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RESEARCH ARTICLE

Adoption of Sustainable Agricultural Practices among Farmers in Ohaukwu Local Government Area of Ebonyi State, Nigeria

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ABSTRACT

The study was conducted with the broad objective of determining the level of adoption of sustainable agricultural practices (SAPs) among farmers in Ohaukwu Local Government Area of Ebonyi State, Nigeria. Multistage, random, and systematic sampling procedures were employed to select 160 respondents for the study. The collected data were analyzed using relevant descriptive and inferential statistics suitable for each objective. The result showed that majority of the respondents were females who were married, having a mean age of 43 years and mean number of years of experience of 17. Majority of them acquired secondary school education while practicing Christianity and were engaged in the production of both crops and animals (mixed farming), having mean farm size of 0.8 ha in scattered plots and mean annual income of N71,400 which was regarded as low income. Most of the farmers were not members to any farmers' cooperative society. The predominant SAPs adopted included crop rotation, compost manure, and use of tolerant varieties. Furthermore, socioeconomic characteristics of the rural farmers were observed to have strong influence on adoption of SAPs by the farmers. The constraints to the adoption of SAPs among farmers were socioeconomic, political, and institutional. The null hypothesis tested using F-test was rejected at 5% level of significance. Consequently, it was concluded that socioeconomic characteristics of farmers actually influenced adoption of SAPs, though there were identified constraints that limited the level of adoption of such SAPs which if mitigated will improve adoption of the SAPs. Based on the study findings, the policy recommendations were that relevant agencies should ensure vigorous dissemination of information to farmers on available windows to low interest rate agricultural credit facilities by the government; reform in land tenure system should be facilitated to support adoption of SAPs; Nigerian agricultural extension program should be restructured to reflect sustainable agricultural context and emphasis; and farmers should be encouraged to seek meteorological information to minimize risks from adverse weather conditions. This will encourage adoption of SAPs and ensure that maximum result is achieved.

Key words: Adoption, agricultural, Ohaukwu Local Government Area, practices, sustainable

INTRODUCTION

Background of the study

Sustainability is a concept increasingly used in reference to economic performance of human activities and actions that affect not only the present but also future generations. These activities include farming, logging, and mining in relationship to the environment. Following the most general definition, an economic activity is considered sustainable if it could be carried out indefinitely. Therefore, for an activity to be sustainable, it must meet the present demand without jeopardizing its ability to meet the demands of generations to come. Sustainable

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agricultural production is the management and utilization of agricultural ecosystem in a way that maintains its biological diversity, productivity, regeneration capacity vitality, and ability to function so that it can fulfill the present and future significant economic and social functions that do not harm other ecosystems.[1] It aims at providing an adequate and dependable farm income, thereby reducing poverty.[2-4]

Sustainable agriculture, as defined by the FAO (2012), is "the management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generation." Therefore, this alternative ensures multidimensional sustainability.

Sustainable agriculture is an agricultural system adapted to a particular area so that crop and animal productions do not decline overtime and are reasonably stable over normal fluctuations of weather.[5-8] Francis and Youngberg (1990) indicated that sustainable agriculture satisfies human needs for fiber and food, protects natural resources and environmental quality. It is based on understanding the long-term impact of activities on the environment and other species, which invariably guides the application of resource conserving equitable farm system, maintains rural community and quality of life.

The issue of sustainable agricultural practices (SAPs) was introduced as a result of some problems associated with the cultivation of land overtime. Some of the SAPs include mixed cropping, cover cropping, organic manure application, minimum tillage, mulching, contour farming, crop rotation, intercropping, alley cropping, improved varieties green manure, and integrated pest management (IPM).[9-13].

