



A REVIEW

Monitoring and evaluation using digital tools

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Abstract : Data collection and monitoring and evaluation (M and E) efforts will take a remarkable deal of time and methodical planning and implementation. In the past, these were finished with paper and pen, which made them susceptible to error, difficult to conduct on a big scale, and immoderate in transaction charges. Information and communication era (ICT) tools, which includes hardware like mobile phones and tablets, applications with the functionality to create digital surveys and software programme application that allows clients to upload the data to storage facilities have reduced the conventional annoying conditions associated with far off data collection and M and E. New knowledge base does not or takes too long time to reach to the farmers, and the needs of practical farming are not communicated sufficiently to the research community. Thus, new collaborative strategies and ICT may be crucial tools to remedy some of the gaps with the useful resource of the use of improving get right of entry to to consequences, know-how trade and communication further to upkeep and schooling. This paper summarizes how digital tools can play major role in extension for monitoring and evaluation and the key troubles, annoying conditions and experiences derived from literature and different case studies.

Key Words : Monitoring, evaluation, ICT, Digital survey, Knowledge, Extension system

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INTRODUCTION

Agriculture these days is evolving in an environment of fast changes in, markets, guidelines, demography and natural environment. These changes pose to the country wide agricultural sectors and rural agencies are context specific and complex and, therefore, setting new desires on all actors in and round the agricultural place to innovate and increase new strategies of taking element to generate knowledge base (Daane,2010). Improved and sustainable agricultural output will be achieved with research and

innovative efforts (COM, 2012).

Public extension systems face problem in attaining all farmers due to the dearth of monetary functionality and personnel to physical meet all farmers and agencies. This is exacerbated with the useful resource of the use of the fact that farmers are fairly populated all through big areas and regularly isolated. Now with the existing extension system only 10% of the farmer population are getting extension services (Bell, 2015).

Another key task is that farmers increasingly

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greater request specified and varied information, as farming is becoming more market oriented. Even farming systems in pretty homogenous agricultural areas with many types of crops cultivated, inputs, ratio/labour used. In order to be genuinely effective, information and knowledge base need to be tailored to satisfy the needs of each farmer. Another dilemma of public extension service is the non-recurring character of information and knowledge provision to farmers. In the most maximum suitable case, the information brought is updated and renewed with the useful resource of regular exchanges amongst extension officers and farmers. However, the downside of this is that it is a long way high-priced and time consuming. The absence of a close-by facilitator or expert is very difficult to farmer as he will not get useful information in time (FAO, 2015). Thus, new collaborative strategies and ICT may be crucial tools to remedy some of the gaps by providing access to knowledge and providing the trainings. This paper elaborates describes modern opinions and growing practices which is probably enhancing the delivery of properly timed information that fits the needs of farmers. The paper moreover concludes how ICT can contribute to the enhancement of the general overall performance of agricultural extension systems.

Emerging practices to improve the delivery of information through ICT :

Presently, a big sort of methods is being tried to use ICT to improve extension services. Different approaches are used to transfer the information like the use of text, voice or picture and through queries or SMS messages. There is direct communication in some cases between sender and the farmer. In others, the messages are disseminated through a farmer extension worker or a close-by facilitator through the Internet. Some methods which support the both way interaction is useful for farmers to answer to or request from the organisation. ICT-based totally completely extension advisory strategies are relevant in areas which includes preproduction, production, marketing and advertising, monetary services and gathering and disseminating the information. Different digital tools are available for amazing applications (Saravanan *et al.*, 2015). For awareness creation and in transfer of technology, TV, radio, videos are used Mobile phones are mainly implemented for gathering and disseminating advisory and market information. Web portals provide unique

opportunities for information sharing and linking with extraordinary stakeholders and e-learning is especially interesting for educational reason. Social media integrates all features, like knowledge sharing, providing advisory, technology transfer and linking with other extraordinary actors.

