported to be owned by rural women to encourage savings and form credit groups (Narender and Anandaraja, 2008). Farmers in Tanzania also used internet to access agricultural information (Mtega and Msungu, 2013).

3.4. Constraints in the usage of ICTs

The research findings of various researchers revealed that inconsistent power supply and low network connectivity are the major constraints in the use of ICTs among the farmers (Chilimo, 2008; Ajani and Agwu, 2012; Sharma et al., 2012; Shankariah and Swamy, 2012 and Oyeyinka and Bello, 2013). For instance, the usage of mobile phones entirely on availability of mobile phone infrastructure and power of recharging batteries (Mtega and Msungu, 2013). Further, limited television viewing in rural areas is due to limited power supply (Kerr et al., 2007). Poor electrification in villages has always been a common problem which has restricted development in different aspects of life. In fact, the low level of electricity coverage has also been found to inhibit the expansion of ICT services to rural areas (UNDP, 2012). The lack of confidence in operating ICTs among farmers also hindered the farmers in using ICTs (Agwu et al., 2008). However, the low awareness of opportunities and benefits in using ICTs for agriculture and rural development purposes among the farmers is also another problem faced by the farmers in using ICTs (Asian Development Bank, 2008). Other problems faced by the farmers in using ICTs are lack of practical exposure (Shankariah and Swamy, 2012), long distance to maintain and repair ICT tools (Asian Development Bank, 2004) and high cost of hardware and software (Agwu et al., 2008 and Oyeyinka and Bello, 2013).

4. Methodology

The study was conducted in the state of Meghalaya, North-East India on account of the coverage and implementation of various ICT initiatives *viz.*, AGRISNET, Common Service Centers (CSCs), Intelligent Advisory System for Farmers (IASF), Knowledge Innovation Repository for Agriculture in North-East (KIRAN), and Mobile Based Agro-Advisory System for North-East India (m4agriNEI). Two districts of Meghalaya *viz.*, East Khasi Hills and Ri-Bhoi District were purposively selected through criterion sampling due to the presence of maximum number of households possessing ICTs in these districts as per the census report of the Government of India, 2011. Further, due to better coverage of ICT initiatives as compared to other districts of the state, East Khasi Hills and Ri-Bhoi District were selected. A total of 120 respondents registered under ICT initiatives being implemented were randomly selected for the study from the selected blocks and villages of East Khasi Hills and Ri-Bhoi District, respectively.

4.1. Description of study area

The state of Meghalaya has eleven districts. Shillong, the state capital of East Khasi Hills District and the heart of the city. East Khasi Hills is bounded by Ri-Bhoi District on the North, Karbi Anglong District on the North-East, Jaintia Hills District on the east, Bangladesh on the south and West Khasi Hills District on the west. The total number of functional Common Service Centres is the maximum in the district with 72 numbers of Common Service Centres in the district. Further, the percentage of

households having ICTs is also the highest in East Khasi Hills District with 58 per cent of households possessing mobile phones, 49 per cent of households having Television, 29 per cent having radio and 12 per cent having Computer/Laptop (GoI, 2011a). There are 27 numbers of Common Service Centres in the district. With regard to the availability of ICTs, Ri-Bhoi District has 45.3 per cent of the households possessing mobile phones, 32 per cent of households having Television, 33 per cent having radio and 4.2 per cent having Computer/Laptop (GoI, 2011a). It was also found out that ICT related services are being used in disseminating agricultural information to the farmers through various ICT initiatives such as mobile based agro-advisory system for farmers in North-East India (m4agriNED), Knowledge Innovation Repository for Agriculture in North-East (KIRAN), Intelligent Advisory System for Farmers (IASF), Meghalaya AGRISNET and Common Service Centres (CSCs).

4.2. Selection of variables and measurement techniques

4.2.1. Dependent variables:

The dependent variables included in the study were access, availability and usage of ICTs. The indicators used in measuring the dependent variable were ICT tools accessed, ICT tools availability, frequency of usage and purpose of usage based on the interview schedule developed by ITU and UNCTAD (Partnership on measuring ICT for development, 2005).

