Journal of Agripreneurship and Sustainable Development (JASD)
Volume 1, Number 1, December, 2018
ISSN (Print): 2651-6144; ISSN (Online): 2651-6365

ANALYSIS OF AGRICULTURAL TECHNOLO GIES AND ADOPTION EFFICIENCY IN WESTERN AGRICULTURAL ZONE OF BAUCHI STATE, NIGERIA

[1]Sani, M. H., [2]Kushwaha, S. and [3]Madaki, M. Y.
[1]Department of Agricultural Economics and Extension, Faculty of Agriculture and Agricultural Technology, Abubakar Tafawa Balewa University, Bauchi, Nigeria
[2]Department of Agricultural Economics and Head of Rajiv Gandhi South Campus (RGSC), Banaras Hindu University (BHU), Varanasi, India
[3]Department of Sustainable Technologies, Faculty of Tropical AgriSciences, Czeck University of Life Sciences Kamycka 129, Prague 6-Suchdol 16500, Czeck Republic
Corresponding Authors' E-mail: drsanimoh@yahoo.com Tel: +234(0)8069070184

ABSTRACT
The study analyzed the agricultural technologies and adoption efficiency in Western agricultural zone of Bauchi State, Nigeria. The study employed multi-strata fixed proportion random sampling from each village settlement making a total sample of 80 farmers of irrigated farm categories (small, medium and large farms) for the study. Similarly, 200 farmers that enrolled in the E-wallet agricultural technology were randomly selected for the study. Primary data were collected using well framed pre-tested questionnaire. The data were analyzed using, descriptive statistics, Adoption Index and probit regression analysis. The findings showed that 80% of owners of large farms and medium farms (65%) were high adopters and about 48% of the owners of small farms were medium adopters. The results of the probit regression revealed that household size, farming experience, attending agricultural exhibition and consulting newspaper were all significant ($P<0.05$), farm size ($P<0.10$) and extension contact ($P<0.01$) in farmers' adoption of the E-wallet agricultural technology. The major constraints to E-wallet agricultural input distribution method in the study area were inadequate registration point (27.24%), network problem (23.16%) and registration of non-farmers (20.43%). The study concluded that adoption level of agricultural technologies in the study area was positively related with age, level of education and farm size. The study recommended that agricultural technologies of E-wallet inputs distribution in the study area should be sustained; virile extension services through private extension services, farmers to farmers' extension approach should be encouraged in the study area.

Keywords: Adoption, Adoption index, E-wallet, Production, Resources, Technologies.

INTRODUCTION
In recent past, lots of new technologies were introduced in agricultural production to achieve the food self-sufficiency with high production efficiency. For sustainable economic and agricultural productivity, transfer of improved technologies and their fast adoption is a primary requirement. Now the question is that, how fast are these new technologies being adopted?

Natural resources provide the basic foundation for economic development. They act as a means of capital formation and accelerate economic growth. However, the value of such resources depends on scientific, indigenous and technical knowledge, cultural practices and

economic feasibility of their utilization. Land and water are the basic natural resources which have direct impact on agricultural production. But the technological changes during the last three decades led to increase in agricultural production. It also led to deterioration of soil health, created nutritional imbalance and disturbed he ecological balance.

Technological changes in the form of Green Revolution have substantially increased the agricultural production in the country (Sani, 2000). Technological changes consists of adoption of high yielding varieties (HYV) of seeds, use of chemicals, fertilizers and pesticides, farm mechanization and improved cultural practices in the area of assured irrigation. Introduction of short duration HYV seeds of important cereals and other commercial crops encourage the farmers to engage in intensive cultivation in the study area. To promote quality protein maize (QPM) for easy adoption or acceptance by farmers, research needs to tackle some challenges of producing good quality seed, development and release of superior hybrids, promotion of no-till and postharvest technologies employed and affordable price given at harvest periods. Post-harvest losses are increasing (20-40%) because harvesting, processing and storage techniques are inefficient, and as a result, supply is unstable (Food and Agriculture Organization [FAO], 2010). Farmers have often complained about low yield in food production resulting to low income and also cases of inadequate information about improved technologies and balanced diet. The parameters of technological changes are as follows: areas under high yielding varieties; fertilizer use (chemical and manure); pesticides use; and irrigation.

