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PERCEIVED EFFECTS OF THE USAGE OF E-AGRICULTURE INFORMATION SOURCES BY THE CEREAL CROP FARMERS IN THEIR CEREAL CROP FARMING IN BORNO AND KEBBI STATE, NIGERIA

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ABSRACT

The study examined the perceived effects of the usage of e-agriculture information sources by the cereal crop farmers in Borno and Kebbi state, Nigeria. The specific objectives of the study are to; investigate the sources of information of e- agriculture and their extent of usage, and to evaluate the perceived effects of e-agriculture usage by the cereal crop farmers in the study area. Three (3) stage sampling procedure were used for the sampling. Data were collected using structured questionnaires. Simple descriptive statistics along with Likert scale of measurement were used to summarize the data collected. The result of the simple descriptive statistics revealed that, about 90% of the cereal crop farmers were using e-agriculture information sources. The likert scale result on extent of usage revealed that, mobile phone which is ranked 1st in extent of usage with the mean score of 2.70 is highly in used by the cereal crop famers, along with radio which is ranked 2nd in extent of usage with the mean score of 2.64. The result on perceived effects disclosed that, mobile phone is ranked 1st as the most significant e-agriculture tool used by the cereal crop farmers. Conclusively, the most used e-agriculture information sources were obviously mobile phone, radio and other farmers (friends). Therefore, cereal crop farmers are encouraged to explore the use of other sources of e-agriculture information, as this will help them gain new knowledge that may help enhance their productivity.

Keyword: *Perceived Effects, Usage, E-agriculture Information Sources, Cereal Crop, Farmers, Borno, Kebbi, Nigeria*

INTRODUCTION

E-Agriculture involves designing, developing and applying innovative ways to use Information and Communication Technologies (ICTs), including digital technologies in the rural domain with a primary focus on agriculture, these include fisheries, forestry and livestock. The aim is to boost agricultural and rural development by improving access to valuable information that can help people whose livelihoods depends on agriculture to make the best possible decisions and use the resources available in the most productive and sustainable manner(Abdulkareem, 2016). World Society Information Summit(WSIS, 2015) refers to E-agriculture as an area of application of information and communication technologies (ICTs) under Action line C7 (E-government). World Society Information Summit was attached with the responsibility of organizing activities related to the E-agriculture Action line. The E-agriculture community of practice was launched in 2007 together with the funding partners. According to Hassan (2009), the E-agriculture community is a global initiative to enhance sustainable agricultural development and food security by enhancing the use of ICT in the sector. The E-agriculture community of practice facilitated by FAO Acts as a catalyst for networking and knowledge sharing on the role of sustainable agriculture and rural development. It provides an international framework to facilitate the process of capturing, managing and disseminating the lesson learned as well as the result and the applications of multilateral process related to the use of E-agriculture and rural development. The overall aim of the community using E-agriculture is to enable farmers to exchange knowledge related to agriculture, and to ensure that the knowledge created is effectively shared and used worldwide (FAO, 2017).

E-Agriculture Information Sources

According to FAO (2007), the definition of E-agriculture, extends beyond the E-government aspect of agriculture, since it includes not only agricultural services provided by governments to citizens, for example, farmers, rural communities, via ICTs, but encompasses a whole range of product services and infrastructure provided by government, the private sector, public research and extension, NGOs and farmers, organizations. ICTs that can be harnessed for E-agriculture may include devices, networks services and applications. These can range from cutting edge internet-based technologies and sensing tools to other technologies that have been around for much longer, such as radio, telephones, mobile phones, television and satellites (Lohento*et al*., 2013).Fernado (2016)

stressed that, public private partnerships should seek to maximize the use of E-agriculture as an instrument to improve production both in quantity and quality. Hand held personal computers are small, light, and robust and have been used for providing access to information, mobile mapping and other data gathering activities.