Operational definition of dependent variables

1. Accessibility of ICTs

It is operationalised as the degree to which an individual respondent is able to use ICTs or its applications for the purpose of agriculture and rural development. A scoring of 1 and 0 was given to the respondents accessing ICTs and not accessing ICTs respectively.

2. Availability of ICTs

It is operationally defined as the degree to which an individual respondent possess ICTs or its applications for the purpose of agriculture and rural development. A scoring of 1 and 0 was given to the respondents accessing ICTs and not accessing ICTs respectively.

3. Usage of ICTs

It is operationally defined as the degree of frequency and purpose of use of ICTs by the individual respondents for agriculture and rural development at the time of investigation. The various dimensions to study the usage of ICTs among the individual respondents under rural development were Agriculture, Rural Health, Rural Education and Rural Governance *etc.* For frequency of usage, Very frequently is defined in terms of its usage of ICTs 'hourly' and 'daily', Frequently in terms of its usage of ICTs 'three times a week' and 'once a week', Occasionally in terms of its usage of ICTs 'once a month', Rarely in terms of usage of ICTs 'once in three months' and 'never' in terms of using ICTs in terms of not using ICTs at all. For the purpose of usage of ICTs in agriculture and rural development, a scoring of 5,4,3,2 and 1 was given for CSCs/kiosk, Internet, Mobile phones, TV and radio in order to identify the type of traditional and modern ICTs being used by the farmers included in the study.

4.2.2. Independent variables

Six independent variables were selected for the study *viz.*, age, education, annual income, social participation, attitude towards ICTs and cosmopolitaness. The age of the respondent was measured as per the chronological age of the farmer. The level of education was measured by the number of years of formal education. Annual income was measured according to the categorization given by NCAER, 2001. The variable of social participation was measured by a scale developed by Sulthana (2001) with modification and the variable of attitude towards ICTs was measured by a scale developed by Kumar and Ratnakar (2011) with modification. The variable of cosmopolitaness was measured with the help of an interview schedule.

4.2.3. Data collection and analysis of data

The data was collected using pre-structured interview schedule. Methods like Focused Group Discussions were used. Focused Group Discussions was conducted with Agricultural Officers of the

State Department, experts of Central Agricultural University and farmers. Statistical tools such as frequency, percentage, Garrett ranking technique, chi-square. Statistical Package of Social Sciences (SPSS) and Microsoft Excel were used for analysis of data.

5. Results and discussion

5.1. Accessibility. Availability and Usage of ICTs

Table 1. Accessibility of ICTs among farmers (n=120)

Sl. No.	Category	Per cent
1.	Mobile	100.00
2.	Television	61.66
3.	F.M Radio	45.00
4.	Radio	32.50
5.	Information kiosk/Common Service Centers	25.83
6.	ATM	16.66
7.	Internet	12.50
8.	Facebook	10.00
9.	Camera	7.50
10.	e-Mail	6.66
11.	Computer	5.83
12.	e-Books	2.50
13.	CD/DVD	2.50
14.	Youtube	2.50

Table 2. Availability of ICTs among farmers (n=120)

Sl. No.	Category	Per cent
1.	Mobile	100.00
2.	Television	61.66
3.	F.M Radio	45.00
4.	ATM	41.66
5.	Information kiosk/Common Service Centers	33.33
6.	Radio	32.50
7.	Internet	12.50
8.	Facebook	10.00
9.	Camera	7.50
10.	e-Mail	6.66
11.	Computer	5.83
12.	e-Books	2.50
13.	CD/DVD	1.66
14.	Youtube	1.66

The data for the level of availability and that of accessibility of ICTs among the farmers surveyed were found to be similar, except for the data on availability and accessibility of ATM and CSCs. This is due to the fact that all the farmers availing ICTs could also access it. As ATM and CSCs could not be availed by the farmers individually, they are, therefore, accessed by all the farmers together in the village. As such, the availability of ATMs and CSCs was measured in terms of their number and location in the villages while their accessibility was measured in terms of the number of farmers who could access and use them.