The dissatisfaction derived from the performance of the agricultural sector, the failure of some agricultural programmes and the need to provide a well-articulated domestic policy to serve as a key for the development of Nigeria agriculture made government of Nigeria in 2011 to lunch a policy document known as Agricultural Transformation Agenda (ATA) (FMARD, 2012). The launching of this policy document was expected to be a roadmap in solving fundamental problems associated with the agricultural sector (Akinwumi, 2011).

The Growth Enhancement Support Scheme (GESS) as a component of the ATA is an innovation approach to fertilizer subsidy and other inputs administration through the electronic system (E-wallet) that ensure that only registered farmers would benefit from the scheme. It is meant to change the mentality of Nigerians to agricultural activity. It is expected that the scheme will boost food production, the income of farmers as well as the value accorded to locally produce agricultural products.

Nigeria spent about ₦1.3 trillion annually to import basic food, ₦638 billion on wheat ₦356 on imported rice ₦271 billion on sugar and ₦71 billion imported fish (FMARD, 2012). This constitutes a huge drain on the nation's income with its untold negative effect on the balance of trade. E-wallet therefore targeted to produce 20 million tons of food by 2015 which will help to reduce government spending on importation (Akinwumi, 2011).

Yemi (2012) said that there is the need to ensure that farmers in the rural area get access to farm input such as fertilizers, seeds and information to enhance their productively. The GESS will be powered by E-wallet, an electronic distribution channel which provides and efficient and transparent system for the purchase and distribution of agricultural inputs based on a voucher system. The scheme guarantees registered farmers e-wallet voucher with they can redeem fertilizers, seed and other agricultural input from agro-dealers at half the cost, the other half being borne by the federal government and state government in equal proportions (Yemi, 2012). The e-wallet agricultural technology will serve as an avenue to educate, inform and communicate with farmers in rural areas across the country on the latest and best agricultural practices as well as current price of commodity in market (Yemi, 2012).

From the foregoing, the study was conducted to achieve the following objectives: determine the adoption level of agricultural technologies on the different categories of farm in

Journal of Agripreneurship and Sustainable Development (JASD)
Volume 1, Number 1, December, 2018
ISSN (Print): 2651-6144; ISSN (Online): 2651-6365

the study area; identify and describe the socio-economic characteristics of the respondents; examine the nature of relationship that exists between farmers' knowledge and adoption of the E-wallet agricultural technology in the study area; and ascertain the challenges faced by the farmers in adopting agricultural technologies in the study area.

MATERIALS AND METHODS

For this study, Dass, Bauchi and Alkaleri Local Government Areas (LGAs) of Bauchi State, Nigeria were purposively selected. The main criteria used for the selection of area for the study was that among the LGAs of the State, it was more blessed by natural endowment. It is also the most advanced in terms of using the conventional commercial farming practices based on HYV seeds, highly mechanized and irrigated farmers, and intensive use of fertilizer and plant protection chemicals. The 10 villages that were near to the river bank were purposively selected. a sample size of 80 farmers were randomly selected using multi-strata fixed proportion random sampling from each village settlement in the study area. Out of 80 sampled farmers, 45 belonged to small farm category (less than 3 ha), 20 belonged to medium farm (3-5 ha) and 15 belonged to large farm category (more than 5 ha). Primary data was collected using well framed pre-tested questionnaire. The data collected were analyzed using Indexing Approach. The adoption of technology is a qualitative variable which can be quantified only through developing an index (Chandra, 1992). The model specification for this study was developed as follows:

$$AI = J_{1,2\ldots m}\left[\frac{FYMAj}{FYMRj} + \frac{AHj}{CAj} + \frac{PAj}{PRj} + \frac{FAj}{FRj} + \frac{IAj}{IRj}\right]\frac{CAj}{GCAj} \quad \ldots(1)$$

where;

AI = Adoption Index of farmers.

