International Journal of Engineering & Technology, 7 (4.43) (2018) 1-5

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Short communication



Evaluation on Accessibility and Usage of Information and Communication Technology (ICT): Insights from Smallholders in Johor, Malaysia

Nadzifah Yaakub[1], Amirul Arif Bin Ab Aziz[2], Fazleen Abdul Fatah[3]*

[1]Faculty of Bioresources and Food Industry, Universiti Sultan Zainal Abidin, Besut Campus 22000 Besut, Terengganu.Malaysia.
[2,3]Faculty of Plantation and Agrotechnology, Universiti Teknologi MARA,Jasin Campus, Kampung Seri Mendapat, 77300 Merlimau, Melaka, Malaysia.
[3]Centre of Graduate Studies, Faculty of Plantation and Agrotechnology, Universiti Teknologi MARA, 40460 Shah Alam, Selangor. Malaysia.
**Corresponding author E-mail: fazleen5201@salam.uitm.edu.my*

Abstract

In today's age of modernization, Information and Communication Technology (ICT) has played a very important role in the development of agriculture sector. This technology has brought a significant change in agricultural development where farmers can directly communicate with traders, government, buyers, and producers. However, due to lack of knowledge and information, farmers are not getting the benefits from these technologies. To understand this, a study was conducted to find out the level of accessibility of ICTs among smallholder farmers. To further understand this issue, the study aims to determine the determinants or critical factors that influence the level of ICT accessibility among oil palm smallholders. A random sampling technique was used to select a total of 85 smallholders in the study area while an administered structured interview schedule on the selected respondents were used for data collection. Frequency counts, percentages and a multiple regression analysis were used in the data analysis. Results revealed that majority of the respondents were males (96.5%), a high percentage (71.8%) chose to use personal computer as their ICT tools while 24% used mobile phone to get access or gain more agricultural and inputs information. The paper concluded that network factor and socio-economics such as age and educational level were the most significant factors that influenced the accessibility of ICTs among oil palm smallholders in Johor, West Malaysia.

Keywords: *Information and Communication Technology (ICT), smallholders, network factor, mobile phone, usage.*

1. Introduction

To date, the information and communication technology or ICTs has played an important role in promoting agriculture based knowledge among smallholders. Many developing Asian countries have promoted ICTs development over the past five decades to achieve broad objectives of economic growth, agricultural development, employment, wages, and education to enhance overall socio-economic welfare [1]. ICTs farming can contribute significantly at the household level in terms of income for smallholders' farmer. Disseminating the adequate information to the farmers can improve the production capacity in their farming area. It is also imperative for farmers in the agricultural sector to take decisive steps to embrace ICTs as they promote higher productivity and access to markets and sustainable economic growth.

In addition, the ICTs have proved to be the new approaches for communicating and sharing the information which help to improve the knowledge and skills of individual farmers [2]. ICTs represent the formation of knowledge for farmers in developing world by helping them sharing the knowledge and information regarding the market prices, agronomic practices and post-harvest in a right manner at the right time. More importantly, ICT tools such as mobile phone, television, internet and radio have potential to disseminate the agricultural information among smallholder farmers in order to make decisions by using resources in the most productive and profitable way [3].

Similarly, these kinds of technologies do not only provide information on weather, prices, and profitable income, research have also showed that ICT may increase farmers' production information and knowledge [4]. The use of ICT in agricultural sector particularly among smallholders is very important since these farmers produce about 80 percent of the developing world's food. Therefore, it is a necessity of such technologies to increase farmers' productivity in agriculture [5].

It is commonly noted that agriculture is one of the most important sectors and could benefit tremendously with the applications of ICT especially in bringing changes to socioeconomic conditions of poor agricultural areas. Nowadays farmers have to deal with failed crops frequently due to limited communication facilities which hinder them to gain accurate information at the right time. In the agricultural sector, some farmers mostly stick on tradition and traditional agricultural method since most of them are illiterate or some are lacking of awareness of technology and its changes [6]. Since relevant and timely information is critical in agriculture, ICTs are seen as a partial solution to rapidly convey information and enable farmers to obtain up-to-date knowledge in agricultural technologies.