A survey on the availability and accessibility of ICTs among the farmers of both the districts revealed that all the farmers had mobile phones. Since the farmers included in the study were registered under various ICT initiatives, especially mobile-based initiatives, it can be said that 100 per cent of the farmers of the selected districts had availability of and access to mobile phones. Another reason why the

accessibility of mobile phones is higher as compared to other ICT tools is that it is affordable, portable as well as useful during emergencies. This is in accordance with the findings of Mascarenhas (2010) and Sife et al., (2010). Besides mobile phones, television was also reported to have been accessed by majority of the farmers included in the study of both the selected districts. Radio was also found to be accessed by the farmers included in the study. This is also in line with the findings of Nakweya (2013), Nazari and Hasbullah (2008), and Shetto (2008). Even though the availability of CSCs is higher in both the selected districts, they were accessed by only few of the farmers included in the study. This is due to lack of awareness of the farmers regarding the presence of Common Service Centers at the village level and how it functions and the difficulty of the farmers in locating CSCs as they are not located at a point where farmers could easily identify it. It was also found that FM radio was accessed by almost half of the respondents included in the study. This indicated that the presence of radio applications in mobile phones could help in educating the farmers, especially if programmes on agriculture and rural development are broadcast as most of the farmers have access to FM radio *via* mobile phones. The availability of ATM was reported to be higher, but it was accessed by only few of the respondents included in the study as most of the farmers included in the study did not have ATM cards. Moreover, since ATMs in the villages surveyed are not located in proximity to the study area, only few farmers had access to them. Further, as there are few young farmers who are educated, the level of access to internet and other web-based services such as Facebook, Youtube, e-mail, and e-books is also very low among the farmers of both the selected districts included in the study.

Table 3. Frequency of usage of ICTs (n=120)

Sl. No	List of ICTs	Frequency of Usage			
		Very Frequently	Frequently	Occasionally	Rarely
		Per cent	Percent	Per cent	Per cent
1.	Mobile phones	71.60	27.50	0.83	0
2.	T.V	50.00	9.16	2.50	0
3.	Radio	18.30	14.16	0	0
4.	F.M radio	20.00	11.60	0	13.30
5.	A.T.M	0	0	0	16.60
6.	Kiosk	2.50	1.66	12.50	9.16
7.	Internet	0	7.50	2.50	10.80
8.	Computer	5.00	0.83	0	0
9.	Facebook	0	5.00	0.83	4.16
10.	Camera	0	0	0	7.50
11.	e-Mail	0	1.66	0.83	4.16
12.	e-Books	0	0.83	0	1.66
13.	CD/DVD	0	0	0	1.66
14.	Youtube	0	0	0.83	0.83

On an overall, mobile phone was regarded as the most frequently used ICT tool among the farmers using it very frequently. This indicated that the increase in the usage of mobile phones is increasing at an alarming rate even in the state. This is due to the reason that mobile phones are easily affordable and could be used by even illiterate farmers. The usage trend in mobile phones also indicated that it can offer huge scope in the future if appropriately use for the purpose of agriculture and other rural development purposes. Next to mobile phones, television was also used very frequently by the farmers. It was also reported that the use of radio is lower as compared to mobile phones and television since the level of availability and accessibility of ICTs is also lower as compared to other ICTs. Internet and its applications are still being used rarely by few of the respondents who are young and educated. Further, few farmers also visited the CSCs occasionally as and only when required to avail services on rural governance, rural education and commercial services such as recharging mobile phones, photocopying and printing. ATMs were also being used rarely by the few of the farmers when most needed.

