

ICTs for Agricultural Extension in India: Policy Implications for Developing Countries

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ABSTRACT

ICTs are changing all the spheres of human lives. Hence, it is a popular belief that, agricultural extension also no exception to this. It is also expected that the ICT led extension systems are going to act as a key agent for changing agrarian situation and farmers' lives by improving access to information and sharing knowledge. Hence, renewed enthusiasm to use new ICTs for agricultural advisory services led to mushrooming of e-initiative pilots in India. Development practitioners are experimenting innovative ICT initiatives exclusively for agricultural information and knowledge delivery. Unlike other sectors, agriculture is a complex, more so agricultural extension, hence, there are some projects shown the way forward and continue to grow and most other projects are floundering after few years of operation. Large number of projects stuck as pilots only and very few continuously innovated, replicated and sustained over the years. However, the variety of ICT initiatives are also added lot of lessons to take future course of action. With the available practical lessons, it is time to move forward in integrating ICTs and Information and Communication Management (ICM) in agricultural extension. Further, ICT capacity building in agricultural research and extension systems, location-specific content generation and digitization, integration of research-extension and IT technology solution providers, integration of pluralistic extension actors, blending ICTs with traditional extension methods, continuous innovation and refinement need be followed with commitment and accountability are crucial for sustaining momentum in the agricultural advisory services by the ICTs. This article is concise review ICT projects implemented since 1990's in India, elaborates best practices and its ingredients for success and also draws policy implications for the effective ICT based agricultural advisory services in developing countries.

Keywords: e-Agriculture, ICTs, Lessons, Best Practices

1 INTRODUCTION

Agriculture continues to be the most important sector of Indian Economy. Research, extension and farmers efforts are all contributed significantly from 50 million tonnes in 1950-51 to land mark achievement of an estimated production of 241 million tonnes of food production in 2010-11. The total demand for food grains is projected to touch 280 million tonnes by the year 2020-21. Meeting his demand will necessitate a growth rate of nearly 2 per cent per annum in food grain production (Singh, 2011) and agriculture sector need to grow targeted 4 per cent per annum. Recommendation of the Planning commission of India's working group on agricultural extension for XI five yea plan (2007-2011) states that the agricultural growth is stagnating and sluggish. Hence, there is an immediate need of vibrant, dynamic and innovative approach to be adopted for agricultural extension in order to achieve targeted growth rate and serve the farmers better. Further, Land and water resources are almost reaching their limits; hence achieving food security heavily relies on "Knowledge Resource". Estimates indicated that 60 per cent of farmers do not access any source of information for advanced agricultural technologies resulting in huge adoption gap (NSSO, 2005). In India, there are about 120 million farm holdings and the number is growing year by year. At least to provide one village extension personnel for 800-1000 farm families, the requirement of

field level extension personnel is estimated to be about 1300000-1500000, against which the present availability is only about 100000 personnel (PC, GoI, 2007). In this existing scenario, it is expected that integration of ICTs in agricultural extension will provide needed impetus to agricultural sector and ICTs can complement the traditional extension system for “Knowledge Resource” delivery to the millions of the farmers (Saravanan, 2010).

2 ICT INFRASTRUCTURE SCENARIO

Strategic reforms in telecommunications sector since 1990's, facilitates strong ICT infrastructure in India. As on June, 2012, total telephone subscribers 965.52 million (31.43 million fixed land line telephones, 934.09 million wireless) and 14.50 million broadband subscribers were estimated by the Telecom Regulatory Authority of India (TRAI, 2012). The tele-density has reached 76.99 (number of telephone subscribers per 100 individuals). However, there is huge gap between urban and rural tele-density, 162.46 and 39.80, respectively. Despite several policy initiatives to promote rural ICT penetration, growth in tele-density continues to be skewed in favour of urban India (TARI, 2012).

3 NATIONAL POLICY ON ICT IN AGRICULTURAL EXTENSION

National policy framework for agricultural extension (2000) stated that information technology revolution is unfolding and has very high visibility. Harnessing information technology for agricultural extension will receive high point in the policy agenda. Extensive use of modern information technology will be promoted for communication between researchers, extension workers and their farmer clients to transfer technologies and information more cost effectively. Further, it emphasised IT application in marketing, wider use of electronic mass media for agricultural extension, farmer participation in IT programmes and support to the state government for using IT in agricultural extension, promoting IT based information kiosks and capacity building for use of IT (DoA&C, 2000).

