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EFFECT OF INFORMATION SYSTEM ON RISK ATTITUDES OF RURAL FARMERS IN GORONYO IRRIGATION SCHEME, GORONYO LOCAL GOVERNMENT AREA, SOKOTO STATE, NIGERIA

Tohib Oyeyode OBALOLA[1], Kazeem Oriyomi ABOABA[2], Babatola Olasunkanmi AGBOOLA[3], Ekoja Peter AMEH[1], Bello Bunza ABUBAKAR[1]

[1]Usmanu Danfodiyo University, Department of Agricultural Economics, P.M.B. 2346, Sokoto, Nigeria, Emails: oyeyodeobalola@yahoo.com, amehpeter098@gmail.com, abubakar.bbunza@udusok.edu.ng
[2]Federal University of Agriculture Abeokuta, Department of Agricultural Economics and Farm Management, Nigeria, Email: aboabakazeem@gmail.com
[3]University of Ilorin, Department of Agricultural Economics and Farm Management, P.M.B. 1515, Ilorin, Nigeria, Email: babatolaagboolao@gmail.com

Corresponding author: oyeyodeobalola@yahoo.com

Abstract

The study examined the relationship between information systems and attitude of the farmers towards risk in Goronyo Local Government, Sokoto State, Nigeria. A three-stage sampling procedure was used to select one hundred and twenty (120) farmers from three sectors in the irrigation scheme. The data collected were analyzed using descriptive statistics, attitudinal scale approach and multinomial logistic regression. The result of socioeconomic characteristics revealed that the farmers were predominantly male and married with mean age, farm-size and farming experience of 37 years, 0.78ha and 13 years respectively.. Radio was reported to be the major source of agricultural information reported by the farmers. The analysis on Attitudinal Scale Approach (ASA) revealed a slight variation in the classification between the risk averse and risk taking group with only a few in the neutral category. The multinomial analysis confirmed that there exists significant relationship between risk attitude of farmers and information systems, age, years of schooling, and household size. The study further revealed that damage by pests and diseases, high costs of farm inputs, inadequate storage facilities, as well as poor remunerative prices of farm produce are some of the major sources of risk faced by farmers in the study area. It was therefore recommended that extension education be intensified in order to bring to the notice of the farmers on the different means available to getting prompt information as regards their production.

Key words**:** *information systems, risk, attitude, attitudinal scale approach, rural farmer*

INTRODUCTION

Rural dwellers in Nigeria depend on agriculture as their major means of livelihood. Yet, agricultural productivity is low due to use of unimproved agricultural technologies as well as risk associated with weather conditions, pests and diseases, etc. [4, 24]. While farmers have always faced risk, farming has over the years becomes increasingly risky as a result of market liberalization and globalization. Smallholder farming has become especially vulnerable. A casual approach to farming, even if it is for household food consumption, is no longer viable. Farmers need to acquire more professional skills, not only in basic production but also in farm business management.

Risk which investment economists describe as the variation from expected outcomes due to imperfect knowledge of investors in decision making is inherent in every form of enterprise but is more intensive in input – output relation among agribusiness productions. Taking decisions that involve risk and uncertainty naturally varies from farmer to farmer and these variances are used to describe differences in risk attitude. Understanding the economic pattern displayed by individual farmers depends on getting individual risk preference [33]. Obviously, agricultural activities are exposed to greater risk. In fact, agricultural activities are more susceptible to

the physical and natural uncertainties than other enterprises. Agricultural activities entail extensive, direct and continuous contact with the forces of nature and in this part of the world where scientific methods are less developed; predicting nature can be less accurate thus, making the primary role of agriculture as the supplier of food and raw materials to the agro-industrial processing and manufacturing sector ineffective. Potential negative outcomes of risk are being given greater importance by farmers just like many other decision makers, which makes them to generally exhibit willingness to trade-off potential income for either risk or uncertainty avoidance [9, 32].