E-agriculture offers strong potentials for driving economic growth, raising incomes and improving livelihoods among rural communities through increased efficiency of agricultural production and value chain development (Sheikh *et al*., 2016). E-agriculture creates opportunities to address some of agriculture's most pressing challenges using ICT-driven solutions to tackle problems as varied as climate change, pests and diseases and poor market access. The cross-sectional nature of E-agriculture propels growth in other sectors (Fredrick *et al*., 2016). A unique ICT-based platform can serve several sectors such as agriculture, health and transportation by offering information to consumers on products and quality by ensuring timely transportation of products to market and by empowering farmers through stronger linkages through small-scale producers and markets (Thia *et al.*, 2016). FAO (2017) identified the sources of E-agriculture information to include;

1) Telephone; for interactive voice response,
2) Mobile phone; for advisory sales, banking and networking,
3) Computer and website; for agricultural information and markets,
4) Internet and broadband; for knowledge sharing, social media, E-community, banking, market platform, trading among others,
5) Broadcasting; for expertise sharing, advisory community,
6) Sensor networks; for real time information, better data quantity and quality, and decision making,
7) Satellite for weather universal accessibility remote sensing,
8) Data storage and analytics; for precision agriculture actionable knowledge,
9) Geographical Information System (GIS),
10) Handheld Personal Computer,
11) Global Positioning System (GPS),
12) Television,
13) News Papers,
14) Extension Agents,
15) Short Messages Service (SMS),
16) Interactive Voice Response (IVR) and
17) Smartphone apps with Integration with special media.

Food and Agricultural Organization and International Telecommunication Union (FAO and ITU, 2017) reported that, E-agriculture also plays the following role in agricultural production system.

These roles include;

i. Regulatory frameworks: E-agriculture helps in assisting with implementing regulatory policies, frameworks and ways to monitor progress.
ii. Capacity development and empowerment: E-agriculture widens the reach of local communities, including women, youth and elders, and provide newer business opportunities and thereby enhancing livelihoods.
iii. Financial services and insurance: E-agriculture increases access to financial services for rural communities helping to secure savings, find affordable insurances and tools to better manage risks.
iv. Food safety and traceability: E-agriculture help deliver more efficient and reliable data to comply with international traceability standards and food nutrition aspects.
v. Agricultural innovation systems: E-agriculture bridge the gap between agricultural researcher, academia, extension agents, various market players and farmers.
vi. Sustainable farming: E-agriculture offers improved access and knowledge to sustainable farming practices, plant protection and animal health or climate smart solutions.
vii. Disaster risk management and early warning systems: E-agriculture provides actionable information to communities and government on disaster prevention, in real time, such as agro-metro information, while also providing advice on risk-mitigation.
Viii. Enhanced market access: E-agriculture facilitates market access for inputs and products as well as trade.

E-agriculture as an emerging field in the intersection of agricultural informatics, agricultural development and entrepreneurship, referring to agricultural services, technology dissemination and information delivered or enhanced through the internet and related technologies. The E-agriculture concept, however, moves even beyond technology to the combination of knowledge and culture, which is primarily focusing on the improvement of communication and the process of learning among the different stakeholders of agricultural sector who are engaging at the

different levels (FAO and ITU, 2017).The use of ICTs such as mobile phones and internet has increased significantly since the creation of the E-agriculture community. It is estimated that there are 608 billion mobile connections for a world population of a little over 7 billion (Alemu and Negash, 2015).According to Alemu and Negash (2015), the cellular phone has provided market links for farmers and entrepreneurs. Growth in mobile phones has been explosive and now reaches more than a third of the population. This has reduced transaction costs, broadened trade networks and facilitated searches for employment. Bertolini (2009) observed that, the telephone is the only E-agriculture used (if any) by the majority of farmers in Africa. Some of the respondents according to Bertolini in the study considered the cellular phone applications such as the SMS to be one of the most important E-agriculture applications. According to Mahanan(2016), Radio is an important mechanism for disseminating knowledge and information in different languages and formats, especially to poor people. In Zambia, the Radio Farm Forum (RFF), a government initiative has shown that radio is important in addressing the common needs and problems of resource-deficient rural farmers by giving them an opportunity to listen to a radio discussion programme on agricultural problems and techniques.FAO (2014) stated that, internet, E-mail, websites and web-based applications are becoming increasingly important in sharing and in disseminating agricultural information and there are many ongoing web-based application initiatives worldwide. There is model flow of information from various sources, such as the farmers, the agricultural research institutes, meteorological stations and agricultural extension officers. The knowledge from these sources is brought together in the Knowledge Base (KB). This is then processed by the inference engine with some of the algorithms and the system can perform various actions. Small scale farmers can then interact with the system through Short-Message-Service (SMS) and the farmer can also obtain information through mass media (Lwande and Lawrence, 2008).