Most of the developing countries such as African and Asian countries are using different technologies and other sources for the

Copyright © 2018 Authors. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

growth of agriculture and economic development. However, it was reported that most of farmers are not getting benefits from ICT technologies due to lack of knowledge and information about these technologies in their agricultural communities or areas [2]. Additionally, farmers could not directly communicate with buyers and traders for selling their production in good prices and track that information as well as record expenditure on farm chemicals and inputs from other sellers [2]. Moreover, lack of encouragement of the local communities and social institutions are among the reasons for the smallholders to hardly adopt ICT technologies since most of the stakeholders or agricultural extensions are not well aware and not appropriately encouraged to the adequacy of the ICT in innovation delivery to be effective [7]. Since agricultural development is dependent to an immense extent on information flows and exchange among all actors in the agricultural chain, this may therefore lead to the question on how ICTs help to contribute smallholders' livelihoods in order to enhance better information exchange and access. In this regard, this study will therefore bridge the information gap by analyzing the impact of ICTs among the oil palm smallholders in Malaysia. To the best of our knowledge, so far there is no survey data based on the impact of ICT on oil palm smallholders probably due to the lack of reliable data on outcome variables, as well as variations across users and non-users in observable and unobservable factors.

2. Literature Review

ICTs are utilized for the widespread of knowledge transfer and sharing of data. ICTs can be utilized to empower, reinforce or replace existing data frameworks and systems. ICTs may disseminate modern and existing farming information and knowledge which is communicated within the agricultural sector since data is used for facilitating agricultural and rural improvement and bringing about social and economic changes [8].

2.1. Accessibility of ICTs

Studies indicated that mobile phones, radio and television are the main tools of communication which can be accessed by farmers for agricultural related information and knowledge [9]. In particular, phone tools (including mobile phones) has been instrumental in extending the opportunity of getting access to the individuals who lived in rural areas [10]. Other study also reported that 86 per cent of the farmers had access to a mobile phone that contributed for creating farmer's relationship with other individuals including extension specialists [11]. The other significant software that promote modern ICT is also the World Wide Web or the Internet that empowers individuals to get access to information [9].

2.2. Availability of ICTs

Mobile phones have already been reported to be largely useful in connection with farmers [12]. According to Ansari and Pandey [13], almost 83.34 % of the farmers in Uttarakhand, India had been using mobile phones to access agricultural information. In addition, almost 98.3 % of farmers in Punjab, India used mobile phones. This indicates a growing concern on the increased perception of ICTs among agricultural populations and hence if correctly used it can provide vast opportunities for changes in rural areas [14].

2.3. Usage of ICTs

The utilization of mobile phones is significant despite of the incompletely improved rural electricity. Mobile telecommunications have determined multi-dimensional benefits to the rural people. Its importance in usage is obvious in a sense of importance and emergency [15]. For example, farmers also reported to utilize ICTs to monitor commodities exchange information, to see where goods might be sold and revealed various market performance or which commodity prices are profitable in buying the produce [16]. This can be translated that mobile phones are increasingly used in daily life and therefore relevant in the lives of the people to further contribute to agricultural development and improved communication. Computer and internet have been also seen to be increasingy used for agricultural knowledge and dissemination [17].

2.4. Constraints of ICTs Adoption

Research has also discovered that incompatible power supply and poor network connectivity are the main constraints for utilization of ICTs among farmers [18]. Poor electrification in villages has been a common issue that has defined scene in different aspects of life. In fact, low level of electricity broadcasting has also been found to inhibit the growth of ICT services to rural areas [19]. Lack of confidence in using ICTs by many farmers has also one of the factors that lead to a lower adoption of ICTs. In addition, farmers may also have lower perception and knowledge on opportunities and benefits of ICTs for agriculture and rural improvement purposes. Other issues including lack of practical exposure, long distance to manage, poor ICT tools service and high maintenance of hardware and operating system [20].

2.5. Availability of Mobile Phone

A study in rural Maharashtra revealed various successful e-governance initiatives and implementation of ICTs that have enhanced standards of livings of the farmers [21]. It has been said that ICT has helped farmers in rural areas by supplying necessary information on modern agriculture. Mobile phones are among the ICT tools that are becoming more demand-driven that helps farmers to interactively engage in two-ways communication and exchange information among them. The acquisition of knowledge has enabled many farmers to reduce an asymmetry in information flows among farmers, buyers and extension services. It has connected rural people by enabling them to request information that could hardly accessible previously without accessibility of ICTs.

2.6. Development of ICT in Agriculture

In most of developing countries, ICTs have played important roles in agricultural development. Often, communities started to use ICTs and technologies to obtain information in order to solve the problem and issues in their farming areas [22]. Other important tools including internet, radio, personal computer and television have positive impacts on information accessibility and communication.