Table 4. Purpose of usage of ICTs in agriculture (n=120)

Sl. No.	Items	Items				
		Mobile (Per cent)	T.V (Per cent)	Radio (Per cent)	Internet (Per cent)	CSCs (Per cent)
1.	Availability of inputs	27.49	34.06	18.29	0	0
2.	Quality of inputs	35.00	6.83	10	0	0
3.	Market price of inputs	9.12	0	0	5.16	0
4.	Marketing of produce	45.00	0	0	0	0
5.	Pest and disease management of:					
i.	Ginger	30.00	0	0	0	0
ii.	Paddy	1.66	0	0	0	0
iii.	Cole crops	19.16	1.66	0	2.50	0
iv.	Potato	26.60	0	0	0	0
6.	Vermi-composting	0	1.00	0	0	0
7.	Growing low volume high value crops	0	1.00	0	0	0
8.	Post harvest management	0	6.66	0	0	0
9.	Water harvesting	0	1.00	0	0	0
10.	Transplanting	0	11.60	0	0	0
11.	Farming systems	0	2.50	0	0	0

Source: Field Survey

The usage of ICTs for availability of inputs was mainly through television followed by mobile phones and radio. The findings of the study indicated that farmers preferred to watch the television programmes broadcasted through Kissan TV channel at 6:30 p.m. in local dialect *via* Doordarshan Kendra Shillong to gather information services on availability of inputs. For quality of inputs among the farmers, mobile phones had maximum usage followed by radio and television. Farmers reported that through IASF, information services on fertilizer management were being used through their mobile phones in order to receive advisory service *via* SMS. Mobile phones were also reported to be used by the farmers to contact experts/extension personnel to enquire about the recommended fertilizer dose in crops. Few farmers used ICTs for getting information on market price of inputs in which mobile phones and internet were used. Since majority of the farmers are unaware of usage of ICTs for getting market information on different commodities *via* the Meghalaya agricultural marketing portal, therefore very few farmers could derive the benefits on getting better market information. The reports on maximum usage of ICTs by the farmers were found to be the highest for marketing of the produce. Mobile phone was regarded as the most widely used ICT tool used for the purpose of marketing of produce. The findings of the study showed that farmers mainly used the mobile phones to communicate with the middlemen in the markets to communicate efficiently and to prevent the middlemen from cheating them as through the use of mobile phones they could track in which market and at what price they are selling from time to time. This is also in line with the findings of Hielig (2003); Kameswari et al., (2011) and Oyeyinka and Bello (2013).

Further, farmers also used mobile phones mainly to attain diagnostic service and solution to problems faced on pest and disease management of ginger. Since ginger is the main cash crop grown in Ri-Bhoi District of Meghalaya, farmers of the district mainly sought advice and contacted m4agriNEI experts *via* mobile phones in order to receive solutions to queries with regard to pest and disease management of ginger particularly with the incidence of stem rot in ginger caused by *Pythium sp.* Very few farmers used mobile phones to receive solutions to pest and disease management of paddy. For cole crops, farmers mainly used mobile phones to receive diagnostic service to pest and disease management of cole crops (Cabbage: *Brassica oleracea var. capitata*, Cauliflower: *Brassica oleracea var. botrytis*).

This is due to the reason that farmers in East Khasi Hills mainly used IASF *via* mobile phones to receive solutions to problems related with cole crops mainly for pest and disease management. For potato, which is also an important cash crop of the state and widely grown in East Khasi Hills, farmers mainly had problems on pest and disease incidences of of the crop particularly with the occurrence of Early Blight of potato caused by *Alternaria solani*. Due to this reason, farmers mainly used mobile phones *via* IASF to obtain solutions faced by the farmers on potato crop. With regard to other agricultural technologies, few farmers used ICTs particularly television for learning the scientific technique of transplanting followed by post harvest management. Since these technologies are location specific and need-based amongst the farmers of the state, hence they are often being broadcasted through television programme of Kissan TV channel of Doordarshan Kendra Shillong (Meghalaya).

