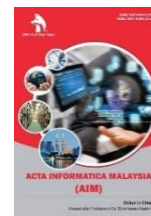




ZIBELINE INTERNATIONAL™  
P U B L I S H I N G  
ISSN: 2521-0874 (Print)  
ISSN: 2521-0505 (Online)  
CODEN: AIMCCO



## REVIEW ARTICLE

## STATUS AND PROSPECTS OF ICT AMONG NEPALESE SMALLHOLDER FARMERS

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## ARTICLE DETAILS

## Article History:

Received 07 January 2022  
Accepted 09 February 2022  
Available online 18 February 2022

## ABSTRACT

The majority of Nepalese smallholder farmers, who account for 70 % of the total food produced in the country, are still not utilizing ICT services for agricultural information. The use of ICT can provide timely information about the market, production technologies, and important recommendations that help smallholders to uplift their livelihood strategies. This review paper aims to assess the status of ICT use among Nepalese smallholder farmers and identify its prospects. For this purpose, a thorough review is done by studying various secondary sources. From the review, the increasing access to mobile phones and internet services among farmers indicates that there lie possibilities of connecting smallholders to the information ecosystem through ICT. However, various factors such as education, cost of technology, socio-economic condition, etc. of farmers influence the decision regarding adoption and non-adoption of ICT, which should be considered before forming plans and policies to increase its use. Various subsidies and incentives in ICT facilities can be an excellent idea to increase the adoption.

## KEYWORDS

Information, market, livelihood, adoption, ecosystem.

## 1. INTRODUCTION

Agriculture is the source of livelihood for the rural population. Conversely, rural population is the backbone of Nepalese agriculture. ADS has classified rural population into small commercial farmers, subsistence farmers, and landless or near landless farmers (MoAD, 2016). The average landholding size of small landholders is less than 0.50 ha, in Nepal (Gc and Hall, 2020). These smallholder farms accounts for 70 % of the total food produced in the country and are mostly involved in traditional agriculture. Such traditional approaches of agriculture are intertwined with numerous challenges in production, marketing, and profit (Lokeswari, 2016). Furthermore, seasonal variability in weather patterns, sporadic climate events, and pest and disease outbreaks also challenge the rural and smallholder farmers. A mix of interlinked risks and challenges related to farming, limited access to infrastructures, technologies, information etc. endanger the already fragile food production system of smallholders (Fan and Rue, 2020).

In response to such challenges, small and marginal farmers need relevant agriculture-related knowledge and information to improve, diversify and sustain their enterprises (Glendenning and Ficarelli, 2012). However, smallholder farmers are left out and not prioritized by extension services which have hindered the development of Nepalese agriculture as a whole. Such farmers are deprived of the latest and relevant information about farming practices because of the high cost of technology and lack of accessible knowledge, leading to a fatal impact on crop production (Bhusal et al., 2021). Information related to soil, sowing, pest and disease management, and market empowers the farmers and aids in better decision making (Armstrong and Gandhi, 2012).

The outcome of various studies shows that it is absolutely a need and opportunity both to upgrade the broadcasting of agricultural information that farmers receive from the government and other sources (Armstrong

and Gandhi, 2012). At present, both public and private sectors are trying to search and implement the better solutions to acknowledge the information needs of smallholders. Providing such information through traditional extension approaches only is not possible, since the needs of smallholders are specific and diverse. Rural smallholders mostly remain disconnected from the influences and information of the outer world, too. These problems can be significantly addressed by using Information and Communication Technologies (ICT). A demonstrable need has been felt to use ICTs as a revolutionary tool to connect rural smallholders with the greater ecosystem of agricultural information.

Information and Communication Technology (ICT) has been extensively used as a promising tool for agriculture development across various countries of the globe. "ICT includes all digital technologies that facilitate the electronic capture, processing, storage and exchange of information" (Dufty and Jackson, 2018). ICT tools such as mobile, radio, telephones, computers, satellite systems, etc. facilitate the dissemination of information. It is said that with the growing use of mobile and the internet, ICT has secured its position and relevance even in the smallholder farms. The main focus of integrating ICT in agriculture is to cater to the various information needs of farmers in a more cost-effective way and solves the issues of poor connectivity. ICT can make a huge contribution to enhancing the sustainability and productivity of small-scale farmers (Gautam, 2018). ICT also plays an important role in empowering rural and small landholder farmers by providing better access to information regarding markets, production strategies, financial services, etc. and hence uplifts their livelihoods (Lokeswari, 2016). Such tools are also found helpful in disseminating information to large and segregated farmer population in a cost-effective manner. Enhancing the capacity of smallholders with reliable knowledge, networks, and institutions to uplift their livelihoods through the use of ICT also aids in achieving a fundamental development challenge. The use of ICT for agriculture information and farming is slowly gaining popularity in Nepal. With the increase in the number of the rural