Unsustainable agricultural practices have led to poor agricultural productivity in Nigeria, which is a major determinant of food insecurity.[14] According to Irepi (1995), the poor performance of Nigerian farmers is attributed to their lack of the use of SAPs and their lack of awareness of these SAPs, these practices are effective in increasing agricultural productivity and at the same time enhance the quality of the soil. Sustainable crop production practices minimize the use of non-renewable inputs that damage the environment or harm the health of crop farmers and consumers. The use of SAPs brings much benefit to the farming community in the long run in terms of combating hunger and poverty and enhancing higher agricultural productivity. Not only does sustainable agriculture address the protection of the environment but it also considers the returns on agricultural enterprise to the farmers. Therefore, sustainable agricultural production is not only worth pursuing but also inevitable. Although the benefits of SAPs are enormous, their use seems low.[15]

In Nigeria, the most serious challenge to agriculture is how to meet up with the food needs of the ever-increasing population in the face of political, social, cultural, and economic problems. However, little is known about the current state of progress in sustainable agriculture. One approach that might lead to such understanding is to gain insight into the adoption rate of SAPs in the rural areas. As defined in Rodriguez *et al*., adoption is the implementation and continued use of a practice. It is different from trial or experiment. Many studies have asserted a limited adoption of SAPs.[16-18] However, the information has neither been specially collected through an agricultural census nor officially published in most countries. Natural resources such as land, water, and energy are unsustainably used. This has brought about issues relating to gradual decline in land productivity such as topsoil depletion, erosion, and soil compaction in agrarian communities, including Ohaukwu Local Government Area (L.G.A) of Ebonyi State. Therefore, there is a knowledge gap in our understanding of the current state of adoption of SAPs at the sectoral, national, and regional levels.[19]

It is, therefore, necessary to change from harmful practices that bring about negative effects on the soil to more sustainable practices. To achieve this, policies and programs have to be developed and implemented to encourage farmers to utilize these practices. However, data on the extent of use of these practices in the study area are lacking. This study, therefore, assessed the extent of the application of SAPs among farmers in Ohaukwu L.G.A of Ebonyi State.

If land is expected to continue to produce, resource base must at least be maintained, rehabilitated, and properly managed. Fortunately, government and certain non-governmental agencies, for instance, the

Nigeria conservation society, are getting involved in creating an awareness of the need to use judiciously, and thus preserve, the Nigerian environment (Pretty, 1994). Although preservation and other measures so far taken are steps in the right direction, they do not appear to be adequate, particularly in ensuring a widespread knowledge, especially among rural farmers and Ohaukwu L.G.A farmers, in particular, of the relationship between the use of the environment and its effects on agricultural and rural development.

Objective of the study

The broad objective of the study was to determine the extent or level of adoption of SAPs among farmers in Ohaukwu L.G.A of Ebonyi State.

The specific objectives of the study were to: examine the socioeconomic characteristics of the farmers in Ohaukwu L.G.A, identify the SAPs adopted by crop farmers in the study area, determine the relationships between socioeconomic characteristics of the farmers and their adoption of SAPs in their agricultural production, and identify the constraints to the adoption of SAPs in Ohaukwu L.G.A. The hypothesis was stated that there is no significant relationship between the farmers' socioeconomic characteristics and their adoption of SAPs in agricultural production.

METHODOLOGY

The study area is Ohaukwu which is one of the 13 L.G.As in Ebonyi State, Nigeria, which is made up of 16 autonomous communities. The 16 autonomous communities include Ameku, Amoffia, Amaechi, Ezzangbo, Effium, Ekwashi, Umuezeaka, Nturakpa, Ukwagba, UmuoguduAkpu, OkposhiEshi, Amaike, UmuoguduOshia, Ishielu, and Umuakpu. According to the National Population Commission (2006), the total population of Ohaukwu Local Government is 196,337 with male population of 92,848 and female population of 103,489. It has an area of 517 km geographically and is located between latitude 0.06^{0N} and longitude 0.83^{0E}. Multistage, random, and systematic sampling procedures were used in this study to choose a total of 160 smallholder farmers from the L.G.A, whereas primary data were collected and analyzed using both descriptive and inferential statistics.