Table 5. Purpose of usage of ICTs on livestock management (n=120)

Sl. No.	Items	Mobile phones	Television	Radio	Internet	Common Service Centers
		(Per cent)	(Per cent)	(Per cent)	(Per cent)	(Per cent)
2.	Livestock management					
	i) Medicines and vaccines	9.16	2.50	0	0	0
	ii) Feed and fodder	1.66	1.00	0	0	0
	iii) Availability of breeds	4.16	7.50	0	0	0
	Total	15	10.8	0	0	0

Table 6. Purpose of usage of ICTs on rural health (n=120)

Sl. No.	Items	Mobile phones	Television	Radio	Internet	Common Service Centers
		(Per cent)	(Per cent)	(Per cent)	(Per cent)	(Per cent)
3.	Rural Health					
	i) Contacting the clinic	35.80	0	0	0	0
	ii) Calling 108 for emergency	17.50	0	0	0	0
	iii) Diseases and preventive measures	0	35.80	2.50	0	0
	iv) Immunization	0	8.33	0	0	0
	Total	53.33	44.6	2.50	0	0

Table 7. Purpose of usage of ICTs on rural education (n=120)

Sl. No.	Items	Common Service Centers (Per cent)	Internet (Per cent)	Mobile phones (Per cent)	Television (Per cent)	Radio (Per cent)
4.	Rural Education					
	i) Employment and job prospects	11.60	0	0	0	0
	ii) Educational institutions	9.16	0	0	0	0
	iii) Accessing educational materials	12.50	0	0	0	0
	iii) Computer courses	11.60	0	0	0	0
	Total	45	0	0	0	0

Table 8. Purpose of usage of ICTs on rural governance (n=120)

Sl. No.	Items	Television (Per cent)	Mobile Phones (Per cent)	Common Service Centers (Per cent)	Radio (Per cent)	Internet (Per cent)
5.	Rural Governance					
	i) Government schemes and services	16.60	15	0.83	0	0
	ii) Online loan/Banking	0	0	7.50	0	0
	Total	16.60	15	8.3	0	0

Table 9. Purpose of usage of ICTs on social purposes (n=120)

Sl. No.	Items	Mobile Phones (Per cent)	Television (Per cent)	Radio (Per cent)	Internet (Per cent)	Common Service Centers (Per cent)
7.	Social					
	i)Contacting family, relatives and friends	87.50	0	0	0	0
	ii) Social networking	8.33	0	0	0	0
	Total	95.83	0	0	0	0

The purpose of usage of ICTs for livestock management, rural health, rural education, rural governance, commercial services and social purposes as provided in the above tables is discussed below:

According to the findings of the study, services on livestock vaccination and availability of breeds of livestock management were reported to have maximum usage by the farmers in the study followed by information services on feed and fodder. Mobile phones were the major ICT tool used for livestock management followed by television. Farmers reported that they mainly contacted m4agriNEI for getting diagnostic services on livestock management services such as vaccination, artificial insemination and availability of breeds. Even though livestock is reared by majority of the farmers in the state, still livestock information services are used by few farmers. This is due to the reason that farmers are still unaware of the information services on livestock provided through ICTs. Another reason is also the limited ICT initiatives which are focussed on livestock information services meant for the livestock farmers.

For rural health, farmers used ICTs mainly for the purpose of contacting clinic, calling the dial health initiative of 108 for ambulance services during emergencies as well as obtaining information services on diseases and preventive measures. The major ICT tool used by the farmers for rural health was mobile phones followed by television and radio. Mobile phones was used for the purpose of contacting the clinic and calling 108 while television was used for availing information services on disease and preventive measures of rural health. The reason mobile phones have a maximum usage as compared to other ICTs was that mobile phones proved beneficial and useful especially in times of emergencies.

The study also found that CSCs was widely used by the few young educated farmers in the area of rural education for searching educational materials, learning basic computer courses, photocopying, printing and browsing internet for employment and job prospects. Young and educated farmers who visited the CSCs for the purpose reported that CSCs acted as a one-stop-shop in providing services for rural education, rural governance and commercial services. They further added that with the presence of CSCs, they do not need to go to the town to avail the same services since they are readily and easily available at the village.

The farmers of both selected districts included in the study used ICTs for getting information services on government schemes and services followed by online loan banking. The most widely used ICT in rural governance in order of priority was television followed by mobile phones and CSCs. CSCs was visited by the farmers mainly for the purpose of online loan banking i.e., registering *via* CSCs with affiliated banks in order to avail loans and to open bank accounts. This is done in order to encourage thrift and banking among the farmers.