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DOI:  
10.26480/aim.01.2022.13.16

population using various kinds of information and communication tools, ICT carries huge potential in the delivery of agricultural information. However, resource-rich farmers with higher education, economic state, and large landholding have easier access to ICT. But, the rural and smallholder farmers, who lead the food production system, are mostly deprived of these opportunities because of various reasons. Various factors influence the adoption and non-adoption of ICT as a source of agricultural information dissemination. The capacity of smallholders needs to be upgraded to fully utilize the possibilities of ICT as a transformational opportunity for rural smallholders to become both consumers and producers. Hence, this paper tries to analyze the status and prospects of ICT among Nepalese smallholder farmers with the help of the following questions.

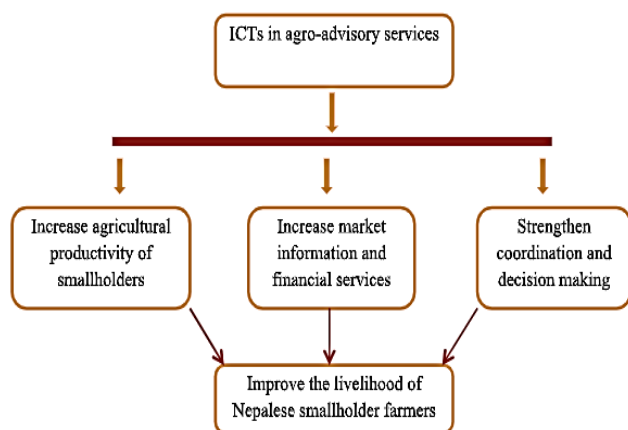
- i) What is the status of ICT among Nepalese smallholder farmers?
- ii) In what ways can ICT help in achieving agricultural development among smallholder farmers?
- iii) What factors influence the use of ICT among smallholder farmers?
- iv) What are the possibilities and recommendations for increasing ICT use among smallholder farmers?

## 2. OBJECTIVE

This study is done to assess the status and prospects of ICT among Nepalese smallholder farmers. The main objectives behind the study are:

- To identify the present status of the use of ICT among Nepalese smallholder farmers,
- To suggest some ideas to increase the use of ICT among Nepalese smallholder farmers.

## 3. CONCEPTUAL FRAMEWORK



## 4. METHODOLOGY

For the preparation of this manuscript, a thorough review of the topic-related materials has been done. The review has been done by studying various journal articles, review papers, book sections, reports, news, etc. from secondary sources. The keyword used for searching the material are: "ICT AND smallholder farmers", "ICT AND Nepalese agriculture", "ICT AND agricultural extension in Nepal" in Google Scholars.

## 5. RESULTS AND DISCUSSIONS

### 5.1 Status of ICT among Nepalese smallholder farmers

In 1965, realization of the importance of information in agricultural development initiated the operation of the Agriculture Information System as a unit of DOA in Nepal. It was later renamed as Agriculture Communication Division in 1990 and is currently known as AICC (Bohara, 2008). At government level, a division called Agriculture Information and Communication Center (AICC) under the Ministry of Agriculture and Land Cooperatives of Nepal is responsible for disseminating agricultural information to farmers using various media (Piya, 2012). AICC has established farmers' call centers for receiving and solving agriculture-related problems of farmers with the help of experts. Radio Nepal and Nepal Television broadcast various agricultural programs in collaboration with AICC. As per the findings, only a few listeners are regularly listening to the agriculture program of Radio Nepal collaborated by AICC, although

more than 90% owned the radio set. Likewise, 56.43% of people among TV set owners watch agricultural programs. The printed materials of AICC have however been accessible to only 16.4% of the respondents (Nepal Development Research Institute, 2015). Apart from acts of AICC, SMS service about the market price by DOA and Kalimati falls under telecommunication initiatives of the government.