$J_{1,2\ldots m}$, and m = total number of major crops

$FYMA_J$ = Amount of FYM applied per unit of area in j^{th} crop; $FYMP_J$ = Amount of FYM recommended for application per unit of area of j^{th} crop; AH_j= Area under HYV of j^{th} crop; CP_J = Cropped area (HYV + local) of j^{th} crop; FP_j= Amount of fertilizer (N + P + K) applied unit of area of j^{th} crop; FR_J= Amount of fertilizer recommended per unit of area for j^{th} crop; PA_j= Amount of pesticide applied as plant protection chemicals per unit of area in j^{th} crop; PR_J = Amount of pesticide recommended for j^{th} crop; IA_J = Number of irrigation applied for j^{th} crop.

IP_J = Number of irrigation recommended for j^{th} crop; GCA = Gross crop area.

The adoption index (AI) of individual farmer varies from 0 to 100 percent depending upon the farmers of adoption of new farm technology. On the basis of adoption index, all farmers were classified into three categories: low adopters (0 to 40 per cent AI), medium adopters (45 to 60 per cent AI) and high adopters (above 60 per cent AI).

Similarly, the researchers examined the farmers' knowledge on E-wallet agricultural inputs distribution method in the study area using multi-stage sampling procedure in selecting 200 farmers. The descriptive statistics, chi-square and probit regression analysis were used to analyze the results. The Probit regression model was used to determine the factors influencing adoption and access to farm inputs under the E-wallet scheme. The model in its general form is specified as:

$$Y = F(X_1, X_2, X_3, X_4, X_5, \ldots E) \quad \ldots(2)$$

$$\text{From equation (2), } Y = a + b_1X_1 + b_2X_2 + \ldots b_nX_n + e \quad \ldots (3)$$

where;

Y = adaption and access to farm inputs under E-wallet agricultural technology is the dependent variable (dummy variable, if farmer adopted E-wallet and got subsidized inputs =1, if not =0)

Journal of Agripreneurship and Sustainable Development (JASD)
Volume 1, Number 1, December, 2018
ISSN (Print): 2651-6144; ISSN (Online): 2651-6365

a = constant; b_1-b_{13} = regression coefficient; X_1 = sex (male =1 and female = 0); X_2 = age (years); X_3 = marital status (single = 1, married = 2, divorce = 3 and widow = 4, separation = 5); X_4 = household size (person); X_5 = educational qualification (no formal education = 0, primary school = 1, secondary school = 2, tertiary education = 3); X_6 =farming experience (years); X_7 = farm size (ha); X_8 = farmers' group membership (yes = 1, no = 0); X_9 = contact with extension agent annually (yes = 1, no = 0); X_{10} = listening to agricultural radio program (number/annum); X_{11} = viewing agricultural television program (number/annum); X_{12}= attending agricultural show (number/annum); X_{13} = attending agricultural exhibition (number/annum); e = error term or residual.

RESULTS AND DISCUSSION

A wide variation in the socio-economic characteristics of the selected farmers was observed. To make the study more reliable, farmers were grouped under three different categories as follows: small farmers (below 3 hectares); medium farmers (3-5 hectares) and large farmers (more than 5 hectares). Land was considered as the basis for this categorization because of its major role in decision making process regarding agriculture.

Table 1 reveals that 80 percent of owners of large farms were high adopters, 65 percent of owners of medium farms were also high adopters, but 46.7 percent of owners of small farms were medium adopters. This finding is in line with of Bastine and Nair (1988) whose research in revealed that adoption rate was higher on large size farms. This is in agreement with Yisa *et al*. (2010) which states that more males were found to be engaged in medium and large farming activities than their female counterpart because of its labour intensive nature.

Table 1: Adoption Level of Agricultural Technology on the Sampled Farms

Farm categories	Adoption			
	Low Adopters	Medium Adopters	High Adopters	Total
Small	14	21	10	45
	(31.1)	(46.7)	(22.2)	(100.0)
Medium	3	4	13	20
	(15.0)	(20.0)	(65.0)	(100.0)
Large	1	2	12	15
	(6.7)	(13.3)	(80.0)	(100.0)
All Farms	18	27	35	80
	(22.5)	(33.7)	(43.8)	(100.)