The findings of the study showed that majority of the farmers in rural areas used mobile phones as a tool of connecting with people and friends. Thus ICTs are widely used mainly for the purpose of social communication. This study is also in accordance with the findings of Mittal and Mehar (2012).

5.2 Constraints in the use of ICTs

The constraint in the use of ICTs by farmers was measured using Garrett ranking technique. The constraint analysis is however important to reach out the voice of the farmers and the problems faced by them in order to enable planners, administrators, development workers and policy makers to implement developmental programmes and interventions which could cater to the needs of the farmers and benefit them in an improved manner. The results are presented in table 12 which are discussed below:

Table 12. Constraints in the use of ICTs among farmers

Sl. No	Item	Mean score	Rank
1.	Lack of confidence in operating ICTs	64.77	I
2.	Erratic power supply	60.02	II
3.	Low Network connectivity	58.43	III
4.	Lack of awareness of benefits of ICTs	58.00	IV
5.	Lack of skill in handling ICTs	57.58	V
6.	Low ICT literacy	50.14	VI
7.	Lack of repairing facilities and centres in villages	47.80	VII
8.	Negative attitude towards ICTs	46.07	VIII
9.	Poor Finance	41.77	IX
10.	Lack of training and practical exposure towards ICTs	40.22	X
11.	High cost of repairing ICTs	38.19	XI
12.	Insufficient regional specific language	33.97	XII

The major constraints faced by farmers were lack of confidence in operating ICTs particularly mobile phone applications due to less exposure and lack of awareness of how to properly use ICTs in order to derive its benefits. Another problem faced by farmers in the use of ICTs was the difficulty in charging mobile phones due to erratic and fluctuating power supply. This however hindered most of the farmers in using ICTs for development. Connectivity is also one problem faced by the farmers in using mobile phones. Farmers reported that the connectivity is very low and limited to only few networks. Due to this reason, farmers do not find the use of mobile phones as reliable and credible when the condition of low network connectivity is a barrier to their usage. Further, it was also reported that majority of the farmers are also unaware of the socio-economic benefits and stimulus that ICTs could bring to their lives except for personal communication. Due to the lack of demonstration, experience and practical exposure among farmers that ICTs could benefit them, it is difficult to advocate the impact of ICTs for development. Farmers also reported that they had difficulty in using mobile applications and internet due to the lack of skill in using it. This however is related with low level of ICT literacy. Some respondents said they cannot use most of the basic functions of the mobile phones, such as SMS, mainly because of illiteracy and lack of skill in using it. Farmers also reported that there were lack of repairing centres and repairing facilities of ICTs for mobile phones and television in the villages. Due to this reason, farmers had to repair their items and take it to the town at a high cost incurring more expenses and more loss for the farmer. The attitudinal barriers by some of the old aged farmers also posed a constraint to the use of ICTs. Few participants directly referred to lack of finance as a barrier in using ICT. Some of the farmers pointed that there was a lack of training and practical exposure to use mobile phone applications as well as internet and felt that they needed some training to educate and teach them how to use ICTs that could benefit them for agriculture and rural development. Farmers also lamented that the cost of repairing of ICTs for mobile phones and television sets is quite high. This however detained them from using ICTs from time to time when the electronic item gets often damaged. Some of the farmers had difficulties with understanding the English language. This is due to the reason that most mobile phones use English language menus. The study is also in line with the findings of Agwu et al., (2008); Chilimo (2008), Reddi and Sinha (2009); Shankariah and Swamy (2012); IFPRI (2013) and Olaniyi (2013).

5.3 Association between accessibility, availability and usage of ICTs with independent variables

The following table showed that all the variables *viz.*, age, education, annual income, cosmopolitaness, social participation and attitude towards ICTs had a significant association with the level of accessibility of ICTs of the farmers.