Information systems provide new approaches for communicating and sharing information, of which agricultural information is not an exception. Using these technologies improve the knowledge and skills of farmers by making available the recent information in achieving optimum yield from the input used. The term information system could be used for multitude of stand including telephone, television, video, voice information systems, and fax [37].

The use of ICT in agriculture for risk management is very important. Use of information and communication technologies have played very effective role in the agriculture development and in the decision making of farmers in different countries [7, 13, 30, 35]. Information and communication technologies have potential to disseminate agricultural information among smallholder farmers. These technologies are integrated with different devices such as computer, internet, mobile phones, television and radio. These facility transfer related and timely information that helps to make decisions to use resources in the most productive and profitable way [10, 29].However, the most common information systems available for the rural farmers are the radio, mobile phones and television.

Fundamental decisions made by farmers such as; what price to sell the produce, where to sell (given the numerous fragmented markets), when to harvest, and when to spray pesticides to save the crop are currently been made easier by ICT in many countries around the world [19] and this had been helping in improving yields and thus stimulating improved food security, trade, and income growth. Could this be attributed to the situation in Nigeria where farmers still depend on the use of traditional method of disseminating and gathering information that is unhealthy for improved agricultural decision making and risk management. It is against this background that the research examined the effect of information system alongside socioeconomic characteristics on the farmers risk attitude with the view to identify solutions to their problems as well as suggest ways on how such solutions can be achieved.

MATERIALS AND METHODS

Study Area

Goronyo is located between latitude 13^0 26' 32 N and longitude 5^0 40'E [20]. It has an area of 1,704km^2 and a population of 182,296 [22]. The annual rainfall is between 500mm to750mm with average monthly temperature ranges from 24^0C and 33^0C [26]. This may vary from season to season. Farming is the major occupation of Goronyo indigenes. Cereal crops (like rice, millet and sorghum), legume crops (such as beans, soya beans, etc) and root crops (such as sweet potatoes and cassava) are produced, although cassava production is relatively low. The major sectors in the local government were farming is predominantly done are: the Falaliya sector, Takume sector, and Mai-Iyali sector.

Sampling Technique

A three-stage sampling procedure was employed in the study. In the first stage, the three sectors (Falaliya, Takakume, and Mai-Iyali) were purposively selected from the local government area due to high level of farming activities in the sectors.

This was followed by random selection of two villages from each sector making a total of six villages. Subsequently, twenty (20) farmers were randomly selected from each village. This makes the sample size to be 120.

Data for this study were obtained from primary source.

This was achieved through a semi-structured questionnaire that was administered to the 120 rural farmers selected for the study.

Analytical Techniques

Descriptive statistics such as frequency, percentages and the likert scale were used in examining the socioeconomic characteristics of the farmers; eliciting the types of information sources used by the farmers as well as the various types of risk faced by the farmers. Attitudinal scale approach (ASA) was used to identify the risk attitude of the farmers and the multinomial logistics was used to evaluate the effect of the information systems on farmers risk attitude.

Attitudinal scale approach (ASA)

Five point Likert scale was used to measure an individual risk attitude. The responses measured on five point scale includes, strongly disagree (SD), which implies the risk aversion attitudes of the farmers. On the other hand, strongly agree (SA) indicates risk taking attitude of the farmers. In between the two extremes i.e. (SD and SA), disagree (D), neutral (N) and agree (A) were also incorporated. Thus, the aggregate score for risk averse individuals was achieved by combining responses from strongly disagree and disagree, the risk neutral category from the responses from Neutral categorization of the Likert scale and strongly agree and agree were also combined to ascertain the aggregate score for risk preference of individuals. This was expressed mathematically as;

$$Attitude = \frac{\sum of\ responses}{total\ question} \qquad (1)$$

The following are the mathematical expression for the three classes of attitude under study;

$$R_{averse} = \frac{\sum(\mathrm{SD} + \mathrm{D})}{total\ question} \qquad (2)$$

where:

R_{averse} = risk averse

SD = strongly disagree

D = disagree

$$R_{neutral} = \frac{\sum(\mathrm{N})}{total\ question} \qquad (3)$$

R_{averse} = risk averse

N = neutral responses

$$R_{takers} = \frac{\sum(\mathrm{SA} + \mathrm{A})}{total\ question} \qquad (4)$$

where:

R_{averse} = risk averse

SA = strongly agree

A = agree

Multinomial Logistics Regression Model

The choice of this method is based on the fact that the risk attitude (dependent variable) is a categorical variable which can take three (3) levels (0, 1, and 2). This classification emanated from the results of the risk attitude eliciting technique of the farmers. For this study, 0 was the risk neutral group; 1 was the risk averse group; and 2, the risk taking group. The risk neutral group was taken as the reference group for which other risk attitudes were compared. The model was utilized to identify the socio-economic characteristics responsible for the risk attitude group a farmer belongs.

The probability that the i^{th} farmer belongs to the j^{th} risk attitude group reduces to:

$$P_{ij} = \frac{e^{\beta_j X_i}}{\sum_{k=j} e^{\beta_k X_i}} \qquad \text{..... (5)}$$

Following [18, 5], the basic model is written as:

$$P_{ij} = \frac{e^{\beta_j X_i}}{\sum_{k=0}^{j} e^{\beta_k X_i}} \qquad \text{..... (6)}$$

where:

i = 1, 2 …..n variables;

k = 0, 1,.. j groups and;

β_j = a vector of parameters that relates X_i's to the probability of being in group j where there are j+1 groups.

In this study, X_1 to X_7 are socioeconomic variables.

Model normalization

The summation of the probability for the three groups must be equal to unity. This calls for a normalization of the equations in the model. The common rule is to set one of the parameter vectors equal to zero [17]. Hence for, k, number of choices, only v-1, distinct

parameters can be identified and estimated. In this study, k is three (3) groups and two distinct parameters were identified and estimated.

Based on equation 5, the probability of being in the reference group (risk neutral) with parameter vectors equal zero is:

$$P_{i0} = \frac{1}{1+\sum_{k=j} e^{\beta_k X_i}} \quad \text{..... (7)}$$

Similarly, the probability of being in each of the other j groups is:

$$P_{ij} = \frac{e^{\beta_j X_i}}{1+\sum_{k=j} e^{\beta_k X_i}} \quad \text{.....(8)}$$

Dividing equation (8) by (7) gives:

$$\frac{P_{ij}}{P_{i0}} = e^{\beta_j X_i} \quad \text{.....(9)}$$

This denotes the relative probability of each group to the probability of the reference group. Hence, the estimated coefficients for each group reflect the effects of X_i' s on the likelihood of the farming household head belonging to that alternative group relative to the reference group. The logarithm of the odd ratio in equation 9 to base e gives the estimating equation.

$$Ln\left[\frac{P_{ij}}{P_{i0}}\right] = \beta_j X_i \quad \text{..... (10)}$$

Equation 10 implies that, j, log odds ratio can be computed [15]. However, following [16], the coefficients of the reference group may be recovered by using the formula:

$$\beta_v = -\left[\beta_1 + \beta_2 + ... + \beta_{v-1}\right] \quad \text{..... (11)}$$

RESULTS AND DISCUSSIONS

Socioeconomic characteristics of the farmers

This section presents and discusses the socioeconomic attributes of the respondents such as age, sex, marital status, educational background, household size, other occupation they engage in apart from farming, farm size and their farming experience. The distribution of farmers according to socioeconomic characteristics is presented in Table 1.

The result reveals that the mean age of the farmers was 37 years. This implies that majority of them are still young, energetic and within the productive age of farming. This tends to play an important role as it informs one's knowledge through experience, thus understanding of the phenomena under study [31]. This corroborates with the findings of [3, 24]. The results also revealed that majority of the respondents (97.5%) were male while 2.5% were female. This could be attributed to the labor intensive nature of farming which may perhaps be hectic and time consuming, especially for females who would have to combine this activity with their domestic chores. The outcome is in line with the work of [11]. The result also revealed that 7.5% of the respondents were single, 88.3% were married, and 3.3% were widowed while 0.8% was divorced.