Note: Figures in parentheses showing the percentage of the total.

Table 2 shows that on large farms, male children and male adults were considered high adopters whereas female children and female adults were low adopters. In case of owners of medium size farms, both gender and age groups were low adopters. This finding contradicts that of Yadov (1987) who said that adoption level of adult males is very low in all categories of farms.

Journal of Agripreneurship and Sustainable Development (JASD)
Volume 1, Number 1, December, 2018
ISSN (Print): 2651-6144; ISSN (Online): 2651-6365

Table 2: Respondents' Adoption of Agricultural Technologies with Age, Sex and Family Size

Farmers' Category	Adoption Level (percent)					
	Lower Adopter	Medium Adopter	High Adopter	Average family size	Effective worker per farm	Sex ratio*
Small farms				6	2	1008
Children:						
Male (100)	35.2	18.3	12.2			
Female	13.6	11.5	9.2			
Adults:						
Male (100)	39.7	19.4	12.2			
Female	14.4	8.1	6.2			
Medium farms				11	5	1016
Children:						
Male (100)	11.4	13.7	21.4			
Female	13.2	17.1	23.2			
Adults:						
Male (100)	9.4	11.3	13.0			
Female	15.6	19.4	31.1			
Large farms				17	10	945
Children:						
Male (100)	16.4	20.7	39.1			
Female	10.2	7.4	6.2			
Adults:						
Male (100)	15.3	17.1	59.7			
Female	4.3	2.4	1.2			

Note: Figure in parentheses was the percent out of which low, medium and high adoption index was calculated. *Number of females per one thousands of males

Table 3 disclosed that adoption level was positively related with education, that is, adoption level was very high with the level of education of education and low among those with low level of education. This result is in line with the findings of Yadov and Gangwar (1987) who said that adoption level of new agricultural technologies was found high among literate farmers in all categories of farms. The results of Table 3 is also in agreement with Sani and Silas (2012) in a study conducted in Jos South LGA of Plateau State on the socio-economic determinants and production constraints in the adoption of new variety of acha (*Digitaria spp*). The authors reported that majority (95.00%) of the respondents disclosed that inadequate capital was their major constraints, identified land tenure system (76.67%), inadequate farm inputs (50%), poor weather condition (46.67%), primitive techniques in processing and storage (93.33%) and inadequate access to mechanization (88.33%) implying that the scale of acha production in the study area was small scale.

Journal of Agripreneurship and Sustainable Development (JASD)
Volume 1, Number 1, December, 2018
ISSN (Print): 2651-6144; ISSN (Online): 2651-6365

Table 3: Comparison of Adoption Level with Education on the Categories of Farms

Farms	Illiterate	Koranic	Primary	Post Primary	Total	Low Adoption	Medium Adoption	High Adoption
Small	22 (48.9)	11 (24.4)	7 (15.6)	5 (11.1)	45 (100)	14 (31.1)	21 (66.7)	10 (22.2)
Medium	4 (20.0)	6 (30.0)	7 (35.0)	3 (15.0)	20 (100)	3 (15.0)	4 (20.0)	13 (65.0)
Large	1 (6.7)	1 (6.7)	3 (20.0)	10 (66.6)	15 (100)	1 (6.7)	2 (13.3)	12 (10.0)
All farms	27 (33.7)	18 (22.5)	17 (21.3)	18 (22.5)	80 (100)	18 (22.5)	27 (33.7)	35 (43.8)

Note: Figures in parentheses to the right side of the total is a percentage of the total; likewise figures in parentheses to the left side of total is also the percentage of the total.

Table 4 shows the results of the reconnaissance survey in the study area. It reveals that in stage one, three LGAs namely; Alkaleri, Bauchi and Dass were randomly selected out of seven LGAs of the zone. In stage two, three wards were randomly selected from each of the selected three LGAs making nine (9) wards: Alkaleri-east, Gwaram, Yuli-lim, Dawaki, Kangyare, Miri, Dott, Wandi and Bununu center). Finally, in stage three, 10% of duly registered farmers in the E-wallet technology in each ward were randomly selected making a sample size of 200 of the E-wallet farmers. This 10% choice is in line with Eboh (2009) who in social science research proposed 10% for a sampling frame of between 2000-5000.