Harnessing social media in agriculture :

Social media (Fig. 1) has given energy to the voice of the ordinary man. Social media is now a main stream form of communication throughout the international and gaining popularity with the increase in the variety of smart phones. It is awesome to consider that in little as quick decades, the evolution of the Internet and social media has taken vicinity right in advance over the years.



Fig. 1 : Social media tools

It have become handiest in 1991 that the World Wide Web have grown to be public, Google was created 15 years back and Facebook was created in small Harvard dorm room. We now live in an international where in questioning about the unknown is often followed with the useful resource of the use of the phrase “Google it” and people thought they have lost right arm if they do not have their mobile phone in hand. There in the meantime are 1.5 billion clients of social media and the popularity now continually growing. (Chui *et al.*, 2012). Limited research available shows that there are developing tendencies in farmer and agribusiness uptake in social media as the popularity of smartphones increase. Social media refers to the method of interactions among humans in which they create, exchange information, ideas, per cent, in virtual agencies and networks. Kaplan and Haenlein (2009) define social media as “a group of

Internet-based totally completely applications that assemble on the ideological and technological foundations of Web 2.0 and that allow the “creation and interchanging or transferring user generated content. The amazing kinds of social media are referred to underneath:

Types of social media:

Twitter :

Twitter is a web social media which limits the messages you deliver to handiest 140 characters lone. Users of twitter can create and share the ideas as Messages or “tweets” internationally. Internationally there are now over 500 million clients of Twitter. Twitter is the most useful and amusing tool for following agricultural interests which networks the farmers and agribusiness humans as well is interacting with entrepreneurs and extraordinary inspiring human’s interior and outside of agriculture.

Facebook :

Facebook (Fig. 2) isnow one of the most usually used and popular social media systems. It is most usually used for humans to connect with their very own family and buddies online and exchange personal information which includes snap shots, updates. Privacy settings can be done on your personal pages to restrict the access of all the users, so only selected users will get permission to access your resources. Facebook is also now considerably used to connect directly with different farmer groups, consumers and clients. There are approximately 1.4 billion clients of Facebook

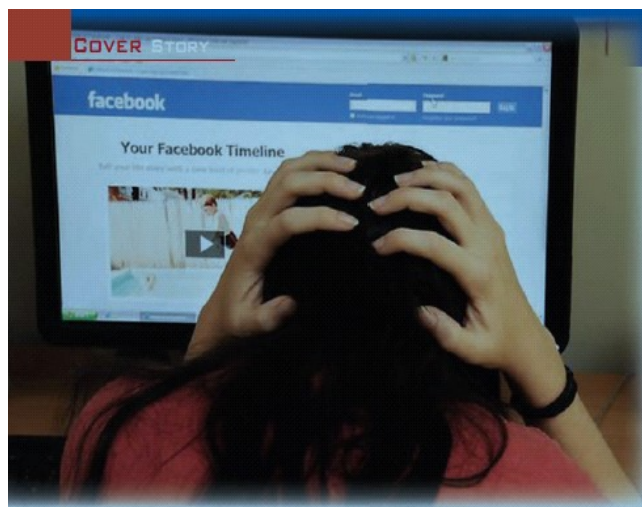


Fig. 2: Using face book

internationally which is useful for farmers and agency to connect with customers.

YouTube :

YouTube is a video streaming issuer which allows clients to create and upload videos to the online website which then can be shared to everybody internationally. There are approximately 1 billion unique site visitors to the YouTube and in a month 100 hours of videos are uploaded to YouTube every minute. In the following sections, case studies that display modern use of ICT are presented. In modern-day years a lot of social media and extraordinary ICT tools were developed (Table 1 and 2) which may allow creation, sharing and upkeep of knowledge base.