A household generally comprise of the man, his wife, and children; in some cases dependent if any. It was however observed that the mean household size was ten (10) persons. Large household size has a tendency to to reduce the costs of production likely to be incurred by the farmers with fewer household members. The polygamous nature as well as the family pattern of the area probably will explain the large family size reported. This is contrary to the findings of [27, 25] but in line with work of [24].

Education which plays a key role in creating awareness among farmers and influences the adoption of management strategies and practices was accessed and the result shows that 41.7% had no formal education, 34.2% had primary education, 21.7% had secondary education and 2.5% had tertiary education. Farmers tend to have several secondary occupations as reported. This however, ranged from fishing and trading (50.0%); artisan (10.8%) and handcraft (3.3%). Off- farm activities could therefore be used by farmers as a means of managing risk. The experience of a typical farmer was thirteen years. Experience serves as a measure of management ability thus, indicates the ability

to acquire skills and adopt new innovation. The more experienced a farmer is, the more his/her ability to make a better decision. The years of experience of a typical farmer were practically good.

Table 1. Distribution of farmers according to socioeconomic characteristics

Characteristics	Frequency	Percentage	Mean
Age (years)			
20-27	20	16.67	**37.24**
28-35	44	36.67	
36-43	26	21.67	
44-51	17	14.67	
52-59	8	6.67	
60-67	5	4.17	
Sex			
Male	117	97.50	
Female	3	2.50	
Marital status			
Single	9	7.50	
Married	106	88.30	
Widowed	4	3.30	
Divorced	1	0.80	
Household size			
3-10	51	42.5	**10.67**
11-17	60	50.0	
18 and above	9	7.5	
Education level			
Quranic	50	41.70	
Primary	41	34.20	
Secondary	26	21.70	
Tertiary	3	2.50	
Other occupation			
Fishing	30	25.00	
Trading	30	25.00	
Artisan	13	10.83	
Civil servant	6	5.00	
Handcraft	4	3.33	
No other occupation	37	30.83	
Farm size (hectare)			
0.6-1.1	87	72.50	**0.78**
1.2-1.6	27	22.50	
1.7-2.1	6	5.00	
Farm experience (years)			
2-9	45	37.50	**13**
10-17	38	31.67	
18-25	26	21.67	
26-33	6	5.00	
34-41	5	4.17	

Source: Field Survey, 2018.

The size of the farm is vital to a farmer and the production of output, since the sizes of the farm to some degrees determine the input to be used. The need to increase production requires increase in the hectares of land cultivated as the farmers in the study area cultivate at average of 0.93 hectares of land. However, it can be inferred that the farmers are smallholder farmers that limit their production. This is in line with the works of [36, 3, 24].

Information Sources

This section shows the information sources available to farmers in the study area and the

ones mostly used by them. The distribution of respondents according to source of information used is presented in Table 2.

Table 2. Distribution of farmers according the information sources used

Information source	Frequency	Percentage
Radio	86	71.7
Television	13	10.8
Mobile phone	5	4.2
Extension agent	6	5.0
Others	10	8.3
Total	**120**	**100.0**

Source: Field Survey, 2018.

The result on Table 2 shows that majority of the farmers (71.7%) obtained information via the radio source, 10.8 % reported television as their source, with 4.2 % and 5.0 % get theirs through mobile phones and extension agent respectively. Radio is a multidimensional source of transferring information, particularly in rural areas of developing countries and the impact presented is helpful among different communities of people such as farmers [28, 8]. There is no doubt that modern information about agriculture can be diffused by using the television. However, the findings of the study showed that radio was the best means of information dissemination considering its portability, affordability and easy to access as reported by the majority of the farmers, thus, corroborates with the findings of [6, 1, 2, 21] who reported radio as one of the best sources of diffusing agricultural, technical and scientific information to the farmers. This is contrary to the findings of [12, 34] who reported television as the best channel of sourcing information.