Table 4: Sample Size Selection Plan

LGA	**Selected LGAs**	**Selected Wards**	**Sample Frame**	**Sample size (10%)**
Alkaleri	Alkaleri	Alkaleri East	274	27
		Gwaram	254	25
		Yuli-lim	213	21
Sub-total			741	73
Bauchi	Bauchi	Dawaki	234	23
		Kangyare	213	21
		Miri	245	24
Sub-total			692	68
Dass	Dass	Dott	200	20
		Wandi	211	21
		Bununu center	181	18
Sub-total			592	59
Total	3	9	2,025	200

Source: Field survey (2016)

Table 5 shows the Probit regression analysis of variables influencing adoption and access to E-wallet agricultural technology in the study area. The results showed that household size, farming experience, agricultural exhibition and consulting newspapers were all significant at $p<0.05$, farm size was significant at $p<0.10$ and extension contact at $p<0.01$. Only household and farm size had negative marginal effect of -0.0088 and -0.0079, respectively. This means that unit increase change in household size and farm size of the farmer caused 0.88% and 0.80%

Journal of Agripreneurship and Sustainable Development (JASD)
Volume 1, Number 1, December, 2018
ISSN (Print): 2651-6144; ISSN (Online): 2651-6365

decrease on adoption and access to subsidized fertilizer under the E-wallet technology; this may be due to the availability of family labour used by farmers to compliment the small quantity of fertilizer at their disposal.

Table 5: Probit Regression Analysis of Adoption and Access to E-wallet Technology

Variable	Coefficient	T-value	P-value	dx/dx
Constant	0.2857	-0.32	0.745	0.0000
Age (X_1)	-0.0098	-0.63	0.528	-0.0025
Sex (X_2)	-0.0844	-0.26	0.791	-0.0273
Marital status (X_3)	0.2056	0.75	0.456	0.0138
Household size (X_4)	-0.0480	-2.00**	0.045	-0.0088
Farming experience (X_5)	0.0171	1.77**	0.017	0.0035
Education level (X_6)	0.0615	0.65	0.513	0.0004
Farm size (X_7)	-0.0406	-1.65*	0.103	-0.0079
Farmers' group membership (X_8)	-0.1004	-0.36	0.715	-0.0037
Extension Contact (X_9)	1.0422	2.98***	0.003	0.2748
Agricultural radio program (X_{10})	0.1436	0.26	0.796	0.4723
Agricultural television program (X_{11})	0.2527	0.85	.396	0.0596
Agricultural show (X_{12})	0.0436	0.14	.891	0.0141
Agricultural exhibition (X_{13})	0.7798	2.43**	.015	0.1386
Newspapers (X_{14})	0.7233	2.38**	.017	0.1264
Number of observation				189
Prob> Chi 2				0.0055
Pseudo R^2				0.1838

Note: * = P<0.10, ** = P<0.05 and *** = P<0.01
Source: Field survey (2016)

This corroborates Ephraim *et al*. (2011) who reported negative significant influence of household size on access to subsidized coupons at P<0.05 and also reported significant influence of farm size on access to subsidized coupons at P<0.10 in Malawi though the marginal effect was positive which contradicted the present findings. This it might due the fact that the system in Malawi is that the larger farm size of the farmer, the higher the number of the fertilizer coupons the farmer can get unlike in Nigeria where all farmers were allocated with two bags of fertilizer irrespective of the farmer's farm size though Seko (2009) reported that there is no significant influence of farm size on access to subsidized agricultural inputs in Ethiopia though the relationship is positive.

A cursory look at the Table 5 also revealed that farming experience, extension contact, attending agricultural exhibition and consulting newspapers had positive marginal effect of 0.0004, 0.2748, 0.1386 and 0.1264, respectively. This implies that a unit increase change of these variables created changes of 0.04%, 27%, 14% and 13% increases on access to subsidized fertilizer under the scheme. This is probably due the fact the more the years of experience the more access to agricultural inputs. This is in line with Seko (2009) who reported the significant influence of extension contact on access to agricultural inputs in Malawi.