National policy for farmers (2007) indicated that the potential of ICT would be harnessed by establishing gyan chaupels (Knowledge centres) in villages. Further, the Common Service Centres (CSCs) of the Department of Information Technology, Ministry of Communications and Information Technology, Government of India and those set up by the state governments and private initiative programmes will be evolved for inclusive broad-based development. Last mile and last person connectivity would be facilitated with the help of technologies such as broadband internet, community radio or internet-mobile phone synergies (NPFF, 2007).

Document of ICAR Framework for Technology Development and Delivery System in Agriculture (2008) outlined the need for the construction of Agri – India knowledge portal – A single electronic gateway to be developed through a peer review process with the help of 15 content accreditation centres from 15 agro – climatic regions of the country. Each accreditation centres will be coordinate with other Agricultural Universities and agricultural institutions in their region for development of content in regional language as well as in English and also do its validation, which will be collected in the central data warehouse integrated in the knowledge portal. The portal will also serve as a platform for facilitation of interaction among researchers and extension personnel in the KVKs through high speed server intranet (ICAR-FFTDDSA, 2008).

National e-Governance Plan indicated that the typical services envisaged in Agriculture as a Mission Mode Projects (MMP) to provide information to the farmers on seeds, fertilizers, pesticides, Govt. Schemes, Soil recommendations, Crop management, Weather and marketing of agriculture produce. Several projects such as ASHA in Assam, KISSAN and e-Krishi in Kerala and Krishi Maratha Vahini in Karnataka have been initiated by the Department of Agriculture and Co-operation (DoA&C), Government of India. To spearhead implementation of MMP in Agriculture,

DoA&C has adopted twin strategy through AGRISNET & two portals AGMARKNET & DACNET (Mathur *et al.*, 2009).

4 ICT FOR AGRICULTURAL EXTENSION INITIATIVES IN INDIA

The reports indicated that 45 per cent of the world's ICT projects implemented in India (Manzar, 2004). And also Asia's highest number of information kiosks implemented across rural India. However, the most of the rural ICT projects are implemented in the socio- economically developed states of South and North India (Paul *et al.*, 2004). Numbers of ICT initiatives are documented in the literature (Saravanan, 2010a; Saravanan *et al.*, 2011; Sulaiman, 2012) and also available in online www.ekrishinaip.in. Some of the e-Agriculture initiatives in India are indicated below.

Sl. No.	Name of the project	Particulars
Web portals		
1.	aAQUA	Online discussion, archived, multi-lingual and multimedia based. 27674 posts 3.3 million views by 12,964 viewers (www.aaqua.org).
2.	KISSAN Kerala	Content processing and dissemination system. Online information, video channel, Tele-advisory, SMS and GIS based agro-services (www.kissankerala.net).
3.	TNAU AGRITECH Portal	Dynamic portal and e-linkage with research stations and farm sciences centres for agro-advisory services (www.agritech.tnau.ac.in).
4.	AGRISNET	Agriculture Resources Information System Network (AGRISNET) is a mission mode project funded by the Ministry of Agriculture, Government of India to develop a comprehensive online knowledge portal to disseminate relevant information to farmers. Under this scheme most of the State Governments are established information rich agricultural websites. For example, Sikkim AGRISNET (http://www.sikkimagrisnet.org), Andhra Pradesh agri-portal, http://www.apagrisnet.gov.in , Uttar Pradesh (UP) Agrisnet Knowledge Portal (http://agriculture.up.nic.in), Tamil Nadu- www.tnagrisnet.tn.gov.in , AGRISNET–HimachalPradesh (http://203.193.179.168/default.aspx) - Expert Advisory Services (http://www.hp.gov.in/expertadvisory/SignUp.aspx).
5.	DACNET	DACNET scheme, 46 web sites and 39 applications are developed (75 were developed and functional), which include web portals on complete information on 9 crop directorates, extension services, Integrated Nutrient Management, Marketing, Mechanisation and Technology, Economics and statistics (www.dacnet.nic.in).
6.	e-Krishi	Web based farm advisory services, market information, resource library and online expert advisory (www.e-