Type of Agricultural Information

The types of agricultural information obtained from various information source helps farmers in making decision as regards their farming activities and marketing of their farm produce. The types of agricultural information obtained from information sources as reported by the sampled farmers are presented in Table 3.

The result reveals that 9.2% of the respondents obtained market information from the information sources, 41.7% obtained climatic information, and 40.8% obtained cultural practices.

Table 3. Distribution of farmers according to the type of agricultural information obtained

Information type	Frequency	Percentage
Market	11	9.2
Climate	50	41.7
Cultural practices	49	40.8
Others	10	8.3
Total	**120**	**100.0**

Source: Field Survey, 2018.

Radio and television have played important roles in enhancing the capacity of farmers by broadcasting different agricultural related programs. However, in the context of Nigeria settings where electricity becomes a factor of concern to the use of some of this means, particularly in the rural area where production is concentrated, farmers mostly depend on radio to meet their information needs on market [14, 8], cultural practices [38, 28] and of course the most widely sourced information as presented by the study, climatic information [38, 23, 8].

Farmers Risk Attitude

The aggregate measurement of farmer's attitude towards risk was analyzed and presented. The risk attitudes of the farmers were categorized into three main groups; risk averse, risk neutral and risk preference. With reference to the methodology applied in the study, the risk averse individuals are those who strongly disagree or disagree with the risk management strategies available.

The risk neutral individuals are those who neither disagree nor agree with the strategies provided and the risk preference individuals are those who strongly agree or agree with the risk management strategies provided. The distribution of respondents according to these categories is presented in Table 4.

The result of attitudinal scale approach (ASA) using Likert scale analysis, as presented in Table 4 showed that almost half (46.7%) of the farmers were categorized as risk averse individuals, lower proportion (7.5%) as risk neutral and almost half (45.8%) of the farmers

were categorized as risk takers (preference) individuals.

Table 4. Distribution of aggregate score measuring risk attitude of the farmers

Risk Strategies (Category)	**Frequency**	**Percentage**
Risk Aversion	56	46.7
Risk Neutral	9	7.5
Risk Taker	55	45.8
Total	**120**	**100.0**

Source: Field Survey, 2018.

Effects of Information System on Risk Attitude

Table 5 identifies the variables that explain the risk attitude of the farmers. The variables of interest are information source, age, gender, marital status, years of schooling, household size and farming experience. With the multinomial logit model, the risk neutral group was used as the reference group for other risk attitude groups. The summary of the result of the analysis are given in the Table

Table 5. Parameter estimates on impact of information systems on farmers risk attitude

	Risk Averse Group		**Risk Loving Group**	
Variables	Coefficient	Standard Error	Coefficient	Standard Error
Constant	-2.391	1.598 (-1.496)	-1.848	4.888 (-0.378)
Information source	2.423***	0.325 (7.455)	1.669*	1.011 (1.651)
Age	3.167*	1.866 (1.697)	2.144*	1.120 (1.914)
Gender	0.145	0.637 (0.227)	1.786	2.021 (0.883)
Marital status	-1.444	1.651 (-0.874)	-2.528	2.411 (-1.048)
Years of schooling	-17.270***	1.529 (-11.294)	-16.422***	0.910 (-18.046)
Household size	0.268**	0.134 (2.000)	3.568**	1.756 (2.031)
Farming experience	0.058	0.092 (0.630)	1.494	1.203 (1.241)
Log likelihood		58.136		
Likelihood Ratio (λ)		34.44**		
ρ^2		0.282		
N		120		

Note: Figures in parenthesis are the t-ratio of the estimated regression coefficients in their absolute values
* = significant at 10% ** = significant at 5% *** = significant at 1%
Source: Own calculations.

From the result, the likelihood ratio test for the model (λ) is significant at 5%. This indicates that the risk attitude groups in the study area are heterogeneous, thus, confirms the appropriateness of the choice of model (polychotomous) used in the study.