The results of Table 5 also showed that sex had negative marginal effect of -0.0273. This means that a unit increase of the male creates 2.73% decrease on access to subsidized fertilizer and this implies that females had more access to subsidized fertilizer than their male counterpart under the scheme though it was not significant. This is in line with Ephraim *et al.*

Journal of Agripreneurship and Sustainable Development (JASD)
Volume 1, Number 1, December, 2018
ISSN (Print): 2651-6144; ISSN (Online): 2651-6365

(2011) who reported that there was no significant influence of gender on access to subsidized coupons in Malawi. Age has negative marginal effect of -0.0025. This means that the unit increase in age creates 0.25% decreases on access to subsidized fertilizer under the scheme. This means that the older the age of the farmer the lesser the access to subsidized fertilizer under the scheme though it was not significant therefore this might occur by chance. This might be due to the fact that the program involves the use of cell phone which is a new innovation and aged farmers tend to resist the adoption of new innovations as well as the use of electronic text messages which need certain level of literacy. This is in line with Seko (2009) who reported that there is no significant influence of age on access to subsidized inputs in Ethiopia though the marginal effect was positive. The result is contradicting to Ephraim *et al*. (2011) who reported positive significant influence of farmer's age on access to subsidized fertilizer coupons at P>0.01. This is probably because the vulnerable members (the aged) of the society were given priority under the program in Malawi which is not the case in Nigeria.

Farmers' group membership has negative marginal effect of -0.0037, this implying that a unit change in non-group members creates 0.37% decrease of access to subsidized fertilizer under the E-wallet technology/scheme though it is not significant. This is likely due the fact that the program is an individually-based program not group. This is in line with Seko (2009) who reported absence of significant influence of farmer's group membership on access to subsidized input in Ethiopia.

Educational level, marital status, listening of agricultural radio program, viewing agricultural television program and attending agricultural show had positive marginal effects of 0.0004, 0.0138, 0.4723, 0.0596 and 0.0141, respectively. This means that the unit increase change in these variables creates increase changes on access to subsidized fertilizer by 0.04%, 1.38%, 47.23%, 5.96% and 1.41%, respectively under the program because the program involves reading of some electronic text messages, hence education plays a vital role.

The results in Table 6 showed the constraints faced the farmers in the adoption and access to E-wallet agricultural technology in the study area. These include inadequate registration point (27%), network problem (23.16%) and diversion of the inputs distributed (20.43%). This is in line with the report of Action Aids Nigeria (2014) which stated that the scheme had very low performance indices in term of redemption of inputs, although, there are yearly increase in farmers' participation and service delivery and adoption of the E-wallet agricultural farm input distribution technology. The Table 6 also revealed inadequate electricity for charging cell phones (17.89%); and high cost of cell phone (11.28%) as other constraints faced by the farmers in adoption and access to E-wallet agricultural input distribution technology in the study area. This is contrary to Okafor *et al.* (2013) who reported that 93% and 88% of the farmers had cell phones in Enugu State, Nigeria.

Table 6: Constraints of Adoption and Access to E-wallet Technology in the Study Area

Constraints	Frequency	Percentage	Rank
Inadequate registration point	140	27.24	1st
Mobile network problem	119	23.16	2nd
Registration of non-farmers	105	20.43	3rd
Inadequate electricity	92	17.89	4th
High cost of cell phone	58	11.28	5th
Total	*514	100.00	

Source: Field survey (2016); * Multiple response exists

CONCLUSION AND RECOMMENDATIONS

The adoption index of individual farmers has been developed to quantify the degree of adoption of new agricultural technology application of FYM, area under HYV (seeds, pesticide use, fertilizer) and number of irrigation applied were the parameters considered for developing adoption index. The farmers were classified as low adopters (below 40 percent AI), medium adopters (45-60 per cent AI) and high adopters (above 60 per cent AI). This study disclosed that in case of small farms, both sexes as well as age groups who were mostly non-literate were low adopters. In case of medium farms, both sexes as well as age groups who have Koranic and primary education were high adopters. In case of owners of large farms, only male children and adults were high adopters while females both children and adults were low adopters. Thus, the study concludes that adoption level of agricultural technologies in the study area was positively related with age, education level and farm size; and sex has least effect on adoption level. The study, therefore, recommended that agricultural technologies of E-wallet inputs distribution in the study area should be sustained; virile extension services through private extension services, farmers to farmers' extension approach should be encouraged in the study area.