		krishi.org).
7.	ASHA	Relevant and need based agricultural information for the farmers of Assam state of North-East India. (www.assamagribusiness.nic.in).
8.	India Development Gateway (InDG) portal	Multilingual portal for agriculture and other rural information. Decentralized content management system by 225 institutional partners and others (www.indg.in).
9.	Rice Knowledge Management Portal (RKMP)	Comprehensive information portal on Rice. Separate domains for farmers, extension personnel and researchers and also e-learning platform is unique feature of this portal (www.rkmp.co.in).
10.	Agropedia	Agriculture knowledge repository of universal meta models and localized content for a variety of users with appropriate interfaces. Built in collaborative mode in multiple languages. Currently hosts nine thousand pages (agropedia.iitk.ac.in)
Web Portals for Market Information and Agri-Business Firms' Portal to Farmers		
11.	AGMARKNET	Market information by portal. Information on 2000 markets and 300 commodities in India (www.agmarknet.nic.in).
12.	ITC-e-Choupal	Innovative trading and e-Commerce initiative in agriculture. Reaches 4 million farmers by 6500 e-Choupals spread over 40000 villages of rural India (www.echoupal.com).
13.	EID Parry- Indiagriline	Information and knowledge solutions through Cane Management System and also other support services to farmers at seventy Namadhu Parry Mayyam outlets (Our Parry Centres). SMS alerts for farmers and cane field staff to plan their activity (Eidparry Annual report, 2010-11). Centre establishment, operating and service charge is recovered from the farmer from the sugarcane payments (www.eidparry.com/agriland.asp).
14.	Indiancommodities.com/	User fee-based market information on Cotton, Sugar, Oilseeds, Pulses, Spices, Rice, Wheat, Tea, Coffee (http://www.indiancommodities.com/)
15.	Mahindra Kisan Mitra	Mahindra and Mahindra Ltd., Farm Equipment Sector of the Mahindra Group hosted MahindraKisanMitra.com, a web portal for the Indian farmers to access wealth of information which is updated on a daily basis. Farmers can check daily mandi prices, read weather updates, latest crop advisories, and agri related news. The site also provides information under various other sections such as crop information, loans, insurance, mandi database, cold storages/warehouses and agri events (www.mahindrakisanmitra.com).
16.	IFFCO Agri-Portal	Information for farmers in local language. Web portal and 100 farmers' information kiosks in 16 States (Patil <i>et al.</i> , 2009) (www.iffco.nic.in).

17.	Agrowatch Portal	The agriwatch.com is the largest agribusiness portal in India and enables access to a large amount of agribusiness related information covering more than 15 sub sectors within the agricultural and food Industry. The daily, weekly and fortnightly Agriwatch trade research reports are published (Patil <i>et al</i> , 2009) (www.agriwatch.com).
18.	iKissan	Agriculture information; Crop specific package of practices of crops, animal husbandry, aromatic and medicinal plants, agricultural machinery, allied agriculture, sprayers, rural credit, insurance iKissan crop solutions; farmers have a critical need to get timely solutions for protecting and nurturing their crops to get best yields. Addressing this key need, iKissan has developed easy-to-use diagnostic packages for different crops which will be provided on demand. Further, it also provides local agri news, weather and market information to the farmers (http://www.ikisan.com).
VKCs/ VRCs/CICs/ CSCs		
19.	Village Knowledge Centres (VKCs)-M.S. Swaminathan Research Foundation (MSSRF)	101 VKCs in Tamil Nadu, Puducherry, Maharashtra, Orissa, Andhra Pradesh and Kerala state of India. VRCs and VKCs working with 315 partners for implementation and location specific content generation (Senthilkumaran, 2011). Demand driven information and knowledge with support services, social inclusion, community ownership and partnership proved critical for the success and sustainability (www.mssrf-nva.org).
20.	Village Resource Centres (VRCs) –Indian Space Research Organisation (ISRO)	473 VRCs have been set up in 22 States/Union Territories in India. The VRCs are connected to Knowledge/Expert Centres (ECs) like Agricultural Universities and Skill Development Institutes (SDI). Over 6500 programmes have been conducted by the VRCs in the areas of agriculture/ horticulture, fisheries, live stock, water resources, tele-health care, awareness programmes, women empowerment, supplementary education, computer literacy, Micro credit, micro finance, skill development/ vocational training for livelihood support <i>etc.</i> So far, over 500000 people have availed VRC services (www.isro.org/scripts/villageresourcecentres.aspx)
21.	Community Information Centres (CICs)	Community information centres in North-East India e-Infrastructure for accessing rural information needs of farmers and others (http://www.cic.nic.in/).
22.	Common Service Centres (CSCs)	Web based e-governance to services, including agriculture information to rural areas. So far 96,163 CSCs were rolled out in India (www.csc-india.org).
Telephony/ Mobile Telephony		
23.	Farmers Call Centre (Kissan Call Centre)	32 Farmers Call Centres, 2043636 farmers calls' answered during 2010-11, total calls answered during last five years (2005-2010) was 6247911.
24..	Lifelines India	Connectivity by innovative mix of internet and telephony.