Concept of Cereal Crop

Africa with its vast land area covering 3 billion ha has 1.3 billion ha of agricultural land out of which only 252 million ha (19.36%) is for arable crops (FAO, 2011). Africa is the Centre of origin and also a major producer of several cereal like sorghum, pearl millet, finger millet, teff and African rice. Another major cereal is maize, has over taken these traditional cereals, while wheat is widely cultivated in the northern Africa

and in Sudan and Ethiopia. Agriculture is the engine for growth in Africa with subsistence agriculture practiced by the majority of the small holder farmers, yields gaps are high and poor soils, amongst other constraints add to the difficulties for sustainable farming and incomes. Cereals like Sorghum, Millets, Wheat, Maize and Rice are the major staple foods of the most populations. The cereals are grown over an acre of 98.6m ha producing 162m tons (FAOSTAT, 2012).

STATEMENT OF THE RESEARCH PROBLEM

More than 70% of the working adult populations in Nigeria are employed in the agricultural sector directly or indirectly and over 90% of Nigeria agricultural outputs comes from peasant farmers who dwell in the rural areas where 60% of the population lives. The vast majority of these farmers have limited access to information, modern input, and other productive resources, such as access to pesticides, fertilizers, hybrid seeds and irrigation without some form of public sector intervention (Ogunwole *et al*., 2014). The rate of growth of Nigeria's food production is 2.5% per annum in recent years, while food demand has been growing at the rate of 3.5% per annum due to high rate of population growth of 2.83% (Kolawale and Ojo, 2010). The accessibility to E-agricultural tools are still very low, especially among the rural poor of Nigeria as many are currently excluded from this new field of agriculture and opportunities. E-agriculture can bridge the digital gap that separate those with and without access to the internet. Having timely and accurate access to information that is tailored towards specific locations and conditions can be very helpful to farmers to make the most effective use of their resources in often changing circumstances. For example; shifting weather patterns, fluctuating pests and diseases epidemics and alterations in soil conditions. E-agriculture can enable them to tap in to reliable credit sources and profitable markets, and engage with other important services, such as input supply, and linkage to efficient value chain. Exploring the most effective sources for delivering information is an essential part of the E-agriculture approach. With the rapid growth of mobile phone ownership, together with mobile broadband provides an excellent opportunity for developing E-agriculture (Hassan, 2009). In view of the above initiative, the research intend to evaluate the effects of E-agriculture by the cereal crop farmers' in the study area. This is because E-agriculture can provide relevant information to cereal farmers that will help boost their productivity and increase their crop yields, thereby improving the

farmers' livelihood. Hence the research work intends to provide answers to the following research questions:

i. What are the sources of information of E- agriculture and their extent of usage by the cereal crop farmers in the study area?
ii. What are the perceived effects of the usage of E-agriculture by the cereal crop farmers in the study area?

Aim and Objectives of the Study

The aim of this study is to evaluate the effects of E-agriculture by the cereal crop farmers' in their cereal crop farming in Borno and Kebbi States, Nigeria.

The specific objectives of the study are to:

i. investigate the sources of information of E- agriculture and their extent of usage by the cereal crop farmers in the study area, and
ii. evaluate the perceived effects of E-agriculture usage by the cereal crop farmers in the study area.

METHODOLOGY

Sampling Techniques and Sample Size

The study was carried out in Borno and Kebbi states, Nigeria. Three (3) stage sampling procedure were used for the sampling. The first stage involved the purposive selection of five (5) LGAs from Borno State and four (4) LGAs from Kebbi State giving a total number of nine (9) LGA selected from the two states. In a nutshell, the 9 LGAs that the study covered were predominantly engaged in cereal crop farming. The second stage of selection involved the proportionate ten per cent (10%) selection of the sample size of villages for this study, from the sample frame of villages for both states under study. Borno had the total sample size of twenty five (25) villages and Kebbi had the total sample size of nineteen (19) villages, this gave a total of forty four (44) villages both in Borno and Kebbi State. The third stage of the selection involved the selection of the sample size of farmers for the study using Yamane Formula. The sample frame were obtained through the farmers' group in the study area. The sample size was obtained using the Yamane Formula (1997):

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

Where:

n = sample size

N = Population of Study (Sample frame total)
1 = Constant
e = Limit of tolerance error (0.07)

The total sample frame for Borno is 17,564 and the total sample frame for Kebbi is 5,637. The total sample size for farmers for Borno is 203, and the total sample size for kebbi is 197. These are shown on Tables 1 and 2 respectively.