Table 1: ICT equipment evolved for sharing and maintenance of knowledge

Knowledge portals	These are digital tools for looking and access to online knowledge base. Knowledge portals allow a common platform for dissemination of information from numerous sources.
E-document management systems	They are portions or collections of software program that could digitize and store files in a digital format. This ICT device is used as a database, bearing for sorting and searching of the files collected.
Data warehouses	These are databases used for reporting and analysis of data. It is a significant repository of data that’s created via way of means of integrating data from one or greater disparate sources.
Groupware or collaborate software	This is software program, which facilitates action-orientated groups operating collectively over geographic distances by using digital tools that helps communication, collaboration and trouble solving. Additionally, groupware can also aid project management functions, inclusive of undertaking assignments, time-dealing with deadlines, and shared calendars.
Community of practice (CoP)	This is a collection of individuals who share a craft and/or a profession. If the members of group interested in a particular domain or area it can be created to get the knowledge related to their field.
Social communities of interest	It is a network of individuals who share a common interest or passion.
Individual communities of interest	They are ICT tools for people to manage individual personal knowledge and networks

Table 2: Software types, evaluated equipment and different examples of equipment of the differing types and a success examples of utility of the equipment, particularly in agriculture

Software type	Tools evaluated	Successful examples
Knowledge portals (KP)	Search engines: Google, Yahoo Slide and report sharing: Slideshare Video and picture sharing: YouTube, Flickr	VOA3R, eXtension, Chil
E-document management systems(E-MS)	Digital libraries: Groen Kennisnetin NL, Organic E-prints	Organic E-prints, Agriwebinar
Data Warehouse (DW)	Eurostat, FADN	FADN
Groupware (GW)	Wikipedia, Yammer, Crowdsourcing	British Farming Forum, Lego Cusoo, Climate CoLab, P&G Connect+Develop, Betacup Challenge
Community of practice (CoP)	ResearchGate, Erfaland	Disease surveillance and warning systems, IDRAMAP
Social communities of interest (SCI)	Facebook, LinkedIn, Google+, Ning, Quora	AgTalk+., E-Agriculture, Jeunes-agriculteurs, E-agriculture, Rede Inovar
Individual communities of interest (ICI)	Wordpress, Twitter, blogs	AG Chat

Social media applications developed :

There are many applications and ICT-enabled tools for data collection features are given in Table 3. According to Chowdhury (2001), ICTs play an crucial role in food protection through facilitating accessibility to related guidelines and information for market communication, improving market profitability, helping farmers to make decisions, developing range in rural economies and decreasing the charge of living. Some of the achievements of ICT/ICM in agriculture are referred to underneath.

Success recollections on ICT/ICM in agriculture: aAQUA: ICT-enabled know-how services to farmers in India :

The aAQUA which stands for almost All Questions Answered, which is web-based farmer knowledge exchange platform built with the useful resource of the use by youthful agricultural extension personnel (Malcom, 2011). aAQUA (Fig. 3) is operational from December