		Reaches 200000 farmers in three States of India (www.lifelines-india.net).
25.	IFFCO Kisan Sanchar Limited (IKSL)	Voice messages in local languages. 95,000 voice messages delivered and 81000 Q&A repository with 5000 feed back messages from the farmers. 10 Lakh active farmers benefiting from IKSL's Value Added Services and IKSL enrollment crosses 4 million and 40000 cooperative societies as IKSL Retailers (www.iksl.in).
26.	Fisher Friend	QUALCOMM, MSSRF, Tata tele services and Asute system technology jointly implemented mobile based advisory services (instant access to helpful information such as weather conditions, where they can and cannot fish and market prices) to fishing communities of costal Tamil Nadu since, 2007. Due to technical challenges and availability of services only 5 nautical miles created mixed impact. Some of successful case studies on mobile services impact were reported by Mittal <i>et al.</i> , 2010.
27.	Reuters Market Light (RML)	Micro-information Services designed specifically for the farming community was launched by RML in 2009. Currently covers over 440 crops and varieties with more than 1400 markets and 2800 weather locations of 15000 villages in 13 States of India. Timely and personalized information and individual farmers have reaped significant return on their investment achieving up to INR 200,000 (\$ 4000) of additional profits, and savings of nearly INR 400,000 (\$8000) by using RML (www.reutersmarketlight.com).
28.	Mobile Advisory Services by Krishi Vigyan Kendras (KVKs) of Indian Council of Agricultural Research (ICAR).	Mobile advisory services to the farmers by the Krishi Vigyan Kendras (Farm Science Centres) are operational in India since, 2010.
	Hybrid Projects (Mix of ICTs, Info-mediaries & Conventional Extension Methods)	
29.	e-Arik	Internet, Offline CDs and farmer-to-farmer communication, conventional extension methods. A study among 300 farmers indicated that an average Rs. 5252 was increased among 73 number of e-Arik registered farmers who were growing Khasi mandarin. Similarly, an average Rs. 1611 was increased among 258 paddy farmers who were registered with e-Arik initiative. The cost and time indicators comparing traditional extension system and e-Arik project, sixteen fold and three fold less time were required to the clientele availing and extension system delivering extension services, respectively. Further it is also reported that 3.4 fold economic benefit as compared to the expenditure of deploying e-agriculture prototype and

		traditional extension system (www.earik.in).
30.	e-Sagu	Agro-advisory services by digital photographs and co-ordinators for 3035 farmers (4130 ha). Benefited Rs. 9491 (USD 240) per ha (www.esagu.in).
31.	Digital Green	Farmer participatory video for agricultural extension. 1681 videos produced and 60313 farmers involved. Increased seven fold more adoption of farm practices and ten times more effective per dollar spent as compared to traditional extension system (www.digitalgreen.org).
32.	Knowledge Share Centres	Information by touch screen kiosks, IVRS, bilingual web portal and awareness created by screening films & CDs by the Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad. Project covered 51 villages in eight districts of Andhra Pradesh State in 2011 (www.naipsri.org/ikisan)

5 IMPACT OF ICT FOR AGRICULTURAL EXTENSION INITIATIVES IN INDIA

Systematic and comprehensive impact studies on application of ICTs for agricultural extension are not available. However, Gandhi *et al.*, (2008) indicated that the Digital Green project increased the adoption of certain agriculture practices seven-fold over a classic extension approaches. Digital Green project was shown to be ten times more effective per dollar spent. Further, 85 per cent of adoption of improved technologies achieved as against 11 per cent of adoption by traditional extension methods. Similarly Krishnareddy and Ankaiah, (2005) reported that deploying e-Sagu prototype increased income of the farmers for the tune of INR. 3075 (63 USD) per ha and also reduced the pesticide usage. Further, their rudimentary estimate of economic advantage indicated that if the e-Sagu prototype used for 1000 farmers, overall net benefit with the proposed ICT based system is INR 100 Million (USD 204800). Saravanan (2008) reported the cost and time indicators comparing traditional extension system and e-Arik (e-agriculture) project, sixteen fold and three fold less time were required to the clientele availing and extension system delivering extension services, respectively. He further reported that 3.4 fold economic benefit as compared to the expenditure of deploying e-agriculture prototype. Interestingly, Gandhi *et al.*, (2009) reported positive social side effects and other qualitative results of Digital Green project on participatory video for agricultural extension.