Table 1: **Sampling Distribution of the Study Areas in Borno and Sample Size**

State	LGAs	Sample Frame of Villages (SFV 10%)	Sample Size of Villages (10% of SFV)	Sample frame of Farmers	Sample size of farmers
Borno	Biu	53 (5)	Gwaram	500	6
			Tabra	800	9
			Miringa	1000	12
			Ngrim	420	5
			Nassarawa	950	11
	Hawul	82(8)	Azare	1045	12
			Shaffa	1200	14
			Ngwa	500	6
			Yimirshika	900	10
			Sabon-gari	800	9
			Subwang	150	2
			Hyera	700	8
			Marama	1200	14
	Kwayakusar	50(5)	Gusi	1050	12
			Guwal	1000	12
			Kwayakusar	800	9
			Wandali	700	8
			Dayar	400	5
	Bayo	39(4)	Gaidam	800	9
			Maina Baba	700	8
			TashanItashe	280	3
			Wuyo	150	2
	Shani	26(3)	Pela	334	4
			Walama	900	10
			Kubo	285	3
Total	**5**	**250(25)**	**25**	**17564**	**203**

Figures in parenthesis are the sample size of villages

(10% of sample frame of villages)
Source: Pre- Survey Information (2018)

Table 2: **Sampling Distribution of the Study Areas in Kebbi and Sample Size**

State	LGAs	Sample Frame of Villages (SFV 10%)	Sample Size of Villages (10% SFV)	Sample frame of farmers	Sample size of farmers
Kebbi	Zuru	92(9)	Bedi	1250	44
			Dongo	150	5
			Amanawa	63	2
			Dongo	324	11
			Manga	265	10
			Dabai	350	12
			Senchi	435	15
			Rikoto	260	9
			Isgogo	174	6
	Fakai	28(3)	Mahuta	293	10
			Matseri	250	9
			Janhawa	125	4
	Danko-Wasagu	30(3)	Gwazawa	420	15
			Ranfin-Zuru	370	13
			Yarbuga	270	9
			DirinDaji	183	7
	Sakaba	40(4)			
			Sakaba	246	9
			DankanKambari	120	4
			DirinGari	89	3
Total	**4**	**190(19)**	**(19)**	**5637**	**197**

Figures in parenthesis are the sample size of villages
(10% of sample frame of villages)
Source: Pre- Survey Information (2018)

Method of Data Collection

The data for this study were collected from primary sources, (structured questionnaires) that contains both open and close ended questions and interview was conducted for farmers who cannot read nor write with the help of well-trained enumerators.

Analytical Technique

The analytical technique that was used in this study is simple descriptive statistics (frequency Tables and percentages) which also involved the use

of likert scale of measurement to present the results on objectives i and ii to describe the perceived effects and extent of usage of E-agriculture information sources.

RESULTS AND DISCUSSION

1.Sources of E-agriculture and their extent of usage by the cereal crop farmers

Objective (i) investigated the sources of E-agriculture and their extent of usage by the cereal crop farmers in the study area. The variables discussed here includes; response on the cereal crop farmers' usage of E-agriculture, sources of E-agriculture information and extent of usage of E-agriculture information sources.

Table 3: **Distribution of the cereal crop farmers' responses on the use of E-agriculture**

Responses	Frequency Percentages
Yes	358 89.5
No	42 10.5
Total	400 100

Table 3above presents the cereal crop farmers' responses on the use of E-agriculture information sources. This revealed that, about 90% of the farmers do use E-agriculture information sources and about 11 percent of them do not use the E-agriculture information sources. This findings implies that, the cereal crop farmers uses E-agriculture information sources in their cereal crop farming in the study area.