Along with government agencies, various private sectors have also contributed as service providers of agricultural information. Various media initiatives of agriculture-related programs e.g. Krishi Samachar, Krishi Karyakram are broadcasted on Krishi TV, other national channels, and on FM radios. Printed media such as Krishi Diary, booklets, and pamphlets of AICC, Krishakpana on Kantipur newspaper, etc. are also in the service. Various mobile applications in the Nepali language e.g. Smart Krishi, Krishi Guru, Hamro Krishi, Narc Krishi, Krishi Kapurkots, IBA Krishi and other online portals of DOA and AICC have also been practicing internet-based initiatives. Also, GIS and GPS services have been used in weather forecasting and in cropping pattern as agro-meteorological initiatives in Nepal (Paudel et al., 2018).

Furthermore, the access of farmers to mobile applications is increased by Project for Agriculture Commercialization and Trade (PACT) and Agriculture Management Information System (AMIS), under the MoAD (Regmi, 2016). Three different applications for the field verification and monitoring of sub-projects with help of GPS in mobiles have been developed by PACT (Paudel et al., 2018). With the increase in coverage and use of modern ICT tools along with modernization of traditional communication tools, a significant role in developing agriculture has been played by both public and private sectors in a pluralistic approach (Singh, 2014).

At present, more than 90 % of Nepalese possess mobile phones and they are more accessible and affordable than in the past (Chhetri, 2016). However, internet access is still a bigger issue among rural and smallholder farmers. TV and Radio are the most common tools used for acquiring information by farmers with no access of the internet. Overall, the farmers with the knowledge of use of ICT for agriculture information are low. Only one-fifth, which is 20 % of the farmers are knowledgeable about the use of ICT in agricultural extension (Chhetri, 2016). Wide mobile coverage and expanding Internet users however, make the situation hopeful as equal access to information is being ensured (Regmi, 2016).

Despite all these efforts, it is visible that the services have not reached to majority of smallholder farmers. A dearth of research-based information exists about the present status of the use of ICT among farmers (Gautam, 2018). However, small rural holders are still not able to connect to the information ecosystem through the use of ICT. Various factors affect the willingness and ability to use ICT which are discussed in the section below.

### 5.2 Use of ICTs in agricultural development

The promotion of agriculture development depends significantly upon agriculture extension and advisory services (Anderson and Feder, 2007). The extensive use of ICT in agro-advisory services helps farmers to minimize farm risks and enables them to become ingenious (Abraham, 2006). Smallholder farmers can use ICT for the following purposes:

#### 5.2.1 Increasing productivity

Farmers are always at risk due to adverse weather conditions, pests and disease outbreaks, and lack of coping capacity which leads to decreased productivity. The fact that agricultural productivity can be improved by the use of ICT has been proposed many times (Armstrong et al., 2012; Armstrong et al., 2011). The sustainability of small-scale farms can also be improved since new technologies provide transformational opportunities along with increasing productivity (Gautam, 2018). In a study done in Africa, SMS test reminders had a positive and significant influence on the yield and productivity of smallholder farmers (Sennuga et al., 2020). Various information regarding general recommendations, weather forecasts, pest and diseases epidemic alerts, etc. can be easily conveyed to the farmers, which plays a contributing role in agricultural yield. A piece of correct and reliable information through ICT helps farmers to select resilient crop varieties as per climate forecast, helps to manage pest and disease outbreaks as per the prediction and helps in adjusting their sowing dates which reduce farm risks and improve productivity (Bhusal et al., 2021). Small scale farmers can use ICT to transfer simple as well as complex information, which are helpful to increase productivity (Krone et al., 2016).

#### 5.2.2 Securing market information

Access of smallholder farmers to ICT services bears the potential to

increase their links to distribution channels and financial services which were unavailable to them before. Farmers can shorten the value chain since farmers can directly connect with the sellers and customers, removing the scope of the middleman. The bargaining power of smallholders is also expected to rise with the help of ICT-based information (Lokeswari, 2016). However, the increase in information and access to various buyers through ICT solely does not improve the bargaining capacity, but belongingness to a group strengthens the voice (Jagun et al., 2008). Smallholders will be better equipped with market information such as prices, margins, financial sources etc. and will also be introduced to the large pool of buyers. Hence, increased access to market information makes the smallholder better at securing profit in their enterprises.