6 LESSONS FROM ICT FOR AGRICULTURAL EXTENSION INITIATIVES IN INDIA

1. *Pilot Project Syndrome*: Most of the ICT based agricultural extension projects were implemented as “Pilot Projects”; and after the pilot period, most of the projects are never implemented in larger scale. Efforts for continuance of pilot projects are not taken sincerely by the implementing and also funding (Donor) agencies.

2. *Unsustainable Large Investments*: Portals like InDG, TNAGRITECH Portal, Rice Knowledge Management Portal (RKMP) was developed investing large amount of money. These portals were developed in project mode for a particular period of time. After the project period, it is difficult to sustain momentum and updating the portal with limited or no financial resource availability. So far, these portals also don't have any services to assure self generating finances for its maintenance and survival.

3. *Users Unwilling to Pay:* Most of the ICT for agricultural extension projects beneficiaries (generally farmers) are not willing to pay for the services they receive. Similar to most developing countries farmers, in India also most farmers feel that “agricultural advisory services” are welfare activity of the State and National Governments. And hence, they are unwilling to pay for the services.

4. *Small Scale of Operation:* The ICTs for agricultural extension projects were implemented in very limited geographical area (except IKSL) and covering few hundreds or at maximum thousands of farmers. Exceptionally, few projects like farmers call centres and e-Soil Health Card Programme covers entire country and Gujarat State, respectively. And few web portals are developed for larger farm stakeholders (AGMARKNET, InDG, e-Krishi, TNAGRITTECH Portal, Rice Knowledge Management Portal). However, continuous updating and maintaining web portals require sufficient resources, which are lacking after few years.

5. *Knowledge Middle Men with Less Permanency:* Most published projects are from educational/ research institutions, which generally, ignored traditional extension system and extension personnel, those who are serving over a long period in rural India. They implemented time bound ICT projects and hired “facilitators”/ “intermediaries”. Once, project completes stated objectives and targets, facilitators also disappear along with the project. In this regard, Digital Green used the services of the public extension personnel. Even, if project winds-up the learning took place among extension personnel will be remain for a longer time and more useful to the farmers. In e-Arik case, public extension personnel are unwilling to collaborate with the ICT project; because of most of the field level extension personnel never used internet and lack of skill in using other ICTs. However, Subject Matter Specialists from Farm Science Centre (KVK- Krishi Vigyan Kendra) was willingly collaborated with the e-Arik project (Saravanan, 2008).

6. *Information alone not for Development:* Along with ICT based advisory services, input supply and testing need to be integrated for the greater impact (Balaji *et al.*, 2007). In e-Arik project of North-East India, farmers demanded inputs as per recommendations of the project research fellows. Along with information, support services need to be ensured. As indicated by Heeks (2005) e-development projects must be designed around the information chain. They must either provide or draw together an entire "information chain package" of all resources necessary to turn data into effective action. Until this happens, ICTs will not deliver on their developmental potential.

7. *Difficulty in Localisation of Content:* Content need to be aggregated from different sources but it needs to be sorted in granular format for rapid adaptation for local use. Localisation and customizability of content are still are not practiced on a significant scale (Balaji *et al.*, 2007). If sufficient scientific information is not available, content need to be generated, tested, refined and used for further advisory services through ICTs. Most of the web portals lack relevant content in local language.

8. *Generic Information:* Most of the ICT initiatives disseminated generic information on crop cultivation practices of major crops and also weather and market information. Multimedia portals and one stop centres for various operations in agriculture are known as academic exercises (Sideridis *et al.*, 2010)

9. *One-Way Information Flow:* Most of the ICT initiatives information flow one-way (Sulaiman, 2012). There was a limited scope for interaction. Projects such as Farmers Call Centre, Village Resource Centre, e-Arik, e-Sagu, digital green, Lifelines India and IKSL provide opportunities for interaction among farmers and experts.

10. *Islands of Learning*: In almost all the projects, the participation of agricultural education, and research institutions appears to be marginal (Balaji *et al.*, 2007). Most of the projects do not have collaboration with other farm research and extension stakeholders. Practical challenges or constraints in implementing the ICT projects are seldom disclosed and shared with others. Learning experience of one project to another project is seldom shared.