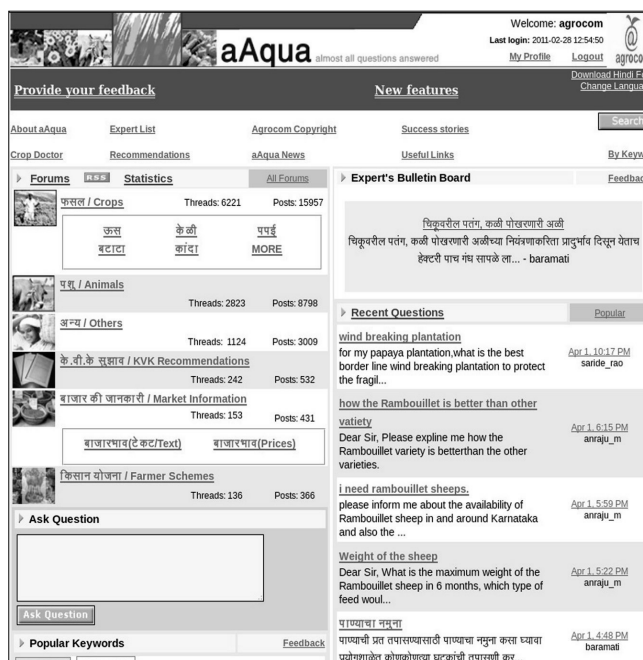


Fig. 3: Home page of a Aqua

Table 3: Examples of ICT-enabled equipment for data collection

Name of Group/Community/Pages	Description	Target users	Region
Facebook			
By farmers			
Livestock Information and Marketing Centre (https://www.facebook.com/groups/Livestock.TN/)	Members (farmers, extension personnel, scientists, market functionaries, consumers, etc.) of this group share information related to livestock production, management, marketing, etc. A separate page is also on Facebook related only to marketing of livestock (https://www.facebook.com/Livestock.Market)	Agricultural stakeholders related to livestock	Tamil Nadu, India
Turmeric Farmers' Association of India (https://www.facebook.com/turmeric.farmers)	This page was created by turmeric farmers to stabilize price of turmeric in the market. Till date, the farmers connect through the page and share information to keep turmeric price stable and increase marketing opportunities of turmeric.	Turmeric farmers	India
Natural farming Development Centre (https://www.facebook.com/groups/NaturalFarmingTN/).	Members of the group share information related to organic farming, permaculture, hydroponics, aquaponics, Natural Repellents, etc	Farmers interested in organic and zero budget agriculture	Tamil Nadu, India
National Ecological Producers Association (APNE) (https://www.facebook.com/anpe.peru)	Information related to ecological farming is shared through the page.	Farmers	Peru
By extension centres			
Krishi Vigyan Kendra, Namakkal (https://www.facebook.com/krishi.namakkal)	Krishi Vigyan Kendra, Namakkal communicates information related to farmers' training programmes, availability of inputs etc. through this account	Agricultural Extension stakeholders	South Asia
By extension professional networks			
Agricultural Extension in South Asia (AESA) (https://www.facebook.com/groups/428431183848161/)	Members post links to relevant publications on extension and advisory services, announcements of workshops and conferences, major policy decisions on extension, reports of meetings / workshops and blogs relevant to the broader theme of extension	Agricultural Extension stakeholders	South Asia
Global Forum for Rural Advisory Services (GFRAS) (https://www.facebook.com/groups/gfras/)	This page provides information related to advocacy and leadership on pluralistic, demand-driven rural advisory services.	AEAS Professionals and others	Global
By extension personnel			
Vivasayam Karkkalam (Let us Learn Agriculture) (https://www.facebook.com/groups/madhualan)	Mr. Madhu Balan, a public extension officer started Facebook group to cater the information needs of farmers in 2012. This group, exchange information on improved farm technologies, initiates discussion with other farmers and extension personnel, share information and photos on best practices by other farmers, government schemes, etc. Question and answers, information on Terrace garden, hydroponics are most discussed topics in this group.	Farmers and others those who are interested in agriculture	India
Twitter			
Farmers			
AgChat (https://twitter.com/agchat)	The AgChat (Twitter online discussion group by the AgChat Foundation) started in 2009 by a group of American farmers is widely used in USA, UK, Australia, New Zealand and Ireland for facilitating discussions of industry issues between farmers and agribusinesses	Farmers, entrepreneur, farm product consumers	USA, UK, Australia, New Zealand, Ireland

Table 3: Contd.....

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Agriculture Proud (https://twitter.com/AgProud)	Twitter handle of Ryan Goodman, a young farmer and rancher from Montana, US. Through his Twitter account he shares his experiences of farm life and answers questions of fellow farmers, agriculture enthusiasts and consumers	Agriculture enthusiasts, consumers, and fellow farmers	USA
Extension centres			
USDA (https://twitter.com/USDA)	The Twitter handle of U.S. Department of Agriculture shares latest news, events, and information in agriculture	Farmers, extensionists, development practitioners	USA
INGENAES (https://twitter.com/INGENAES)	This Twitter handle of Feed the Future initiative Integrating Gender and Nutrition within Agricultural Extension Services shares information and gender appropriate, nutrition-enhancing technologies to improve life and livelihood of women farmers	Researchers, extensionists, farmers	Global
Professional networks			
MEAS (https://twitter.com/MEAS_extension)	Twitter handle of the project Modernizing Extension and Advisory Services shares good practice strategies and related information to ultimately raise farm income and enhance livelihood of rural poor of 12 selected countries of Asia and Africa.	Development	Global
GFRAS (https://twitter.com/infogfras)	This page provides information related to advocacy and leadership on pluralistic, demand-driven rural advisory services.	Extensionists, development practitioners, researchers, policy makers	Global

Source : (Suchiradipta Bhattacharjee, Saravanan Raj, 2016)

2003 and demonstrates to farmers with the useful information by the use of mobile phones, web website and SMS-based.