### 5.2.3 Strengthen coordination and decision making

ICT fosters a better relationship of farmers with various non-governmental organizations, private companies and institutions working in agriculture with the help of its diverse networking (Singh et al., 2017). Such coordination avails the farmers of the information generated by those companies and organizations working in the agricultural field. It is useful in decision-making for farmers. Agriculture demands the right decision at right time. Various information regarding weather, pests and diseases, market etc. can be disseminated through ICTs to smallholders. Farmers can receive information from sowing to harvesting, which helps to make an informed decision and also protects from rumors and misunderstandings (Hiltz et al., 2013). Farmers can make informed decisions regarding production practices followed by marketing through the effective use of ICT.

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#### 5.3.1 Geography and Infrastructure

Uneven geographic location and difficult topography are some of the hindrances in providing extension services throughout the country. A pivotal role can be played by ICT in extending agricultural information across all the terrains of the country. However, in rural areas, there still exist problems such as lack of electricity and no internet access. Also, most of the farmers are illiterate and face difficulty in simply reading and understanding the provided information, too. People with higher degrees tend to become more familiarized with advanced technology; hence most of the rural farmers in Nepal cannot perceive more information through ICT in comparison to highly educated farmers (Muinde, 2009). The idea of ICT and its use in agriculture is still a foreign idea for most of the people living in rural areas. Rural farmers are still unaware of the facilities that come with the information and communication technologies. Only 63% of Nepalese have access to the services of internet and smartphones (Shrestha, 2018). Rural farmers lack access to different television channels, mobile applications and websites, too. Hence, infrastructures should be prioritized to cater to the needs of rural and smallholder farmers through ICTs.

#### 5.3.2 Gender

A clear gender difference can be felt in the usage of ICT, derived from the fact that Nepal is a male-dominated country where male holds better access to education, technologies and decision making. "The access to, content and use of ICT are connected to gender norms and inequalities, as well as to efforts questioning and changing these" (Sida, 2015). Women are 14 percent less likely to have mobile phones and other technical devices than men (Treinen and Alice van der Elstraeten, 2018). In contrast to this, factors such as land ownership and gender do not limit the use of ICT tools (Armstrong and Gandhi, 2012). However, gender-sensitive ICT solutions to cater the local needs and expectations of farmers help to improve gender equality and also agricultural productivity.

### 5.3.3 Cost of Technology

In a comparative study between users and non-users of ICT services, factors such as education, social categories, landholding, along with income affected the decision-making of farmers regarding the use of ICT (Ali and Kumar, 2011). The socio-economic condition of farmers greatly affect the access to information source (Williams and Agbo, 2013). The cost of the technologies is high that the resource-poor farmers cannot afford them. Although ICT is taken as a cost-effective way of extension, high cost of ICT itself acts as a barrier for the use of extension services. Smallholders can struggle to afford android phones and internet services in the first place.

### 5.3.4 Simplicity and understandability

Information disseminated through ICT is not adopted if it does not resonate with the needs and situation of smallholder farmers. To make the information convincing, relevancy in content is a must. Local language stands as barrier to the adoption of ICT services for agricultural extension (Munyua, 2007; Williams and Agbo, 2013). It has been found that if the information is broadcasted and translated in the local language, then farmers understand better (Tata and McNamara, 2018). Despite the benefits of ICTs, face-to-face communication comes foremost while building trust and collaboration among rural and smallholder farmers (Lokeswari, 2016). Hence, it is better to have the perfect balance between ICTs and farm visits to help and influence rural smallholders.

### 5.4 Possibilities and recommendations

Effective utilization of ICT has huge potential of making smallholder farmers prosperous as the required information is transferred timely in an easy, accessible, and cost-effective way. The increase in the use of mobile phones and social media by Nepalese farmers further aggravates the possibilities of connecting them in the information system. Following are some recommendations for the better linkage of smallholder farmers with ICT for disseminating agricultural information.

- Low prices for broadband internet connection in rural areas need to be ensured.
- Farmers groups should be motivated to use ICT. Providing IT education and establishing IT-based information centers can help increase the access and use of ICT among smallholder farmers groups.
- Periodic training to extension experts and farmers regarding the updated operation of ICT can be helpful.
- Government should subsidize ICT facilities so that smallholders can easily afford them.
- Tele-communication networks can be brought to collaboration for SMS marketing, forecasts and practical information about agriculture.
- The local government can use ICTs in its agricultural extension and disseminate information about market, pest and diseases, weather forecasts in local languages by co-coordinating with smallholder farmers groups.