Ogutu et al. [23] revealed that cooperation in the ICT-based venture has a positive and critical impact on the use of acquired seed, fertilizer, work profitability and land efficiency in Kenya. This venture provides opportunities for the extension of the scope of ICT-based in rural areas, because of their ability to upgrade smallholder ranchers' investment in agricultural information markets, while enhancing their work and land profitability. Besides that, the studies conclude that projects that go for improving food security and farm incomes ought to consider both the advancement of yield by expanding rural innovations and additionally utilization of ICT tools to get accurate data on necessary inputs to enhance productivity.

Other study indicated that utilization of ICTs brought about most higher advantages to the producer and avoid them from third parties. ICTs were utilized for upgrading both research discoveries among the partners which guaranteed ideal coordination amongst research and augmentation for the welfare of agriculturists. African nations uncovered that ICTs assumed a critical part in improving agricultural production, in spite of cell phones had unimportant effect while phone main lines a noteworthy supporter of agriculture development [16]. The outcomes additionally proposed that specific financial attributes, for example, advanced education

levels and abilities are essentials for successful changes in agricultural production because of the appropriation and usage of new advances. web, cell phones, radio and TV were the most vital tools of communication that provide learning and data to agriculturist about farming [24].

2.7. Adoption and Diffusion of Technology

Technologies present as important part in economic development. Adoption and diffusion of innovation are two inspired concepts defining the choice to utilize or not utilize and the distribute of given innovation among agricultural sector past a period of time. Adoption of a few development is not a one-step manage as it taken time for adoption to execute. First time adopters may continue or refrain to utilize the brand new innovation. Hence, good enough understanding of the process of innovation adoption and its dissemination is key for planning successful agricultural research and extension programs.

Adoption and diffusion are separated but have similar concepts. Adoption frequently refers to the option to utilize a brand new innovation or practice by economic units on a usual basis. Diffusion frequently refers to spatial and temporary disperse of the brand new innovation among distinctive economic units. Ali et al. [24] formed a clarification between adoption and diffusion. He defined diffusion as the process by which innovation is communicated through various channels over time among the individuals of social structure. This explanation recognizes the following four components: (1) the innovation which speaks to the up to date idea, practice or question being diffuse, (2) communication channel that speak to the way information regarding the brand new innovation streams from change agents (expansion, innovation providers) to last clients or adopters (e.g., farmers), (3) the time duration over which a social structure embraces an innovation, and (4) the social structure. [25] at that point defined option as utilize or non-use of a brand new innovation by a farmer at a given duration of time. This explanation can be amplified to all economic units in the social structure.

Feder et al. [26] identified person adoption (farm level) starting with total adoption. Individual (farm level) appropriation was represented as the level of utilize of a brand new innovation in a long term balance when the farmer has entire information regarding the brand new innovation and its ability. Total adoption (diffusion) was represented as they prepare of disperse of an innovation in a region. This explanation infers which total adoption is standardized by the total level of utilize of a given innovation within a given topographical area.

3. Methodology

This study was conducted in oil palm plantations at Felcra Berhad Kawasan Sri Wangi, Seri Medan, 83400, Batu Pahat, Johor. 85 respondents were randomly selected through criterion sampling due to the existence of smallholders and better coverage of ICT initiatives as compared to other oil palm areas in other states, districts or village in Johor.

An administered questionnaire was used in this study during the survey and interviews with the farmers. The first section of the questionnaires includes demographic variables such as gender, educational level, location, ethnicity, race, and family size. The others sections cover accessibility of ICT and knowledge of ICT, usage of ICT and network factors.

3.1. Data collection and analysis of data

Data analysis included percentages and frequency counts for each socio demographics variables. While a multiple regression analysis was used to determine significant factors that influence accessibility of ICTs among smallholders. The indicators used in measuring the independent variables were ICT tools accessed, frequency of usage and purpose of usage based, network factors and demographic variables towards measuring the accessibility of ICTs as a dependent variable.

Statistical tools such as descriptive statistics including frequency, percentage and Likert scale were used for each socio demographics variables. For the purpose of analyzing data, Statistical Package of Social Sciences (SPSS) was been utilized in this study.