Information source, age and household size are positive and significantly responsible in classifying the farmers into the risk averse and risk taking groups. This implies that the probability of being in these groups relative to the reference group increases as these explanatory variables increases. However, years of schooling is negative and significantly responsible in classifying the farmers into a risk averse and risk taking groups. This implies that the probability of being in these groups is lower relative to being in the reference group as these two explanatory variables increase.

Table 6 shows that majority (63.3%) of the farmers reported damage caused by pests and diseases as very important, 33.3% as important while 3.3% as not very important, thus, ranked as the most important risk type faced by the farmers.

This corroborates with the findings [24] who reported incidence of pests and diseases as the most pressing constraints militating against farmers' production.

This was followed by high costs of inputs, poor remunerative prices of farm produce and inadequate storage facilities as theses were highly reported as an essential risk type and consequently ranked 2nd, 3rd and 4th respectively.

However, the analysis on drought, weather condition, theft and pilfering as well as market availability as an important source of risk was refuted based on the responses

received depicting these factors as not important as far as their production is concerned.

Table 6. Distribution of various types of risk based on their importance

SOURCES	VI	I	U	NVI	NI	WS	MS	RANK
Damage by pests and diseases	76	40	0	4	0	548	4.56	1st
	(63.30)	(33.30)	(0.00)	(3.30)	(0.00)			
High cost of input	44	62	1	13	0	497	4.14	2nd
	(36.70)	(51.70)	(0.80)	(10.80)	(0.00)			
Inadequate storage facilities	35	48	1	36	0	442	3.68	4th
	(29.20)	(40.00)	(0.80)	(30.00)	(0.00)			
Theft/pilfering	3	39	2	65	11	318	2.65	10th
	(2.50)	(32.50)	(1.70)	(54.20)	(9.20)			
Unfavorable weather condition	2	43	2	51	1	291	2.42	11th
	(1.70)	(35.50)	(1.70)	(42.50)	(0.80)			
Drought	0	2	4	83	31	217	1.80	12th
	(0.00)	(1.70)	(3.30)	(69.20)	(25.80)			
High post-harvest losses	23	50	4	42	1	412	3.43	6th
	(19.20)	(41.70)	(3.30)	(35.00)	(0.80)			
Poor market linkage	15	51	2	51	1	388	3.23	8th
	(12.50)	(42.00)	(1.70)	(41.50)	(0.80)			
Lack of market available for farm produce	4	48	1	67	0	349	2.90	9th
	(3.30)	(40.00)	(0.80)	(55.80)	(0.00)			
Lack of market information	18	55	7	40	0	411	3.42	7th
	(15.00)	(45.80)	(5.80)	(33.30)	(0.00)			
Perish ability of produce	10	70	6	34	0	416	3.46	5th
	(8.30)	(58.30)	(5.00)	(28.30)	(0.00)			
Poor remunerative prices of farm produce	35	73	4	8	0	495	4.12	3rd
	(29.20)	(60.80)	(3.30)	(6.70)	(0.00)			

Source: Field Survey, 2018.
VI = Very Important; I = Important; U = Undecided; NVI = Not Very Important; NI = Not Important; WS = Weighted score; MS = Mean score. Figures in parenthesis are in percentages

CONCLUSIONS

The achievement of agricultural development programs in developing countries basically depends on the nature and level of use of mass media channels in mobilization of people for development in general. Of course, with respect to the study, radio among several other information sources turn out to be the most widely used in getting the required information particularly on climate and other cultural practices. In the same vein, no clear distinctive class of attitude was observed as farmers were seen to either be risk averse or taker. The study confirmed significant relationship between information systems, and the farmers risk attitude. In addition, socioeconomic characteristics of the farmers; age years of schooling and household size contribute significantly to the preference of the farmers on risk.

Conversely, it becomes pertinent to note that the highlighted sources of risk to the farmers can be managed by giving priority to the observed ranking. It is therefore recommended that intensification of extension activities in making known to the farmers several types of information sourcing platforms related to their production is key in

any of the programs or policies targeted to the farmers.