RESULTS DISCUSSION

Socioeconomic characteristics of farmers in the study area

The result of the analysis on gender of rural farmers as presented in Table 1 showed that majority (68.12%) of the respondents were female, whereas only few others (31.87%) were male. This implied that there were more females who engaged in agricultural production in the study area than males. This is in line with the finding of FAO (2007) as quoted that majority of rural farmers in Nigeria were female.[20]

The result of the analysis on age showed that majority (45.62%) of the respondents were between the age bracket 36–45 years while the least (5.62%) were those who were above 55 years. It was also observed that the mean age of the respondent farmers was 43 years. This means that most of the rural farmers in the study area were within the age of active workforce. This conforms to Mbam (2015) who reported that majority of rice farmers in Southeast Nigeria were between the age of 41–50 years.

The result of the analysis on farming experience showed that majority (63.75%) have spent between 11 and 20 years in farming, whereas the least (3.12%) had spent more than 30 years in farming. It was further observed that the mean number of years of experience of the respondents was 17 years. This implied that most of the rural farmers have spent adequate time in farming and so may have gathered enough experience needed to make profit in their different ventures. Similarly, Rodriguez (2009) reported that majority of rural farmers in India have spent at least 20 years in farming.[21]

The result of the analysis on educational level showed that majority (58.12%) acquired secondary school education, whereas a few (5.62%) were those who had acquired B.Sc or its equivalent. It was further observed that nobody had obtained any qualification above B.Sc among the rural farmers. The reason for the low acquisition of higher educational degrees among the farmers

Table 1: Description of socioeconomic characteristics of rural households in the study area

Socioeconomic characteristics	Frequency	Percentage	Mean
Gender (dummy)			
Male	51	31.87	
Female	109	68.12	
Total	160	100.00	
Age (years)			
15–25	12	7.50	43
26–35	39	24.37	
36–45	73	45.62	
46–55	27	16.87	
Above 55	09	5.62	
	160	100	
Farming experience (years)			
1–10	37	23.12	17
11–20	102	63.75	
21–30	16	1.00	
Above 30	05	3.12	
Total	160	100.00	
Educational qualification			
FSLC	21	13.12	
WAEC	93	58.12	
NCE	25	15.62	
HND	12	7.50	
B.Sc	09	5.62	
Above B.Sc	00	0.00	
	160	100.00	
Marital status			
Single	31	19.37	
Married	122	76.25	
Divorced	07	4.37	
	160	100.00	
Religion			
Christianity	142	88.75	
Islam	03	1.87	
African traditional religion	15	9.37	
	160	100.00	
Farm size (hectares)			
<0.5	45	28.12	0.8
0.6–1.0	89	55.62	
1.1–1.5	18	11.25	
1.6–2.0	06	3.75	
Above 2.0	02	1.25	
	160	100.00	
Type of farm production			
Animal	9	5.62	
Crops	60	37.50	
Both	91	56.87	
	160	100.00	
Annual income (₦)			
<20,000	7	4.37	71,400
20,001–40,000	15	9.37	
40,001–60,000	37	23.12	
60,001–80,000	93	58.12	
Above 80,000	8	5.00	
Total	160	100.00	
Membership to cooperative society			
Yes	31	19.37	
No	129	80.62	
	160	100.00	
Source of land			
Inherited	62	38.75	
Lease	48	30.00	
Communal	45	28.12	
Purchase	01	0.62	
Rented	04	2.50	
	160	100.00	

Source: Field survey, 2018

could be as a result of inadequate educational facilities existing in the area and it may be cost intensive for them to travel out to acquire such qualifications. This does not synchronize with the finding of Igwe (2013) which reported that majority of rural farmers in Ivo L.G.A were those who only acquired primary school education because education was not a prerequisite for agricultural production.

The result of the analysis on marital status showed that majority (76.25%) were married, whereas a few (4.37%) were divorced. This implied that most of the rural farmers in the study area were those who were married and so may have family needs they need to meet. Furthermore, the low percentage of those who were divorced could be because it is a sign of irresponsibility in Africa for divorce to occur and so, people tend to shy away from such status. This is in tandem with the finding of Keshavarz (2010) who reported that African traditions do not encourage divorce.[2,22]

The result of the analysis on religion showed that majority (88.75%) of the farmers were Christians while the least (1.87%) were those who practiced Islam. It

was further observed that only 9.37% of the farmers practiced African traditional religion. This means that most of the respondents believed in Jesus Christ as their savior. This could be because Christianity has been observed as the dominant religion in the Southeastern Nigeria ever since it overtook the African traditional religion in the early 80s.