3.2. Regression Analysis

In order to identify the factors that impact the accessibility of ICTs, multiple regression analysis will be used in this study.

$$Y= a +b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + \varepsilon \quad (1)$$

where;

Y = accessibility is a binary variable (1= user, 0=non-user)

A = constant

B_1- B_6 = coefficients to be estimated

X_1 = Usage of ICTs

X_2 = Age (Years)

X_3 = Education (Years of schooling)

X_4 = Gender (Male/Female)

X_5 = Annual Income (Rm)

X_6 = Network Factor

ε = Error term

Further explanation of operational definition for dependent and independent variables:

1. Accessibility of ICTs is defined as the degree to which a respondent is able to use ICTs. It is a binary variable of 1 and 0 that corresponds to the respondents who will be accessing ICTs and not accessing ICTs respectively.
2. Usage of ICTs is defined as the degree of frequency and purpose of use of ICTs in agriculture by respondents. Four types of frequency usage are used in this study which are defined as 'very frequently' that refers the usage of ICTs 'hourly' and 'daily,'. Frequently is interpreted as 'three times a week' and 'once a week', while occasionally means 'once a month', and finally rarely is interpreted as 'once in three months' and 'never' in which means not using ICTs at all.
3. Independent variables in this study include socio-demographics such as age, education, gender and annual income.
4. Other network factors such as the barriers or constraints that hinder farmers to adopt ICTs will also be analyzed in this study including the electricity, cost of repair, network connectivity, software and others.

4. Results and Discussion

Reliability analysis test was used to figure out the strength of true measurement across element and all these elements within the instruments properly without any bias. Reliability test also was used to observe if the questions created satisfy and strong with the study that being conducted or not [27]. The Cronbach's Alpha of 0.808 showed that the data was considered to be strongly acceptable and the instruments are reliable to be utilized in this study.

Table 1 shows the descriptive data that concerning the socio-demographics for each respondent which has been summarized into frequency and percentage. About 96.5 percent were male while only 3.5 percent were female. The result revealed that the mean age range of the respondents was between 36 to 40 years old. Majority (96.5 %) of the respondents were males while only 3.5 % were female. Out of 85 smallholders, a high percentage (77.60 %) were married and the income range of the sampled farmers was between RM2000- RM2500.

Table 1: Information on distribution of socio-demographic variables (N= 85).

Variables	Categories	Frequency	Percentage
Age	26 - 30 years	20	23.5
	31 - 35 years	19	22.4
	36 - 40 years	21	24.7
	41 - 45 years	14	16.5
	46 years and above	11	12.9
Gender	Male	82	96.5
	Female	3	3.5
Marital Status	Single	19	22.4
	Married	66	77.6
Education	High School	55	64.7
	University	30	35.3
Income (RM)	2000-2500	44	51.8
	2500-3000	25	29.4
	3000-3500	16	18.8
Types of ICT	Personal Computer	23	27.1
	Mobile Phone	61	71.8
	Radio	1	1.2

Source: Own Survey, 2018

The major types of ICTs used by the smallholders include mobile phone (71.8 %) followed by personal computer (27.1 %) and radio (1.2 %) The farmers reported the benefits of mobile phone usage as to include contacting local buyers for their output easier, getting access to marketing information and current prices and reduced transactional cost.

Table 2 shows that the outcomes of model summary of the multiple linear regression model analysis between dependent variable and independent variables in this study. R^2 indicated about 59 % of the variation in the accessibility of ICT among oil palm smallholders was clarified by usage of ICT, network factors and socio-economic factor.

Table 2: Estimated result using a multiple regression analysis.

Variables	Coefficient	Std. Error	t-ratio
Constant	0.149	1.09	0.137
Usage of ICT	0.356	0.227	1.569
Network Factor	0.478***	0.174	2.742
Age	-0.013**	0.006	-2.389
Gender	0.094	0.13	0.72
Education	0.29***	0.079	3.669
Income	0.054	0.044	1.232

Dependent variable: Accessibility of ICT
****Significant at the 1% level, ** Significant at the 5% level*
Source: Own estimation

The coefficient of network factor (β = 0.478, t-value = 2.742) indicated that the variable has a strong and significant relationship with accessibility of ICTs. Higher connectivity to the internet and computers as well mobile phones plays increasingly significant role in ensuring effective accessibility of ICTs among smallholders.

Education variable also shows a positive and strong relationship with accessibility of ICTs at 1 percent level. This was evident as majority of young smallholders who obtained higher level of education or university degree were found to have more degree of accessibility of ICTs. Educated farmers tend to use ICT tools to access information regarding the agricultural good practices, agricultural price information and other important and relevant information regarding their farming activities. This is consistent with previous literature that education brings modern agricultural production know-how and technologies including improved seed varieties and agro-climatic information for farmers to adopt which subsequently provides an encouraging mental attitude for the acceptance of new practices and technology [28].