REFERENCES

[1]Abbas, M., Hassan, S.A., Lodhi, T.E., 2009, Role of extension services in promoting Agroforestry in district Bahawalpur. J. Agri. Res. 47(2): 211-219.
[2]Ani, A., Baba, S., 2009, Utilization of selected electronic mass media as sources of agricultural information by farmers in Northern part of Taraba state, Nigeria. Tropical Agric. Res. Ext. 12 (1): 17-21.
[3]Ayinde, O.E., Obalola, T.O., 2017, Effect of Socioeconomic Characteristics and Income Status on Onion Farmers Risk Attitude in Sokoto State, Nigeria. Agricultura Tropica Et Subtropica 50(3): 141–146.
[4]Ayinde, O.E., Omotesho, O.A., Adewumi, M.O., 2008, Risk attitudes and management strategies of small – scale crop producer in Kwara State, Nigeria: A ranking approach. African Journal of Business Management 2(12): 217-221.
[5]Babcock, B. A., Chaherli, N.M., Lakshminariayam, P.G., 1995, Programme Participartion and Farm-level. Adoption of Conservation Tillage: Estimates from a Multinomial Logit model. Working paper 95-WP 136, Centre for Agricultural and Rural Development, Iowa State University, Ames, Iowa.
[6]Bolorunduro, P.I., Iwuanyanwu, I.E.J., Aribido, S.O., Adesehinwa, A.O.K., 2004, Effectiveness of extension dissemination approaches and adoption levels of livestock and fisheries technologies in Nigeria. J. Food Agri. Environ. 2(1).
[7]Cash, D.W., 2001, In order to aid in diffusing useful and practical information: Agricultural extension and boundary organizations. Science, Technology and Human Values 26: 431–453.
[8]Chhachhar, A., Qureshi, B., Khushk, G.M. Ahmed, S., 2014, Impact of Information and Communication Technologies in Agriculture Development. J. Basic. Appl. Sci. Res. 4(1): 281-288.
[9]Dewan, A.A., 2011, Farmers' motivations, risk perceptions and risk management strategies in a developing economy: Bangladesh experience. Journal of Risk Research 14(3): 325-349.
[10]Ekbia, H.R., Evans, T.P., 2009, Regimes of information: Land use, management, and policy. The Information Society 25(5): 328–343.
[11]Fakayode, S. B., Rahji, M.A.Y., Adeniyi, S.T., 2012, Economic analysis of risks in fruit and vegetable farming in Osun State, Nigeria. Bangladesh J. Agril. Res. 37(3): 473-491.
[12]Fossard, E.D., 2005, Writing and producing radio Dramas. Sage Publications, New Delhi.
[13]Galloway, L., Mochrie, R., 2005, The use of ICT in rural firms: A policy literature review. The Journal of Policy, Regulation and Strategy for orientated Telecommunications (7): 33–46.
[14]Goyal, A., 2010, Information, direct access to farmers and rural market performance in Central India. Journal Applied Economics 2(3): 22-45.
[15]Greene, W. H., 1993, Econometric analysis. Macmillian.
[16]Hill, M.A., 1983, Female labor force participation in developing and developed countries: consideration of the informal sector. Review of Econometric and Statistics 63(3): 459-468.
[17]Kimhi, A., 1994, Participation of farm owners in farm and off-farm work including the option of full-tine off –farm work. Journal of Agricultural Economics 45(2): 232-239.
[18]Maddala, G. S., 1990, Limited Dependent and Qualitative Variables in Econometrics. Cambrigde University Press, Cambridge.
[19]Mehra, A., 2010, Small Technologies Fuel Big Results in the Developing World. The Huffington Post, September 13, 2010. http://www.huffingtonpost.com/amit-mehra/small-technologiesfuel-b_b_715274.html, Accessed October 2010.
[20]Middle Rima Valley Irrigation (MRVI), 2001, Middle Rima Valley Irrigation Project. Final Report Vol. 3 Government Printers p.60.
[21]Murty, A., 2012, Electronic media in rural agricultural business- A promotional injection. National monthly refereed journal of research in science technology 1 (11): 63-68.
[22]National Population Commission (NPC), 2006, The 2006 National Population Figure, Structure and Distribution
[23]Nazaril, M., Bin, H., Hassan, S., 2011, The role of television in the enhancement of farmers' agricultural knowledge. African Journal of Agricultural Research 6(4): 931-936.
[24]Obalola, T.O., Ayinde, O.E., 2018, risk and risk management strategies of smallholder onion farmers in Sokoto State, Nigeria. Acta agriculturae Slovenica 111(3): 559-566.
[25]Ojo, M.A., Muhammed, U.S., Adeniji, B. Ojo, A.O., 2009, Profitability and technical efficiency in irrigated onion production under middle rima valley irrigation project in Goronyo, Sokoto State. Nigeria. Journal of Agricultural Science 3: 7-14.
[26]Okeke, K.I., Owa, O., Omoayena, B.O., 2007, Socio-economic impact of irrigation on crop producers: The case of Middle Rima Valley irrigation project in Goronyo, Sokoto State, Nigeria. Proceedings of the 21st Annual Conference of Farm Management Association of Nigeria (FAMAN), Pp. 149-151, Olabisi Onabanjo University, Ogun State.
[27]Okoruwa, V.O., Akindeinde, A.O. Salimonu, K.K., 2009, Relative economic efficiency of farms in rice production: A profit function Approach in North Central Nigeria Tropical and Sub-tropical. Agro-ecosystem 10: 279-286.
[28]Okwu, O.J., Kuku, A.A. Aba, J.I., 2007, An assessment of use of radio in agricultural information dissemination: a case study of radio Benue in Nigeria. African J. Agri. Res. 2 (1): 014-018.
[29]Ommani, A.R., Chizari, M., 2008, Information dissemination system (IDS) based e-learning in