Table 4: **Distribution of the cereal crop farmers sources of E-agriculture information used**

Sources of e-agriculture	Frequency	Percentages
Telephone	30	7.5
Mobile phone	368	92.0
Computer website	38	9.5
Internet broadband	34	8.5
Radio	354	88.5
Palmtop PC	19	4.8
Television	255	63.8
Newspapers	133	33.3
Extension agents	154	38.5
Short message service (SMS)	127	31.8
Social media	116	29.0
Satellite	80	20.0
Other farmers (friends)	196	49.0

Table 4 present the cereal crop farmers sources of E-agriculture information used in their cereal crop farming in the study area. The study revealed that, mobile phone was high in use by the farmers with 92% of them using it, this is followed by about 89% of them who were using radio as their source of E-agriculture for their cereal crop farming. While only about 5% of the cereal crop farmers were using palmtop PC, and about 8% of the cereal crop farmers were using telephone, about 64% of the cereal crop farmers were using television, about 39% were using extension agents, 33% of them were using newspapers. Similarly, about 32% were using short messages services, while 49% of the cereal crop farmers were contacting other farmers who might be their friends about their farming activities. Twenty percent (20%) of them were using satellite as their sources of E-agriculture, about 10% and about 9% of the cereal crop farmers were using computer website and internet broadband respectively. Twenty nine percent(29%) of the cereal crop farmers were using smartphone/social media as their source of the E-agriculture in their cereal crop farming.

Table 5: **Distribution of the cereal crop farmers' extent of usage of E-agriculture information sources in their cereal crop farming in the study area**

E-agriculture information sources	Extent of Usage					
	Highly used (HU 3)	Fairly used (FU 2)	Not in used (NU 1)	WS	WM	Rank
Telephone	78	14	367	459	1.15	11th
Mobile phone	951	94	36	1081	2.70	1st
Computer website	45	62	354	461	1.15	11th
Internet/broadband	57	50	356	463	1.16	10th
Radio	921	84	51	1056	2.64	2nd
Palmtop PC	27	24	379	430	1.08	12th
Television	465	172	159	796	1.99	4th
Newspapers	138	168	270	576	1.44	7th
Extension agents	285	110	250	645	1.61	5th
Short message services (SMS)	123	182	268	573	1.43	8th
Smartphone /social media	219	118	268	605	1.51	6th
Satellite	147	62	320	529	1.32	9th
Other farmers (friends)	657	22	170	849	2.12	3rd

Table 5 presents the cereal crop farmers' extent of usage of E-agriculture information sources in the study area. Likert scale was used to ascertain the extent of usage of E-agriculture by the cereal crop farmers. Scores were assigned as highly used (3), fairly used (2), and not in use (1). The result presented shows that, mobile phone is ranked 1st in usage by the cereal crop farmers in the study area and it has the mean score of 2.70. This signifies that mobile phone is highly in used because it is easily accessed by the farmers in the study area as compared to other E-agriculture information sources. Radio is ranked 2nd in extent of usage by the cereal crop farmers with the mean score of 2.64. This implies that, radio is also highly in used by the cereal crop farmers and has the capacity of reaching large number of farmers in different location as news travel fast through radio. Also, information about farming are delivered to farmers about new farming practices in diverse languages that suit the understanding of the farmers. Information giving to farmers by other farmers or their friends about new farming practice has help the cereal crop farmers in boosting their productivity, this is evident in this study as it is ranked 3rd and carries the mean score of 2.12, which also signifies that it is highly in used by the cereal crop farmers in the study area. This is considered E-agriculture because, E-agriculture has gone beyond technology to the combination of different culture, knowledge and skills of stakeholders from across the globes. This finding has confirmed that

fact, because other farmers can stand as transmission agents' delivery new innovation to other farmers who are less privilege to have the first class information.