With regard to age, aging farmers are found to have lesser degree of accessibility of ICTs when compared to younger farmers who possess higher educational qualification level. This indicates that the usage and accessibility of ICTs is heavily drawn on younger generation that may easily adopt on-farm technologies. At their golden age, farmers may not be able to fully understand the new technologies as compared to their accumulated years of practices of economic activities and experiences in farming through observations and experimentations on the field. Additionally, elder famers may require longer time to realize the benefits of ICTs, in which case, they will not be expected to use complicated ICT tools or software.

To this end, the results implied that these three variables are important factors in determining the accessibility of ICTs among the farmers. However, other variables including usage, gender and annual income had no significant relationship with the accessibility of ICTs among smallholders.

5. Conclusion

As a conclusion, this study confirmed that there were significant relationships between network factor, education background, and age of respondent towards to the accessibility of ICT among oil palm smallholders. Farmers in the study area knew about ICTS and utilized them to obtain useful agricultural information.

The network variable has become one of the major factors that affect the accessibility of ICT among oil palm smallholders. Therefore, it is recommended that stable and strong network is provided to ensure all farmers can access information in improving their farming practices. Majority of the smallholders in Johor area used mobile phones and personal computers to gain information and get access to the markets. The utilization of this technology is therefore very reliant on supporting network, which means each agricultural area needs to consider about network factors to facilitate farmers to use ICT tools in their daily lives. The maintenance of network also needs to be considered in order to avoid difficulties in using ICT tools among smallholders to gain information about agriculture.

Our finding also implies that the higher the level of education of respondents, the higher their level of access to ICTs. It is noted that new technology cannot be adopted without sufficient and skilled workforce who should be equipped with knowledge and education. Higher education allows workers to adopt diffusion of technologies and drives development and hence getting greater access towards ICTs. This implies that education and knowledge should not only expand to primary education but also secondary and tertiary education in order to enhance agricultural development.

Lastly, the results indicate that the older farmer has lower accessibility of ICTs. Hence, this factor shows that some of the older farmers do not fully understand the use of ICT tools in obtaining more information and they have less interest in using ICTs due to technical difficulty. In order to avoid the isolation of older farmers of the benefits of ICTs, they need to be integrated and informed market knowledge and usage through extension visits and hands-on practical.

References

[1] Nandeesha. (2014) Impact of Information and Communication Technology on Agricultural Sector In Karnataka: A Study on Raitha Samparka. *International Journal of Advanced Research in Management and Social Sciences* 3(7), 151-160.

[2] Chhachhar, A. R., Qureshi, B., Khushk, G. M. & Ahmed, S. (2014) Impact of Information and Communication Technologies in Agriculture Development. *Journal of Basic and Applied Scientific Research* 4(1), 281–288.

[3] Ekbia, H. R. & Evans, T. P. (2009) Regimes of information: Land use, management, and policy. *The Information Society* 25(5), 328-343.

[4] Chapman, R. & T. Slaymaker. (2002) *ICTs and Rural Development: Review of the Literature, Current Interventions, and Opportunities for Action*. ODI Working Paper 192. London: Overseas Development Institute.