agricultural of Iran (perception of Iranian extension agents). World Academy of Science, Engineering and Technology 38: 468–472.
[30]Opara, U.N., 2008, Agricultural information sources used by farmers in Imo State, Nigeria. Information Development 24(4): 289–295.
[31]Osuagwu, C.O., Chikaire, J.U., Anaeto, F.C. Oparaojiaku, J.O., 2017, Analysis of Agricultural Business Risks Management Strategies among Rural Farmer Entrepreneurs in Imo State, Nigeria. Scholarly Journal of Agricultural Science, 7(2), 50-56.
[32]Picazo-Tadeo, A.J., Wall, A.A., 2011, Production risk, risk aversion and the determination of risk attitudes among Spanish rice producers. Agricultural Economics 42:451–464.
[33]Reynaud, A., Couture, S., 2012, Stability of risk preference measures: results from a field experiment on French farmers. Theory Decision 73(2): 203–221.
[34]Saadi, H., Mahdei, K.N., Movahedi, R., 2008, Surveying on wheat farmers' access and confidence to information and communication channels about controlling eurygasterintegriceps in Hamedan province-Iran. American J. Agri. Biol. Sci. 3 (2): 497-501.
[35]Taragola, N.M., Van Lierde, D.F., 2010, Factors affecting the internet behaviour of horticultural growers in Flanders, Belgium. Computers and Electronics in Agriculture 70: 369–379.
[36]Tsoho, B.A., Salau, S.A., 2012, Profitability and Constraints to dry season Vegetable production under fadama in Sudan savannah ecological zone of Sokoto State, Nigeria. Journal of Development and Agricultural Economics, 4(7), 214-222.
[37]Warren, M.F., 2002, Adoption of ICT in agricultural management in the United Kingdom: The intra rural digital divide. Agricultural Economics 48(1): 1–8.
[38]Weiss, A., Van Crowder, L., Bernardi, M., 2000, Communicating agro-meteorological information to farming communities. Agricultural and forest Meteorology 103(1): 185-196.