Television is ranked 4th with the mean score of 1.99. This implies that, the extent of usage of television is also high among the farmers. This might be as a result that it combined both audio and visual aspects which the farmers can easily see and understand any demonstration made on new innovation for farmers to learn and adopt the use. The extent of usage of extension agents ranked 5th with the mean score of 1.61, this signifies that the cereal crop farmers still have access to extension agents as their extent of usage is also on the high side. Also the result shows the extent of use of smartphone integrated with social media to rank 6th with the mean score of 1.51. This implies that, social media usage is also on the high side in use by the cereal crop farmers in the study area, this could be as the result of it helping farmers to interact with other people/farmers from other parts of the world to gain access to information on their cereal crop farming. In a similar vein, reported in this study that, newspaper is ranked 7th in the extent of usage of E-agriculture information sources with the mean score of 1.44. This implies that, newspapers were also fairly in use when it comes to disseminating information to farmers about their farming activities. The implication is that, it can only be successfully used by the farmers who are literate, because understanding the content of written words can only be by those who can read and write. Therefore the farmers who cannot read nor write are at the disadvantage of using newspapers. Going by this same finding, the cereal crop farmers has reported that, short message services (SMS) is fairly used by them in their cereal crop farming which is ranked 8th with the mean score of 1.43. This is closely related to the use of newspaper since they both demand reading and understanding the content of the message. This finding is in agreement with that of Lwande and Lawrence (2008), who in their findings revealed that, small scale farmers can interact with the system through short message service (SMS) and the farmer can also obtain information through mass media. Satellite is also indicated to be fairly in used by the cereal crop farmers in the study area, this is ranked 9th with the mean score of 1.32. The usage of satellite is essential, as it help the farmers to gain access to knowledge about farming that comes from other part of the world that might not be possibly accessed without the use of this satellite.

Computer/website and telephones are ranked 11th in the extent of usage by the cereal crop farmers and they both have the mean score of 1.15. This signifies that, the cereal crop farmers were fairly using this medium for information on their cereal crop farming, as it clearly indicated that majority of this farmers were not using computer/website. Similarly, internet/broadband is ranked 10th with the mean score of 1.16, this implies that, this E-agriculture information sources was fairly in used by very few of the cereal crop farmers in the study area, while majority of them were not using it. Palmtop PC is ranked 12th with the mean score of 1.08 is fairly used by few of the cereal crop farmers, while majority of them were not using it. This finding commensurate with that of FAO (2014), who stated that, internet, e-mail, computer/websites and web-based applications are becoming increasingly important in sharing and in disseminating agricultural information worldwide.

2. **Perceived effects of the usage of e-agriculture information sources**

Objective (ii) present the perceived effects of the usage of E-agriculture information sources by the cereal crop farmers in the study area.

Table 6: Distribution of the cereal crop farmers perceived effects of their usage of E- agriculture information sources in their cereal crop farming in the study area

E-agriculture info. Sources	Significant (S 3)	Undecided (UD 2)	Not signif. (NS 1)	Wted score (WM)	Wted mean (WM)	Rank
Telephone	105	220	255	580	1.45	12th
Mobile phone	1080	58	11	1149	2.87	1st
Computer/website	174	358	163	695	1.73	10th
Internet /broadband	159	380	157	696	1.74	9th
Radio	957	122	20	1099	2. 74	2nd
Satellite	204	506	79	789	1.97	8th
Palmtop PC	72	482	135	689	1.72	11th
Television	678	192	78	948	2.37	4th
Newspaper	465	240	125	830	2.07	5th
Extension agents	507	174	144	825	2.06	6th
Short messages service	432	234	139	805	2.01	7th
Smart phone/social media	423	294	112	829	2.07	5th
Other farmers (friends)	645	324	23	992	2.48	3rd

Likert scale of 3 ordinate for measurement was used to categorized the perceived effects of the usage of E-agriculture information sources as significant (S 3), undecided (UD 2), and not significant (NS 1). The result of the findings shows that, mobile phone has the mean score of 2.87 and

is ranked 1st in the perceived effects of the cereal crop farmers livelihoods status. This implies that, mobile phone have a way of significantly influencing the cereal crop farmers interest to use E-agriculture information in their farming. This result finding is in agreement with that of FAO, (2017), who revealed that, mobile phones are often used for advisory sales, banking and networking. Similarly, this finding depict that of Alemu and Negash(2015), who revealed that, cellular phone has provided market links for farmers and entrepreneurs. According to them, mobile phone has reduced transaction costs, broadened trade network and facilitate searches for employment. In a similar vein, radio which has the mean score of 2.74 and is ranked 2nd in the perceived effects of the usage of E-agriculture information sources by the cereal crop farmers, implies that, the use of radio as E-agriculture information sources have significant effect on the cereal crop farmers livelihood status. This implies that the cereal crop farmers have easy access to radio where they get information faster about their cereal crop farming activities. This study is in agreement with that of Mahanan (2016), who revealed that radio is an important mechanism for disseminating knowledge and information in different languages and formats, especially to the rural poor people.