The fora are open to all clients for browsing without any costs for non-commercial use (Malcom, 2011). In aAQUA, content material is prepared in the form of debate fora of queries sent by farmer or experts. There are 22 fora comprising 6 lessons that included plants, animals, recommendations of KVK, farmer schemes and market information etc. The fora are open to all clients for browsing without any costs for non-commercial use (Malcom, 2011).

Marketing and distribution of agricultural produce:

One of the applications using ICT for agricultural marketing and advertising is Agmarknet this is presented underneath:

Agmarknet: an agricultural marketing and advertising information system :

In India to provide market price information

effectively the Directorate of Marketing and Inspection, Department of Agriculture and Cooperation, Ministry of Agriculture and the Agricultural Informatics Division, National Informatics Centre, Ministry of Communications and Information Technology, collaborated to create the Agricultural Marketing Information Network (Fig. 4).

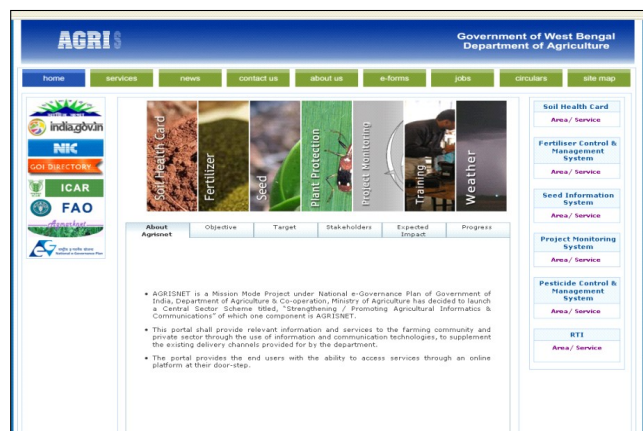


Fig. 4: Agmarknet portal

The main purpose of this project is efficient collection and dissemination of market information, storage and modes of transportation (www.agmarknet.nic.in).

Community e-centres to enhance agricultural productivity :

To improve agricultural productivity, Community e-centres can be used by connecting rural people to direct markets. This will give ready access to implementation price of inputs and products. Swaminathan Foundation established local knowledge centers in Pondicherry. These are operated by local villagers. The operators collect the weather announcements from public sources which they put up on notice boards for the information to farmers and fishermen. The telecentre also provides appropriate information over loudspeakers, to benefit people who are illiterate, and publishes as newsletter. Another example is the e-Choupal model (Fig. 5), which is established by a private Indian tobacco organisation. These telecentres are operated ITC-knowledgeable close by farmers and provide the agricultural community with get right of entry to to suitable practices in agriculture and market expenses for commodities.

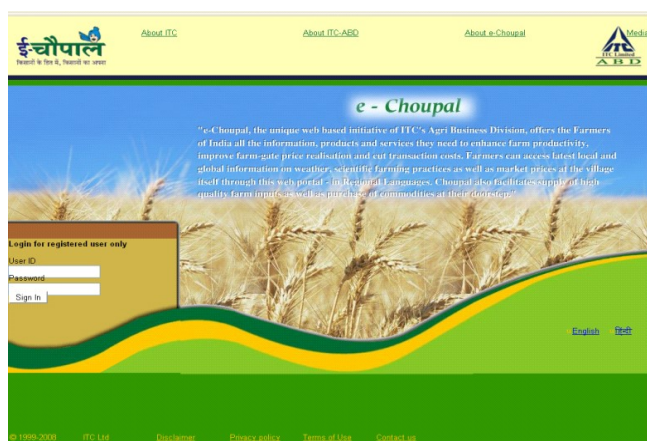


Fig. 5: e-Choupal (http://telecentresap.org/meeting/cmap2007/India_Presentation_eChoupal.pdf).