The result of the analysis on farm size showed that majority of the respondents (55.62%) had farm size between 0.6 and 1.0 ha, whereas the least (1.25%) had farm size of above 2.5 ha. It was further observed that the mean farm size of the farmers was 0.8 ha in scattered plots. This further implied that the farmers did not engage in commercial agriculture, rather they engaged in small-scale farming which does not bring high return on investment. Similarly, Umeh and Odom (2013) in Onu and Onu (2016) reported that majority of rural farmers in Ohaozara L.G.A were small-scale farmers whose farm size was below 1.0 ha.

The result of the analysis on the type of farming showed that majority (56.87%) of the respondents were engaged in the production of both crops and animals (mixed farming) while the least (5.62%) were engaged in the production of only animals. Furthermore, about 37.5% were engaged in the production of only crops. This means that most of the respondent farmers were not specific in their production, rather they engaged in the production of both crops and animals. This is typical of the Nigerian farmers who do not specialize in production of either crops or animals but engages in the production of both crops and rearing of animal, all to meet their personal needs. This is in line with FAO (2013) which reported that majority of Nigerian farmers practiced mixed farming.

The result of the analysis on annual income showed that majority of the respondent farmers (58.12%) earned between N60,001 and N80,000 annually from farm production while the least (4.37%) were those whose annual farm income fall below N20,000. The mean annual income generated from the farming activities was N71,400 which was regarded as low income. This could be attributed to so many factors, which includes the small-scale farming which the farmers engaged in, as well as the fact that they did not specialize in, either crops or animals as specialization in an enterprise has been observed to be a prerequisite to improve production which leads to higher income. This does not synchronize with the finding of Azubuike (2014) which reported that for sustainable agriculture to be achieved, there is a need for specialization to ensure increased productivity and income.

The result of the analysis on membership to cooperatives showed that majority (80.62%) of the respondent farmers were not members to any farmers' cooperative society while only 19.37% were members of cooperative society. This implied that the most of the farmers did not belong to any farmers' association and so may be lacking information about recommended agricultural production practices. This is in conformity with the finding of Igwe (2013) which reported that majority of rural farmers in Ivo L.G.A did not belong to farmers' cooperative societies.

The result of the analysis on source of land for agricultural production showed that majority (38.75%) got land from inheritance, whereas the least (0.62%) purchased land for agricultural production. This means that most farmers did not pay for the land they used in agricultural production since they had inherited it from their family. This finding is against the result of Iwuanyanwu and Okereke (2017) which reported that majority of rural farmers in Ikeduru L.G.A of Imo State got land for agricultural production from communal ownership which does not encourage large-scale production.

Adoption of SAPs

From Table 2, it was observed from the analysis on the SAPs adopted by rural farmers in crop production that there were several agricultural practices which they adopted. The predominant practices adopted included crop rotation (90.44%), compost manure (84.71%), planting of tolerant varieties (80.89%), cover cropping (66.24%), and crop diversity (61.78%). Conversely, among the practices that were not adopted, the following were the least; alternative energy (6.36%), irrigation (9.55%), and alley cropping (10.82%). This work is in tandem with Fischer, Shah, and Velthuizen (2002) who reported that rural farmers found it difficult to adopt high-tech innovations such as irrigation and alternative energy.

Effect of the socioeconomic characteristics of the farmers on adoption of SAPs in their agricultural production

Table 3 shows that socioeconomic characteristics of the rural farmers have strong influence on adoption of SAPs. This was justified from the Z-value of 19.108 and Pearson goodness of fit which was 8807.020 and statistically significant at $P = 0.01$. The result also indicated that six out of seven variables considered met the a priori expectation while one did not.

The result for gender (X_1) was positively signed and significant at 1% ($P = 0.01$) level of significance. This implies that there is a direct relationship between gender of respondents and adoption of SAPs. This was in line with the a priori expectation as males in the study area are expected to have higher adoption level than the females.