Table 13. Association between accessibility and availability of ICTs with independent variables

Sl. No.	Variables	Accessibility and Availability of ICTs	
		Chi-square	Asymp. Sig. (2 tailed)
1	Age	66.809	0.000**
2	Education	84.201	0.000**
3	Annual Income	37.432	0.021*
4	Cosmopolitaness	81.414	0.000**
5	Social participation	72.130	0.000**
6	Attitude towards ICTs	1.256	0.000**

** Significant at 1 per cent level

*Significant at 5 per cent level

This was evident as majority of young farmers included in the study with high level of education were found to have more degree of availability and accessibility of ICTs as compared to old aged farmers with low level of educational qualification. The study also reported that farmers with higher level of income had higher purchasing ability of ICTs. The higher degree of orientation of farmers towards outside the social system, extent of social participation and favourable attitude of farmers towards ICTs also influenced the farmers to avail and access ICTs. This implied that the variables included in the study had a significant association that led to the increase or less accessibility and availability of ICTs among the farmers.

Table 14. Association between usage of ICTs with independent variables

Sl. No.	Variables	Usage of ICTs	
		Chi-square	Asymp. Sig. (2 tailed)
1	Age	65.500	0.000**
2	Education	69.266	0.000**
3	Annual Income	68.897	0.000**
4	Cosmopolitaness	59.571	0.000**
5	Social participation	72.260	0.000**
6	Attitude towards ICTs	1.132	0.000**

** Significant at 1 per cent level

*Significant at 5 per cent level

From the table, all the variables of age, education, annual income, cosmopolitaness, social participation and attitude towards ICTs included in the study had a significant association with the usage of ICTs of the farmers. With regard to usage of ICTs, it was found out that old aged farmers had lesser degree of usage of ICTs when compared to young farmers with preferably higher level of educational qualification. Since annual income of farmers was significantly associated with the availability of ICTs, this implied that there would be increased usage among farmers with higher level of income. Research participants, *viz.*, farmers included in the study also stated that the level of ownership and usage of ICTs was higher among farmers with better annual income. Further, it was also found out in the study that farmers with higher degree of cosmopolitaness, social participation and favourable attitude of ICTs had higher degree of usage of ICTs.

7. Conclusion

The results of the study revealed that the level of availability and accessibility of ICTs was the highest for mobile phones followed by television and radio respectively. Mobile phones were also regarded as the most frequently used ICT tool as compared to other ICTs. The reason mobile phones was highly accessed and most frequently used by majority of the respondents is that it is easily affordable and could be easily used by even illiterate farmers. The areas where ICTs are widely used in agriculture is information services on availability of inputs, quality of inputs, contacting middlemen for marketing of produce, pest and disease management of ginger, pest and disease management of cole crops, pest and disease management of potato and market price of inputs. CSCs were also used by the few young educated youths in the area of rural education *i.e.*, obtaining information services on employment and job prospects, accessing educational materials and learning basic computer courses. However, the study has found that lack of confidence in operating ICTs, erratic power supply, low network connectivity, lack of awareness of benefits of ICTs, lack of skill in handling ICTs, low ICT literacy, lack of repairing facilities, attitudinal barriers towards ICTs, poor finance, lack of training and practical exposure, high cost of repairing ICTs and insufficient regional language were the major constraints faced by the farmers in the effective use of ICTs. Since there is an increased penetration in the level of availability and accessibility of ICTs among the farmers of the state, there is a need to ensure that the problems of the farmers are being met in order to enable the farming community derive maximum benefits on better access to information services through the use of ICTs for agriculture and other developmental purposes. Based on the findings of the study, the following recommendations were also made:

1. Dissemination of agriculture-related information through F.M radio programmes would be recommended.
2. Better infrastructural facilities in CSCs should be improved with prominent locations for farmers to be easily accessible.
3. More awareness-cum-training programmes on ICTs should be encouraged among farmers by agricultural state departments, research organizations and its allied departments in order to increase the confidence, competence and skill in using ICTs for development.
4. Use of renewable energy such as solar panels would be recommended in order to overcome erratic and fluctuating power supply in the state particularly in rural areas.
5. Increased engagement in social media among rural youths on farming in order to enhance the communication pattern among themselves and extension personnel.
6. Since there is lack of repairing centres of ICTs at the village level, vocational training for the youths on ICT infrastructure would be recommended.

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