[5] Ogbeide, O. A. & Ideba, E. (2015) Smallholder Farmers and Mobile Phone Technology in Sub-Sahara Agriculture. *Mayfair Journal of Information and Technology Management in Agriculture* 1(1), 1–19.
[6] Eamin Ali Akanda1, AKM. & Md. Roknuzzaman. (2012) Agricultural Information Literacy of Farmers in the Northern Region of Bangladesh. *Information and Knowledge Management* 2(6), 1-11.
[7] Williams, E. E. & Agbo, I.S. (2013) Evaluation of the Use of ICT in Agricultural Technology Delivery to Farmers in Ebonyi State, Nigeria. *Journal of Information Engineering and Applications* 3(10),18-26.
[8] Oladele. (2015) Effect of Information Communication Technology (ICT) on agricultural information access among extension officers in North West Province South Africa. *South African Journal of Agricultural Extension* 40(2), 30-41.
[9] Syiem, R. & Raj, S. (2015) Access and Usage of ICTSs for Agriculture and Rural Development by the tribal farmers in Meghalaya State of North-East India, *Journal of Agricultural Informatics* 6(3), 24-41.
[10] Gupta, B., Dasgupta, S. & Gupta, A. (2008). Adoption of ICT in a government organization in a developing country: An empirical study. *Journal of Strategic Information Systems* 17(2), 140–154.
[11] Ferris, S., Robbins, P., Best, R., Seville, D., Buxton, A., Shriver, J. & Wei, E. (2014) Linking Smallholder Farmers to Markets and the Implications for Extension and Advisory Services. *Good Practices and Best Fit Approaches in Extension and Advisory Service Provision*, MEAS Discussion Paper 4.
[12] Okello, J. J., Kirui, O. K., Gitonga, Z. M., Njiraini, G. W. & Nzuma, J. M. (2014) Determinants of Awareness and Use ICT-based Market Information Services in Developing-Country Agriculture : The Case of Smallholder Farmers in Kenya. *Quarterly Journal of International Agriculture* 53(3), 263–282.
[13] Ansari, M.A. & Pandey, N. (2011) Assessing the potential and use of mobile phones by the farmers in Uttarakhand (India): A special project report. G.B. Pant University of Agriculture and Technology, Pantnagar, India.
[14] Sharma, M., Kaur, G. & Gill, M. S. (2012) Use of Information and Communication Technology in Agriculture by Farmers of District Kapurthala. *Journal of Krishi Vigyan*, 83-89.
[15] Sife, A. S., Kiondo, E. & Lyimo-Macha, J. G. (2010) Contribution of Mobile Phones to Rural Livelihoods and Poverty Reduction in Morogoro Region, Tanzania. *The Electronic Journal of Information Systems in Developing Countries* 42(1), 1–15.
[16] Oyeyinka, R. A. & Bello, R. O. (2013) Farmers Use of ICTs for Marketing Information Outlets in Oyo State, Nigeria. *Journal of Agricultural Science*, *5*(11).
[17] Mtega, W. P., & Msungu, A. C. (2013) Using information and communication technologies for enhancing the accessibility of agricultural information for improved agricultural production in tanzania. *Electronic Journal of Information Systems in Developing Countries*, 56(1), 150-158.
[18] Qiang, C. Z., Kuek, S. C., Dymond, A. & Esselaar, S. (2011) Mobile Applications for Agriculture and Rural Development. *World Bank*, (December), 1–120.
[19] United Nations Development Program. (2012). *Promoting ICT based agricultural knowledge management*. *Increasing Agricultural Productivity and Enhancing Food Security in Africa : New Challenges and Opportunities*.UNDP Ethiopia No. 3/2012. http://www.ictet.org/downloads/Pro_tSjnt9_q0e6.pdf
[20] Ajani, E. N. & Agwu, A. E. (2012) Information Communication Technology Needs of Small-Scale Farmers in Anambra State, Nigeria. *Journal of Agricultural and Food Information* 13(2), 144–156.
[21] Jayade, K. G. & Khot, P. G. (2014) Impact of Ict and Mobile Technology in Agriculture. *International Journal of Emerging Technologies in Computational and Applied Sciences (IJETCAS)*, 428–432.
[22] Addul Razaque, C.,Barkatullah, Q.i, Ghulam, M.K. & Shaki,l A. (2014) Impact of Information and Communication Technologies in Agriculture Development. *Journal of Basic and Applied Scientific Re*search 4(1), 281-288.
[23] Ogutu, S. O., Okello, J. J. & Otieno, D. J. (2013) Impact of Information and Communication Technology- based Market Information Services on Smallholder Farm Input Use and Productivity: The Ca se of Kenya. *World Development* 64, 311-321. 22–25.
[24] Ali, S., Dean, A., Jabeen, U. A. & Nikhitha, M. (2016) Impact of ICTs on Agricultural Productivity. *European Journal of Business, Economics and Accountancy* 4(5), 82–92.
[25] Rogers, E. M. (2003). Diffusion of innovations (5th ed.). New York: Free Press.
[26] Feder, G., Just, R. & Zilberman, D. (1985) Adoption of agricultural innovations in developing countries: a survey. *Economic Development and Cultural Change* 33 (2), 255–298.
[27] Gozali, L., Masrom, M., Haron, H. N. & Zagloel, Y. M. (2018) A Framework Toward Successful Business Incubator For Indonesian Public Universities : A Pilot Review, (May).
[28] Akudugu, M. A., Guo, E. & Dadzie S. K. (2012) Adoption of modern agricultural production technologies by farm households in Ghana: What factors influence their decisions?. *Journal of Biology, Agriculture and Healthcare* 2(3), 1-13.