Furthermore, proper collaboration between various stakeholders such as internet service providers, software developers, agriculture ministry, electricity ministry, telecommunication, extension education, and smallholder farmers groups is necessary to make the ICT services affordable, reliable and sustainable.

## 6. CONCLUSION

Hence, the use of ICTs in agricultural information dissemination is slowly increasing in Nepal. The increase in access to smartphones and internet services acts as hopeful rays to transform extension service delivery. Rural and smallholder farmers who are marginalized from effective agricultural information can be directed back into the information ecosystem through the use of ICT. However, to ensure that the services reach the smallholder farmers, the focus should be given to building technical infrastructures and spreading awareness among the rural farmers. Factors affecting the adoption and non-adoption of ICT such as infrastructure, gender, cost of technology etc. should be assessed properly and used in favor of increased ICT usage. Besides, a proper focus on connecting smallholder farmers with ICT should be made in the policy level, itself. Various subsidies and incentives in ICT facilities can be an excellent idea to increase the adoption. Various training on how to use ICT for their benefits should be provided



to smallholders. In this way, the potential that ICT can play a huge role in agricultural extension and for raising the livelihoods of Nepalese smallholder farmers should be explored and utilized.

## ACKNOWLEDGMENT

We thank all the people involved directly and indirectly in the writing process of this article. The support and guidance of everyone involved in the process are highly appreciated and valued. We are extremely thankful to our parents and colleagues for their continuous inspiration.