Table 2: Adoption of sustainable agricultural practices

Variables	Frequency	Percentage
Crop rotation	142	90.44
Cover cropping	104	66.24
Crop diversity	97	61.78
Integrated pest management	79	50.31
Managed grazing	118	75.15
Local selling of produce	124	78.98
Alternative energy	10	6.36
Compost manure	133	84.71
Reduced tillage	64	40.47
Planting of tolerant varieties	127	80.89
Agro-forestry	85	54.14
Irrigation	15	9.55
Alley cropping	17	10.82

Source: Field survey, 2018. Multiple responses recorded

Table 3: Coefficient estimates of logit analysis on the effect of socioeconomic attributes on farmers adoption of sustainable agricultural practices

Variable symbols	Variable name	Coefficient estimates	Standard error	Sign. value
b_0	Constant	7.265	17.561	18.188
X_1	Gender	16.870	7.848	0.006*
X_2	Age	−0.918	3.847	0.003*
X_3	Educational level	5.205	2.070	0.043**
X_4	Household size	2.046	1.206	0.005*
X_5	Annual income	5.876	1.542	0.060***
X_6	Farm size	12.970	2.962	−0.684
X_7	Years of experience	−0.2238	0.781	0.330

Source: Field survey, 2018. **P=0.05 (95%)

Age (X_2) was found to be inversely related to the adoption of SAPs in the study area but was statistically significant at 1% (99% confidence interval). This shows that aged people did not adopt SAPs since they have fixed habits of doing things. It implies that the young ones are more driven to the adoption of SAPs than the aged. This is in line with the a priori expectation because it is only the young who have the energy and prone to risk-taking that adopts SAPs more than the aged. Moreover, the young were observed to be inquisitive and ready to utilize any available opportunity to make profit.

Education level (X_3) was positively signed and also significant at 1% (99% confidence interval). This means that the higher the number of years spent in formal education, the more the adoption of SAPs. This could be due to the fact that education is prerequisite to understanding the nitty-gritty of new practical techniques; therefore, educated farmers are more knowledgeable on that what to do to make more profit. This profit motive drives them into adopting new techniques to ensure that sustainable agricultural production is achieved. This is in line with the a priori expectation since education is an important condition for success in every venture. This is in line with the work of Ekwe (2012) who opined that education plays a role in determining the success of any agribusiness venture.

Household size (X_4) has positive influence on adoption of SAPs and statistically significant at 95% confidence interval. It implies that the higher the farmer's household size, the more he has the drive for adoption of SAPs. This is because a larger family will warrant the need to raise enough income to take care of them. Moreover, farmers with large household size have higher/wider information sources and so may adopt better than those whose household size is less.

Annual income (X_5) had a positive relationship with adoption of SAPs and was significant at 10% (90% confidence interval). This implies that the higher the income level of farmers, the higher the adoption of SAPs. This is in line with the a priori expectation since it has been observed that higher income warrants higher ability to pay for any improved technique needed to increase production and income. Azubuike (2015) reported that increase in income increases ability of farmers to adopt different sustainable agricultural production practices such as

crop rotation, cover crops planting, crop diversity, use of beneficial animals or natural pest predators, biointensive IPM, managed gazing, alternative energy, soil management, selection of sites, and among others.

Furthermore, the result also showed a positive relationship between farm size (X_6) and adoption of SAPs which was not significant at either 1%, 5%, or 10% level of significance. This was in line with the a priori expectation as farmers with bigger farm size tend to adopt more SAPs than those farmers whose farm size was smaller. This was in line with the findings of Asaka (2006), who reported that farmers with bigger farm size have used crop rotation for centuries as a technique to keep the soil healthy and avoid depleting it entirely of nutrients. Here, different crops are planted in different locations over several years in such a way that the succeeding crop helps replenish the nutrients the previous one has taken out of the soil or vice versa.

The result also showed that years of experience (X_7) had a negative relationship with the adoption of SAPs. This means that the higher the number of years a farmer is experienced in farming, the lower his adoption of SAPs. This is not in line with the a priori expectation since higher years of experience mean more knowledge in the farming and more possibility of making profits. This is because more experienced farmers know where to source their resources at the cheapest possible rate more than the inexperienced farmers. This work is contrary to the work of Mbam (2015) who opined that years of experience increase the farmers' access to microcredit used for investment in agriculture for adoption of SAPs. Conversely, younger farmers with less farming experience as a result of their age have greater drive to adopt innovative practices than their older counterparts with higher farming experience.