Principles and process to strengthen the delivery of information through ICT:

To update the extension system with the ICT a number of context conditions have to be met. The use of ICT in extension will be successful if the people has the knowledge use of Internet and operating the devices. For example, computer skills, technical knowledge is required to host e-learning platforms, web portal and mobile app development. Web portals, e-learning and text-based SMS messages are very useful for literate

farmers at the same time as video, voice-based advisory services and community radios are suitable for illiterate farmers. We can expand the reach of extension by integrity traditional media and new ICT. For high utilization of digital tools by farmers requires knowledge of developing content and interaction of service providers. (Francis and Addom, 2014). ICT only disseminate the content but it does not generate. Moreover, ICT based services create greater synergy when combined with other extension strategies like farmer field schools and demonstrations (Christoplos, 2010). There has been an assumption that with the 'right' technological funding, extension agencies will reap new desires and turn out to be more sustainable. While using the ICT to strengthen to delivery of information many constraints will be there like institutional structures, human and financial capital constraints (Christoplos, 2010). For ICTs to enhance extension, Saravanan *et al.* (2015) endorse the following steps for implementation, each step is based upon on the scenario and judgement of the extension business enterprise:

Successful implementation of ICT :

For successful implementation of ICT, the first step is to assess the needs of target community. 2. Conduct benchmark surveys in advance before introduction of ICT enabled monitoring and evaluation. Benchmark surveys moreover help to get a exquisite examine of the actual scenario. 3. Based on the need's assessment and benchmark surveys, localised and custom designed content material fabric needs to be created. 4. Based on the needs of target group ICT tools need to be determined and to be installed. 5. Sensitization on presence of the services and how to access them is required to the target audience. 6. To ensure sustainability of the services, it's a long way encouraged to search for partnerships with stakeholders present within side the purpose place or look for integration of the services in public agricultural extension system. 7. Monitoring and adaptation is crucial, mainly in the beginning of the task. Modifications need to be made at the same time as the task does now not correspond to the needs of the audience. 8. Finally, an impact assessment needs to be realised to determine the degree of achievement of the task.

Challenges for promoting ICT in extension :

Despite the promise and ability of ICT in extension services, there are numerous annoying conditions going via ICT as an extension strategy, which are listed

Table 4: Advantages and constraints of numerous ICT interventions

Intervention	Advantages	Constraint	Evidence
Text messages to beneficiaries	Wide reach; can be accessed on any device	Cost of SMS; lower phone ownership among target groups (poor, women); restricted to shorter messages	Can improve clinic attendance and adherence to prescribed care (Lester, 2010)
Text messages to health care providers	Wide reach; can be accessed on any device	Cost of SMS; may be difficult to retrieve if provider receiving many messages a day	Modest benefits, may need more evidence
Structured SMS for data collection	Wide reach; can be accessed on any mobile device	Training needs for structured SMS; incorrectly formatted messages may be rejected	Clearly more efficient and faster than paper methods and can improve data quality (Habiba <i>et al.</i> , 2012)
Use of PDAs/Smartphones for data collection	Can have validation built in, run offline/online, transmit data	Cost of devices, power	Trails using mobile phone technology-tools reported reduction in correct diagnoses when compared to the standard (Free, 2013)
Use of smart phones by health workers	Can run many applications; greater storage space; increasing smartphone ownership	Greater power needs; may require longer training	Trails using mobile phone technology-tools reported reductions in correct diagnoses when compared to the standard (Free, 2013)
Use of mobile money	Easily send micro payments to many beneficiaries	Requires agent network to convert to cash (may be limited to urban); high fees; cash could be used for other purposes	Feasible to implement, clearly has ability to reach out into rural areas
Use of e-Vouchers	Avoid handling cash; easy to distribute	Need system to validate and redeem	Feasible to implement, clearly has ability to reach out into rural areas
Videoconferencing/telemedicine	Can access expert opinion from anywhere	Requires connectivity; may have greater bandwidth	Feasible to implement, clearly has ability to reach out into rural areas. More evidence needed to show effectiveness