REFERENCES

Action Aids Nigeria (2014). *Challenges and prospects of Agricultural Transformation Agender three years after the policy document.* Retrieved August 20, 2015 from http://www.actionaidforum.com.

Akinwumi, A. (2011). *Food insecurity in Nigeria's agricultural value-chain*: A paper presented at the Bank of Industries Nigerian Investment Forum, London.

Bastine, C. L. and Nair, E. R. N. (1988). "The extent of adoption and constraints in the adoption of improved technologies in paddy crops: A study of Kasoragod District of Kerala, India". *Journal of Tropical Agriculture,* **6**(3): 295 -298.

Chandra, N. (1992). *Determinants and impact of technology adoption on the farm economy in Chotanagpur region of Bihar.* Unpublished Ph.D. Thesis submitted to the division of Agricultural Economists I. A. R. I, New-Delhi India.

Eboh, E. C. (2009). *Social and Economic Research; Principles and Application.* Pp 102-105 and 171-176.

Ephraim, W. C., Matita M. and Dorward, A. (2011). Factors influencing access to agricultural input subsidy coupons in Malawi. *Journal of Future Agriculture*. **8**(2): 20-25.

Federal Ministry of Agriculture and Rural Development (2016). *National Food Security Programme,* Federal Republic of Nigeria.

Food and Agriculture Organization (FAO) (2010). *Agricultural biotechnologies in developing countries: Options and opportunities in crops, forestry, livestock, fisheries and agro-industry to face the challenges of food insecurity and climate change (ABDC-10)*. FAO International Technical Conference 1 -37.

Kushwaha, S. and Gupta, S. B. L. (1991). Resource allocation for alternative farming systems. *Rural Integration,* **8**(15): 8-15.

Okafor, G. O., Malizu, M. and Faith, C. (2013). New Media and Sustainable Agricultural Development in Nigeria. *Journal of New Media and Mass Communication*, **3**(20): 66-73.

Seko, K. K. (2009). *Analysis of agricultural input supply system: The case study of Dale Woreda Southern nations, nationalities and peoples' region.* Unpublished M.Sc. thesis, Haramaya University, Ethiopia.

Sani, M. H. (2000). *Sustainable Strategy for Vegetable Farming under Small-scale Fadama condition in Dass Local Government Area, Bauchi State.* Unpublished Ph.D. Thesis, Agricultural Economics and Extension Programme, School of Agriculture and Agricultural Technology, Abubakar Tafawa Balewa University, Bauchi, Nigeria, 198 Pp.

Sani, M. H. and Silas, Y. G. (2012). Socio-economic Determinants and Production Constraints in Adoption of New Variety of Acha (*Digitaria spp*) in Plateau State, Nigeria. *Continental Journal of Agricultural Economics,* **6**(3): 15-22.

Yadov, R. N. and Gangwar, A. C. (1987). "Factors affecting adoption of new rice technology in Dar-bhanga District, Bihar. A discriminate function approach". *Agricultural Situation in India,* **41**(9):811-814.

Yemi, A. (2012). Growth Enhancement Support Scheme (GES): *Towards the Transformation of Nigeria's Agricultural Sector*. Paper presented to Minister of Agriculture prepared by Ciuci Consultant, pp 1-5.

Yisa, E. S., Tsado, J. H. and Uzoma, C. A. (2010*). Adoption of Improved Technology Among Small Scale Cassava Farmers in Lapai Local Government Area, Niger State.* Proceedings of the 24th Annual National Conference of Farm Management Association of Nigeria 11th-14th October held at Adamawa State University, Mubi Nigeria.