The final model is presented as follows:

$$Y = 7.265 + 16.870X_1 - 10.918X_2 + 5.205X_3 + 2.046X_4 + 5.87X_5 + 12.970X_6 - 2.23X_7$$
$$(17.561)\ (7.848)\quad (3.847)\ (2.070)\quad (1.206)\ (2.712)\quad (2.962)\ (0.781)$$

Constraints to adoption of SAPs

The result of the Varimax rotated component matrix (factor analysis) on the constraints to the adoption of SAPs as presented in Table 4 identified some variables which were regarded as constraints to the adoption of SAPs. These variables were classified into three groups, namely, socioeconomic, political, and institutional based on close resemblances. Socioeconomic constraints included lack of necessary capital for SAP (0.980), inadequate knowledge of SAPs (0.943), lack of necessary capital for SAP (0.875), land tenure system that does not support SAPs (0.714), and low literacy level (0.696). Political constraints were absence of government economic incentive (0.812) and unavailability of required input (0.698) while institutional constraints were inadequate contact with extension agent (0.991), climatic factors do not support sustainable agriculture (0.719), poor extension sustainable agricultural content (0.706), and lack of awareness of SAPs (0.679). This is in line with the finding of Schaller (2013) which reported that the constraints to the adoption of SAPs included low literacy level

Table 4: Constraints to the adoption of sustainable agricultural practices in the study area

Constraints	Socioeconomic	Political	Institutional
Lack of necessary capital for sustainable agricultural practice	0.980	0.023	−0.473
Climatic factors do not support sustainable agriculture	0.075	0.020	0.719
Poor extension sustainable agricultural content	0.009	−0.100	0.706
Inadequate contact with extension agent	0. 264	−0.222	0.911
Absence of government economic incentive	0.091	0.812	0.138
Lack of awareness of sustainable agricultural practices	0.024	−0.819	0.697
Inadequate knowledge of sustainable agricultural practices	0.943	−0.622	0.303
Land tenure system that does not support sustainable agricultural practices	0.714	0.005	0.015
Unavailability of required input	0.117	0.698	−0.611
Low literacy level	0.696	0.220	−0.931

Source: Field survey, 2018

and unavailability of required input, poor extension sustainable agricultural content, lack of necessary capital for SAP, absence of government economic incentive, and lack of awareness of SAPs.

Test of hypothesis

If F-cal >F-tab, reject null hypothesis otherwise accept the alternative. Therefore, since F-cal (82.67) >F-tab (3.71) at 0.05 level of significance, the null hypothesis which stated that there is no significant relationship between the farmers socioeconomic characteristics and their adoption of SAPs in agricultural production was rejected and the alternative which stated that there is a significant relationship between the farmers socioeconomic characteristics and their adoption of SAPs in agricultural production was accepted.

CONCLUSION

Result obtained from the study showed that the rural farmers actually adopted some SAPs in the study area to include crop rotation, compost manure, local selling of produce, planting of tolerant varieties, and managed grazing. It was also revealed that socioeconomic characteristics actually influenced adoption of SAPs though there were identified constraints that limited the level of adoption of such SAPs which if mitigated will enhance the adoption of the SAPs in the study area.

RECOMMENDATIONS

Based on the findings of the study, the following policy recommendations were put forward;

i. Relevant agencies should ensure vigorous dissemination of information to farmers on available windows to low interest rate agricultural credit facilities by the government
ii. Reform in land tenure system should be facilitated to support adoption of SAPs
iii. Nigerian agricultural extension program should be restructured to reflect sustainable agricultural context and emphasis
iv. Farmers should be encouraged to seek meteorological information to minimize risks from adverse weather conditions. This will encourage adoption of SAPs and ensure that maximum result is achieved.