Friends in this study refers to other farmers who the cereal crop farmers confide in about their farming activities. Some key note farmers are stake holders who are regarded as E-agriculture information sources, who get the agricultural information from other stakeholders with modern technologies that help facilitate the understanding of E-agriculture information to in-cooperate in their cereal crop farming. This has the mean score of 2.48 and is ranked 3rd in the perceived effects of E-agriculture information sources on the livelihood status of the cereal crop farmers. This result findings reflects the definition of E-agriculture as a concept by FAO and ITU (2017), who further defined E-agriculture as a concept that moves even beyond technology to the combination of knowledge and culture, which primarily focuses on the improvement of communication and the process of learning among the different stakeholders of agricultural sector who are engaging at different levels. Television has the mean score of 2.37 and is ranked 4th in the perceived effects of E-agriculture information sources on the cereal crop farmers livelihoods status. This signifies that television is very significant and is highly in used by the cereal crop farmers in the study area. This also might be because through television, practical things are shown about cereal crop farming to farmers to learn and put into use. This finding

support that of Lohento, *et al.*(2013), who stated that E-agriculture can range from cutting edge internet based technology and sensing tools to other technology that have been around for much longer and television is considered one of them.

Identified as one of the E-agriculture information sources is smart phone integrated with social media which has the mean score of 2.07 and is ranked 5th. This findings on smartphone integrated with social media has proved to be very effective in exposing the farmers with current information about agricultural farming especially in cereal crop farming. Farmers in the study area reportedly having gain experiences on spacing of their cereal crops on social media using smartphone. For example. Facebook, instagram, and internet. This work is in agreement with that of FAO (2017), who reported that, the overall aim of E-agriculture using internet is to enable farmers to exchange knowledge related to agriculture, and to ensure that the knowledge created is effectively shared and used worldwide. Reported in this study is extension agents which carries the mean score of 2.06 and is ranked 6th in the perceived effects of E-agriculture on the cereal crop farmers' livelihood. The study revealed that extension agents roles in cereal crop farming in the study area is very significant and are highly in used by the cereal crop farmers, however, significant number of them reported that their perceived effect is not significant and some reported that, they were undecided to use extension agents. Short messages were the integration of the use of mobile phones and smart phones delivery, short messages to farmers about their farming activities. The cereal crop farmers reported using this E-agriculture information medium to obtain information from other farmers and other stakeholders about their cereal crop farming. This revealed to be significant by majority of the farmers.

Satellite has the mean score of 1.97 and is ranked 8th as perceived effects of E-agriculture information sources on the cereal crop farmers livelihood status. Some of the cereal crop farmers have reported that, satellite has been one of their information sources in their cereal crop farming, especially stations that deals with crop production and agricultural activities. Significant number of the cereal crop farmers reported undecided using satellite as one of the sources of their information for their cereal crop farming and very few of the farmers reported not significant to perceived effect of E-agriculture information sources on their cereal crop farming. Internet/broadband has the mean score of 1.74