## REFERENCES

- Abraham, R., 2006. Mobile phones and economic development: Evidence from the fishing industry in India. 2006 International Conference on Information and Communication Technologies and Development, Pp. 48–56.
- Ali, J., Kumar, S., 2011. Information and communication technologies (ICTs) and farmers' decision-making across the agricultural supply chain. *International Journal of Information Management*, 31 (2), Pp. 149–159.
- Anderson, J.R., Feder, G., 2007. Chapter 44 Agricultural Extension. In R. Evenson & P. Pingali (Eds.), *Handbook of Agricultural Economics*, 3, Pp. 2343–2378. Elsevier. [https://doi.org/10.1016/S1574-0072\(06\)03044-1](https://doi.org/10.1016/S1574-0072(06)03044-1)
- Armstrong, L., Adinarayana, J., Dunstan, N., 2012. The use of ICT and geospatial techniques to improve Australian and Indian ground water and land resource management under climate change scenarios: A position paper. *Proceedings of the International Conference on Geospatial Technologies and Applications, Geomatix'*, Pp. 12.
- Armstrong, L., Gandhi, N., 2012. Factors influencing the use of information and communication technology (ICT) tools by the rural famers in Ratnagiri District of Maharashtra, India.
- Armstrong, L.J., Diepeveen, D.A., Gandhi, N., 2011. Effective ICTs in agricultural value chains to improve food security: An international perspective. 2011 World Congress on Information and Communication Technologies, Pp. 1217–1222.
- Bhusal, A., GC, S., Khatri, L., 2021. A review article on role of information and communication technology in agriculture and factors affecting its dissemination in Nepal. *Journal of Applied Biotechnology & Bioengineering*, 8 (3). <https://doi.org/10.15406/jabb.2021.08.00257>
- Bohara, A., 2008. Strategic implementation of ICTs in agriculture information dissemination: A case of Gulmi Districts. *Proceedings of IOE Graduate Conference*, Pp. 61–75.
- Chhetri, A., 2016. ICT Productivity in Agriculture. *Journal of Extension Systems*, 32 (1), Pp. 5–8.
- Dufty, N., Jackson, T., 2018. Information and communication technology use in Australian agriculture. <https://apo.org.au/node/201506>
- Fan, S., Rue, C., 2020. The Role of Smallholder Farms in a Changing World. In S. Gomez y Paloma, L. Riesgo, & K. Louhichi (Eds.), *The Role of Smallholder Farms in Food and Nutrition Security*, Pp. 13–28. Springer International Publishing. [https://doi.org/10.1007/978-3-030-42148-9\\_2](https://doi.org/10.1007/978-3-030-42148-9_2)
- Gautam, M., 2018. ICT and Agriculture Development A Farm Level Case of Nepal. *Asian Journal of Humanities and Social Studies*, 6 (4).
- Gc, R.K., Hall, R.P., 2020. The Commercialization of Smallholder Farming—A Case Study from the Rural Western Middle Hills of Nepal. *Agriculture*, 10 (5), Pp. 143. <https://doi.org/10.3390/agriculture10050143>
- Glendenning, C.J., Ficarelli, P.P., 2012. The relevance of content in ICT initiatives in Indian agriculture. *International Food Policy Research Institute*, Pp. 1–40.
- Hiltz, S.R., Gonzalez, J.J., Turoff, 2013. ICT support and the effectiveness of decision making in disasters: A preliminary system dynamics model. ISCRAM.
- Jagun, A., Heeks, R., Whalley, J., 2008. The impact of mobile telephony on developing country micro-enterprise: A Nigerian case study. *Information Technologies & International Development*, 4 (4), Pp. 47.
- Kenneth, C.K.S., 2006. Network structure, ICT use and performance attitudes of knowledge workers.
- Krone, M., Dannenberg, P., Nduru, G., 2016. The use of modern information and communication technologies in smallholder agriculture: Examples from Kenya and Tanzania. *Information Development*, 32 (5), Pp. 1503–1512.
- Lokeswari, K., 2016. A study of the use of ICT among rural farmers. *International Journal of Communication Research*, 6 (3), Pp. 232.
- MoAD. 2016. *Agriculture Development Strategy (ADS) (Kathmandu, Nepal)*. Ministry of Agricultural Development.
- Muinde, F., 2009. Investigation of Factors Affecting the Adoption of Information and Communication Technologies for Communication of Research Output in Research Institutions in Kenya. <https://doi.org/10.26686/wgtn.16973386.v1>
- Munyua, H., 2007. ICTs and small-scale agriculture in Africa: A scoping study.
- Nepal Development Research Institute. 2015. Report on Impact Assessment of Effectiveness of AICC's Communication Sources in Agriculture in Western Nepal. [https://www.ndri.org.np/wp-content/uploads/2017/11/2015\\_May2015\\_AICC\\_Impact-Assessment-of-Effectiveness-of-AICCs-Communication-Sources-in-Agriculture-in-Nepal.pdf](https://www.ndri.org.np/wp-content/uploads/2017/11/2015_May2015_AICC_Impact-Assessment-of-Effectiveness-of-AICCs-Communication-Sources-in-Agriculture-in-Nepal.pdf)
- Paudel, R., Baral, P., Lamichhane, S., Marahatta, B.P., 2018. ICT Based Agro-Advisory Services in Nepal. *Journal of the Institute of Agriculture and Animal Science*, 35 (1), Pp. 21–28.
- Piya, C.K., 2012. Investigation and analysis of present situation and future prospect of information and communication technology to develop agriculture in Nepal.
- Qiang, C.Z., Kuek, S.C., Dymond, A., Esselaar, S., 2012. Mobile applications for agriculture and rural development.
- Regmi, A., 2016. Application of ICT tools in agriculture sector in Nepal.
- Sennuga, O., Olayemi, Conway, J., Sennuga, M., 2020. Impact Of Information and Communication Technologies (Icts) On Agricultural Productivity Among Smallholder Farmers: Evidence from Sub-Saharan African Communities., 7, Pp. 27–43.
- Shrestha, A., 2018. 63 Percent of Nepal's Population Connected to the Internet. *TechLekh: Latest Tech News, Reviews, Startups and Apps in Nepal*.
- Sida. 2015. Gender and ICT.
- Singh, M., 2014. Critical Analysis of Mobile Based Agro - Advisory Services: A Case of mKRISHI [Thesis, Division of Agricultural Extension, IARI, New Delhi].
- Singh, S., Ahlawatat, S., Sanwal, S., 2017. Role of ICT in Agriculture: Policy implications. *Oriental Journal of Computer Science and Technology*, 10 (3), Pp. 691–697.
- Tata, J.S., McNamara, P.E., 2018. Impact of ICT on agricultural extension services delivery: Evidence from the Catholic Relief Services SMART skills and Farmbook project in Kenya. *The Journal of Agricultural Education and Extension*, 24 (1), Pp. 89–110.
- Treinen, S., van der Elstraeten, A., 2018. Gender and ICTs—Mainstreaming gender in the use of information and communication technologies (ICTs) for agriculture and rural development. FAO.
- Williams, E.E., Agbo, M.I.S., 2013. Evaluation of the Use of Ict in Agricultural Technology Delivery to Farmers in Ebonyi State, Nigeria. *Evaluation*, 3 (10).