11. *Lack of Systematic Evaluation*: Most of the projects never revealed actual evaluation results, generally they reported 'positive' results, and most common difficulties such as; inadequate rural ICT infrastructure (especially frequent power-cuts) and difficulty in content localisation and customisation were indicated. Systematic and objective evaluation or impact of the projects was seldom done. Similar type of projects, with little modification, was implemented in isolated manner. Except few projects, large number of projects evaluation results were never published or communicated. Even after experimenting hundreds of ICT projects for rural development in the last two decades, there was no noteworthy comprehensive comparative evaluation of e-agriculture projects in India (Keniston, 2002; Saravanan, 2010).

12. *Lack of Co-ordination*: In the absence of collective and coordinated efforts by the public-private agricultural research and extension institutions, ICTs have not penetrated satisfactorily in rural India despite time, money and efforts invested so far (Patil *et al.*, 2009).

7 CONCLUSION

In India, during the last one and half decade, hundreds of Grassroots ICT projects are implemented. Invariably, agriculture becomes one of the indispensable parts of the project service menu. However, we yet to get substantial results in increase of agricultural production because of deployment of ICTs. Most projects are implemented in smaller geographical area and covering few hundred farmers and hence, drawing generalisations may not appropriate. Much hyped ICT projects are yet to make any break through in agricultural information dissemination. Even though, ICTs are promising to make difference and also accelerating information access by some farmers, but, most of the ICT projects were taken as pilots projects, institutionalising of ICTs need to be given more emphasis. ICTs for agricultural extension projects need to be compared and evaluated objectively. Low cost ICT tools such as mobile phones having lot of promise for agricultural extension. At the same time, experiences are indicating that ICT are going to play greater role in private sector agribusiness, market information and market intelligence. Further, certain type of farm information (*e.g.* informing government schemes) and online monitoring of the progress of the governmental schemes are proved successful. Hence, it is high time to find out appropriate information to provide through ICTs. As indicated earlier, formulating National and State level e-Agriculture policy, human resource development, strengthening ICT infrastructure, localisation and customisation of appropriate content are to be taken-up to harvest the benefits of ICTs for agricultural extension services provision and agricultural development.

8 POLICY IMPLICATIONS FOR DEVELOPING COUNTRIES

1. *National and State Governments e-Agriculture Policy*: National and state e-Agriculture policy need to be formulated. It should explore and outline the possibilities of leveraging ICT for the agricultural extension services provision.

2. *Human Resource Development*: Creating awareness on ICT potentials, ICT using skill and capacity development among the extension personnel of the public and private extension systems and also among farmers and other stakeholders in the extension systems will facilitate better usage of ICTs.

3. *Strengthening ICT Infrastructure*: Extension organisations and extension personnel need to be equipped with ICTs for facilitating farm information among the agricultural stakeholders.
4. *Localisation and Customisation of Content*: Research, educational institutions and extension systems should continuously strive for the appropriate content localisation and customisation as per the demand of the farmers and other stakeholders.
5. *Integration of ICTs with Public-Private Extension System*: Appropriate ICTs to be identified and deployed in the extension system to complement ongoing extension efforts of the public and private extension systems.
6. *Farm Research and Developmental Institutions Collaboration*: Establishing strong working collaboration among the ICT initiatives of the research and developmental institutions (IT solution providers) should be initiated. The leading research and educational institutions in agriculture and information technology solution providers should join together to leverage ICT penetration for agricultural extension and they should also guide the other ICT initiatives for agricultural extension services provision.
7. *Convergence of Communication Methods & ICTs*: For effective agricultural extension service delivery, the convergence of traditional extension communication methods (personal contact methods, print media, radio and TV) and new ICTs are to be appropriately used to reach farm stakeholders.
8. *ICTs & ICM*: Integrating ICTs and Information and Communication Management (ICM) in agricultural extension will accelerate the knowledge facilitation among the agricultural stakeholders.
9. *Social networks & Open Source Materials*: Promotion of appropriate use of social networks and open source material to disseminate information among agricultural stakeholders is needed to be emphasised.
10. *Promote Leadership and Find Champions*: ICT interventions need leadership. The champions are needed to push projects forward and make them visible and interesting to the agricultural stakeholders. These leaders must operate from local to national level (World Bank, 2011; Szilagyi, 2012).

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