and is ranked 9th in the perceived effects of E-agriculture on the cereal crop farmers livelihood status in the study area. Broadband connecting boosts agricultural productivity and as broadband or high speed internet use has spread, internet applications requiring high transmission speeds have become an integral part of information in agriculture. Many of the cereal crop farmers requires broadband connections to advertise their produce. Therefore broadband access new market around the world and to grow quality foods to the society especially in the study area. This finding revealed that, majority of the cereal crop farmers' revealed undecided to the perceived effects of the use of internet/broadband on their livelihood status, while others revealed significant to the perceived effect of the use of internet/broadband on their livelihood status, while others revealed not significant. This finding is in close relation with that of FAO and ITU(2017), who unveiled that, E-agriculture is aimed at the intersection of agricultural informatics, agricultural development and entrepreneurship, focusing on agricultural services, technology dissemination and information delivered through the internet. Also evidently, in this study, the cereal crop farmers have identified Newspaper as one of the E-agriculture information sources they use in their cereal crop farming, this has the mean score of 2.07 and is also ranked 5th in the perceived effect of E-agriculture usage by the cereal crop farmers on their livelihood status. This findings implies that, the cereal crop farmers in the study area who read newspapers and farm magazines are more likely to adopt more of all types of improved practices than those who do not. That is the reason why majority of the farmers in this study reported that, the use of newspaper in their cereal crop farming is significant. Now that, the agricultural sector is attracting numerous investors who are elites but have little or no technical knowledge of agricultural production, it is therefore important that, newspapers are adequately used and considered in dissemination of agricultural information as part of E-agriculture information sources. Majority of the cereal crop farmers has reported undecided which has the mean score of 1.72 and is ranked 11th in the perceived effect of the usage of E-agriculture information sources on their livelihood status in the study area. While few of the cereal crop farmers reported that, the perceived effects of the usage of E-agriculture information sources is not significant, and very few of the cereal crop farmers revealed that, the perceived effect is significant. It is drawn from this study that, handheld personal computer is not in much use by the cereal crop farmers in the study area. This might be as a result of unavailability of this devices or as a result of poverty and lack of education

that the farmers were not able to purchase it and use in their cereal crop farming. This result reflects that of Fernado(2016), who reported that, the handheld computer are small, light and robust and have been used for providing access to information, mobile mapping and other data gathering activities. Which means, only well enlightened farmers that can afford the use of this devices.

Computer/website has the mean score of 1.73 and is ranked 10th in the perceived effect of the usage of E-agriculture information sources on cereal crop farmers livelihood status in the study area. Majority of the cereal crop farmers reported undecided to the perceived effect of the use of E-agriculture information sources and few revealed not significant and significant respectively to the perceived effects of the usage of E-agricultural information sources on the cereal crop farmers livelihood status. This signifies that computer/website are scarcely in use by the cereal crop farmers, as access to this devices is not easily granted to them. Since most of the cereal crop farmers were not literate and leave in the remote areas in the rural villages, while significant number of the cereal crop farmers that uses this devices revealed that, it help them get market information and advertised their farm produce for sells online. This finding commensurate with that of FAO(2017), who reported that, computer/website are devices used in agricultural information and marketing.

Evidently in this study, few number of the cereal crop farmers ascertained that the usage of telephony is significant as perceived effect of their usage of it on their livelihoods status. Others reported undecided and not significant with the mean score of 1.45 and is ranked 12th of the perceived effects of the usage of E-agriculture information sources on their livelihood status. Telephones are used for interactive voice response in the study area. But the use of mobile phone have outweighed the use of telephone in the study area, with very few cereal crop farmers reported significant in usage. This findings agrees with that of Bertolini (2009), who observed that, the telephone is the only E-agriculture used (if any) by the majority of farmers in Africa, and he further stated that some farmers considered the cellular phone applications such as the SMS to be one of the most important E-agriculture application.

CONCLUSION

Base on the result of this findings, the study conclude that, the cereal crop farmers were engaged in the use of E-agriculture information sources in their cereal crop farming with majority (about 90%) of the farmers using it. Notably, mobile phone, radio and other farmers (friends) were the most preferred and most used E-agriculture by the cereal crop farmers. This could attribute to the fact that, the cereal crop farmers gets more information about their cereal crop farming through these medium. It can be seen on both the result of likert scale of measurement that, other friends (friends) were ranked 3rd in the usage by the cereal crop farmers. Since E-agriculture has gone beyond technology to the combination of different knowledge of stakeholders in agriculture and cultures, it is important to note that, other farmers or friends can be sources of E-agriculture to other farmers who are less privileged to get such information through social media or through other means of communication. Other sources as seen on Tables 5 and 6 were also used by the farmers, but with less dedication since most of the cereal farmers were not having formal education and were financially handicaps to afford or access more expensive E-agriculture tools to use. Therefore, the cereal crop farmers are encouraged to explore the use of other sources of E-agriculture information, as this will help them gain more new knowledge that may help to enhance their productivity.

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