Source : (CMAM, 2014)

underneath:

One key task is the scaling up of ICT in extension services. Many ICT interventions fail to scale up and reap extensive adoption due to market fragmentation and the dearth of financially sustainable agency models with a view to enchantment to private place investments in modern solutions for small-scale agriculture (World Bank, 2016). Complex and dense information, on agricultural practices and inputs, need to be converted into ICT-based messages (Aker, 2011). Mobile phone usage is rapidly increasing but equal does not hold for the Internet. In the prolonged run, the Internet could have a splendid greater impact on rural growth (World Bank, 2016). Even with the information furnished from the ICT intervention, it is not confident that the farmer will act upon this information because of the inaccessibility of possibility markets and the complex interlinked relationships among sellers and

buyers in low-profits developing economies (World Bank, 2016). Rural areas farmers can speak and understand local languages, so they are unable to understand the communicating information in the national language. In regard to adoption rates, integrating traditional media and new ICT's can expand the research of extension. However, to reap immoderate rates of adoption, farmers need to be engaged in identifying the relevance and content material will be shared and distributed to other farmers (Francis and Addom, 2014). The next task is women and elderly often have lower literacy and schooling rates than youthful men. This requires the development and use of tailor-made information and schooling materials. In this respect, audio-visual tools are more likely to offer opportunities to obtain women farmers (Quisumbing and Pandolfelli, 2009).

Challenges for promoting ICT in Extension:

Table 4 underneath lists some of the principle kinds of interventions and the benefits while the use of each ICT interventions.

Despite the promise of ICT to address the diverse troubles there are constraints which may reduce the ability of these solutions to go to scale as considerably as important to reap maximum impact are discussed below:

Sustainability :

Efforts need to be made to ensure that there can be a direction for incorporation into a larger programme for useful resource, funding and scale up, if the consequences of the programme are promising, for example, assuring an organised technique to the implementation of ICT interventions that includes a pilot phase, implementation, impact research and then evaluation which includes a cost-benefit analysis, and makes recommendations on the scale up and institutionalization of the innovation with the useful resource by the governments.

Ongoing operational charges:

While calculating the ongoing operational charges consider the the use of the ICT solution (airtime, hardware maintenance, etc.).

Lack of infrastructure:

This can be in terms of proper facilities to store commodities which includes vaccines, further to lack of power to charge mobil phones or laptops. Although remarkable strides were made to enhance the mobile network coverage, it is not uncommon to discover villages and primary health facilities wherein one cannot get a signal sufficient to constantly transfer data via General Packet Radio Service (GPRS).

Conclusion:

Policy makers and extraordinary stakeholders need to be known to how appropriate ICT-based digital can help to persuade agricultural practice and tasks to promote food protection and sustainable agriculture. To recognize the ability of ICT-enabled agriculture, Governments need to provide the following:

A sound, market-oriented ICT regulatory framework, Incentives which includes a legitimate agency and taxation environment to encourage investor

and donor involvement in ICT infrastructure development in Asia and the Pacific. The preconditions for interregional collaboration in Asia and the Pacific through, for example, the introduction of ICT-based monitoring and forecasts. Support to research institutions and extraordinary non-profit groups that use ICT tools to assess and transmit commodity prices, thereby allowing markets to emerge. To distribute the information widely in the local languages and to match potential local demand with global content, initiatives has to take by combining the existing media channels with the latest digital tools.