REFERENCES

1. Asaba EB. Bridging the information and knowledge gap between urban. IAALD 2006;529:48-58.
2. Titilola D Economies of diversification: A generalization and decomposition of economies of scope. Int J Prod Econ 2000;126:229-35.
3. Umeh GN, Odom CN. Roles and constraints of youth associations in agricultural and rural development: Evidence from Aguata L.G.A of Anambra State, Nigeria, J Agricu Sci 2013;7:515-9.
4. Wilken LO. Diversification, vertical integration, and the regional pattern of dairy farm size. Rev Agricu Econ 1991;24:442-57.
5. Agute O. The management of indigenous with other knowledge system agricultural development: Challenges and opportunities for developing country. Sci Tech Inf Rural Dev 2001;529:48-58.
6. Azubuike C. Entrepreneurial social infrastructure: A necessary ingredient. Ann Am Acad Polit Soc Sci 2014;529:48-58.
7. Bayard VN, Jolly HC. Interactions in integrated agricultural systems: The past, present and future. Renew Agric Food Syst 2007;23:314-24.
8. Budelman RM. Organic Grain Farming in the United States: Report of the Findings from a Nationwide Survey Part I: Summary of Survey Responses. Manhattan, KS: Presented at 2006 Risk and Profit Conference; 2006.
9. Caswell U, Quagrainie KK, Engle CR. Analysis of catfish pricing and market dynamics: The role of imported catfish. J World Aquac Soc 2001;33:389-97.
10. Donahue ME, Troch W. Farming systems and poverty: Improving Farmers' Livelihoods in a Changing World. Rome, Italy, Washington, DC: World Bank, Food and Agriculture Organization of the United Nations (FAO); 2003.
11. Drost U, Dixon J, Gulliver A, Gibbon D. Farming Systems and Poverty: Improving Farmers' Livelihoods in a Changing World. Rome, Italy, Washington, DC: World Bank Food and Agriculture Organization of the United Nations (FAO); 1996.
12. Ekwe N. Smallholder Cash Crop Production under Market Liberalization: A New Institutional. Wallingford: CAB; 2014.
13. FAO. World Agriculture towards 2030/2050: Interim Report. Rome, Italy: Global Perspectives Studies Unit, Food and Agriculture Organization of the United Nations; 2002.
14. Igwe VC. Determinants of rural farmers climate change adaptation measure in Ivo L.G.A of Ebonyi State. Ebonyi: Ivo L.G.A; 2013.
15. Irepi F. The World Status of Desertification. Desertification Control Bulletin. Nairobi, Kenya: United Nations Environment Programme No 20; 1995.

16. Iwuanyanwu J, Okerek CO. Analysis of agricultural Risk Management Practices and Technologies Adopted by Crop Farmers in Ikeduru L.G.A of Imo State, Nigeria. Nigeria: L.G.A; 2017.
17. Keshavarz SA. Knowledge System Agricultural Development: Challenges and Opportunities for Developing Country Scientific and Technical Information and Rural Development. Frances: IAAD World Congress; 2010.
18. Mbam BN. Assessment of the Effects of Micro-credit Acquisition and Utilization for Agricultural Technologies Adoption by Rice Farmers of South East Nigeria. Nigeria: Micro-credit, Utilization, Rice Technologies; 2015.
19. NPC. Nigeria Census Figure. National PopulationCommission,Abuja.Relatóriode Gestãoexercício de para O FNO; 2010p. p. 176-20. Available from: http://www.basa.com.br/bancoamazonia2/includes/investidores/arquivos/processo_de_contas/fno/rgfno10.pdf. [Last accessed on 2011 Sep 17].
20. Kelsey LD, Hearne CC, editors. Onu and Onu A Concept of the Extension Education Process, in Cooperative Extension Work. Ithaca, New York: Cornell University Press; 2016.
21. Pretty R. Diversification, vertical integration, and the regional pattern of dairy farm size. Rev Agric Econ 1994;24:442-57.
22. Rodriguez O, Antle JM, Capalbo S, Mooney S, Elliott E, Paustian K. Spatial heterogeneity, contract design, and the efficiency of carbon sequestration policies for agriculture. J Environ Econ Manage 2009;529:48-58.