REFERENCES

- Aker, J.C. and Mbiti, I. (2010).** Mobile phones and economic development in Africa. *J. Economic Perspectives*, **24** (3): 207-232.
- Bell, M. (2015).** Powering behaviour change for a brighter agricultural future. MEAS Discussion Paper, University of California, Davis.
- Christoplos, I. (2010).** *Mobilizing the potential of rural and agricultural extension*. Rome: Food and Agriculture Organisation of the United Nations (FAO).
- COM (2012). Communication from the Commission to the European Parliament and the Council on the European Innovation Partnership ‘Agricultural Productivity and Sustainability’. COM(2012) 79 final.
- Daane, J. (2012).** Enhancing performance of agricultural innovation systems. *Rural Development News*, **1** : 76-82.
- FAO (2015). Success stories on information and communication technologies for rural development. RAP Publication 2015/02. Bangkok, Thailand: FAO Regional Office for Asia and the Pacific.
- Free ,C., Phillips, G., Galli L., Watson, L. Felix, L. (2013).** The effectiveness of mobile-health technology-based health behaviour change or disease management interventions for health care consumers: A Systematic Review. *PLOS Medicine*, **10** (1): e1001362. doi:10.1371/journal.pmed.1001362.
- Kaplan, A. M. and Haenlein, M. (2010).** Users of the world, unite! The challenges and opportunities of social media. *Business Horizons*, **53**(1): 59-68. doi: 10.1016/j.bushor.2009.09.003.
- Lester, R.T. (2010).** Effects of a mobile phone short message service on antiretroviral treatment adherence in Kenya (WelTel Kenya1): a randomised trial. *Lancet*, **27** : 376(9755):1838-45. doi: 10.1016/S0140-6736(10)61997-6.
- Quisumbing, A.R. and Pandolfelli, L. (2009).** Promising

approaches to address the needs of poor female farmers. Resources, constraints and interventions. IFPRI Discussion Paper 00882, July 2009. Washington: IFPRI.

Saravanan, R., Sulaiman, R., Davis, K. and Suchiradipta, B. (2015). *Navigating ICTs for extension and advisory services.* GFRAS Good Practice Note for Extension and Advisory services. Success-Stories%20on%20ICTICM%20in%20AR4D%20in%20AP%20Region%202011.pdf (accessed 04 December 2020).

WEBLIOGRAPHY

World Bank (2016). *World Development Report 2016: Digital Dividends.* Washington, DC: World Bank.

Chatfield, A., Javetski, G., Fletcher, A. and Lesh, N. (2014). CommCare evidence base, "CommCare", available at : <https://wiki.comcarehq.org/display/commcarepublic/CommCare+Evidence+Base> (accessed on 10 October 2020).

Chowdhury, N. (2001). Information and Communications Technologies. In: *Appropriate Technology For Sustainable Community based management of acute malnutrition (CMAM)*, available at : <http://www.d-tree.org/> (accessed on 5 November 2020).

Chui, M., Manyika, J., Bughin, J., Dobbs, R., Roxburgh, C.,

Sarrazin, H., Sands, G. and Westergren, M. (2012). The social economy: Unlocking value and productivity through social technologies. McKinsey Global Institute. Retrieved from http://www.mckinsey.com/insights/high_tech_t 17th of Excellence Year *telecoms_internet/the_social_economy*.

Community based management of acute malnutrition (CMAM) (2014). Available at : <http://www.d-tree.org/>. *Food Security. International Food Policy Research Institute.*

Francis, J. and Addom, B.J. (2014). Modern ICTs and Rural Extension: Have we reached the tipping point? *Rural 21*, 01/2014: 22-24. Grameen Foundation 2016. Community Knowledge Worker. Available at <http://www.grameenfoundation.org/what-wedo/agriculture/community-knowledge-worker> Retrieved on 8 June 2020.

Habiba Garga, Evina C.D., Vouking, M. and Tamo, V.C. (2012). Are e-health programs effective in LMIC? SURE Rapid Response . Available at : http://www.cdbph.org/documents/Rapid_Response_Effectiveness_of_e_health_programs_in_LMIC_july_2012.pdf (accessed 02 September 2020).

Malcolm Hazelman and Attaluri, S. (2011). Success Stories on ICT/ICM in AR4D in Asia and the Pacific Region. available at : <http://www.apaari.org/wp-content/uploads/2011/06/>.

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