INFLUENCE OF PUBLIC AND PRIVATE SECTOR EXTENSION SERVICES IN THE ADOPTION OF IMPROVED CASSAVA VARIETIES BY FARMERS IN RIVERS STATE, NIGERIA

Emmanuel Ifeanyi Ogueri
Department of Agricultural Economics and Rural Sociology, Faculty of Agricultural Technology,
Niger Delta University, Wilberforce Island, Amassoma, Bayelsa State, Nigeria.
Corresponding authour: emma_ogueri@yahoo.com

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Abstract: The public sector extension service in Nigeria was anchored by the Agricultural Development Programmes (ADPs). In Rivers State, the ADP was established in 1987 as a semi-autonomous, self accounting unit with the Ministry of Agriculture and Natural Resources and funding was based on the following ration, RSG – 14%, FG-20% and world bank-66%.

Similarly, the private sector extension services in Rivers State was provided by the multinational oil and gas companies notably, SPDC, TEPNG and NAOC with SPDC taken the lead, hence its choice in the study. SPDC started agricultural projects in 1965 in Ogoni but the activities were blown to limelight in early 90s with 9 extension officers resident in the company's host communities called zones.
The main objectives of the public and private sector extension services was to ensure food security through communication of technologies to farmers for enhanced adoption of improved varieties and farming systems mostly in the areas of crop, fisheries and animal productions.

This study x-rayed the adoption of improved cassava varieties that was considered in great demand over local varieties (due to its numerous advantages) as a source of major staple food (garri, amala, fufu) in Nigeria.
Participatory and interactive bottom-up approach was employed to obtain data from the farmers and extension officers.
Simple descriptive statistics and Pearson correlation were used.
Technologies considered influential on improved cassava varieties adoption were planting time, planting length/population, planting distance (spacing), planting regime, weed control, appropriate fertilizer availability / application methods, harvesting time and other agronomic procedures.

Results showed moderate adoption of overall recommended technologies of improved cassava production from farmers served by the public and private sector extension services but relatively higher adoption rate by the private sector than the public sector. A phenomenon caused by additional incentives by the operators of the private sector extension system.
However, there was a significant difference in the adoption of recommended planting date between farmers reached by public and private extension officers. Conversely, there were no significant differences between farmers served by the extension systems with respect to the adoption of spacing, fertilizer type and fertilizer quantity.
Thus, it revealed that when the component technologies were pooled, their overall adoption was not significantly different between farmers served by the public and private sector extension services.
It was also found that private sector extension system operates like a social responsibility without legislative framework; hence their continued operation in Nigeria was doubtful. This situation could impose a serious threat to food security and negatively affect government transformation plan for agriculture.

It was recommended among others that the skills of extension officers of both public and private sectors be improved through periodic trainings. Regular logistics was important for effective extension system and that holistic approach using Research-Extension-Farmers-Inputs-Linkage-System (REFILS) should be employed and MTRM organized so that the farmers through the extension officers would constantly be informed of new varieties from the Research Institutes. Legislative framework would be a must for multinational oil and gas companies in Nigeria to continued support for agricultural development.

In conclusion, until cassava production is enhanced through mass adoption of improved varieties, the Federal Government plan of using cassava flour as input in bread production would introduce scarcity to source of Nigerian most staple food which could result to starvation. This scenario and security situation in Nigeria would rather be imagined than described.

Keywords: Agricultural extension value chain, Overall adoption, improved cassava production technologies, Food security, Public and Private sector extension system, Legislative framework.

Acronyms

ADP - Agricultural Development Programmes
SPDC - Shell Petroleum Development Company, Nigeria Limited
TEPNG - Total Exploration and Production Nigeria Limited
NAOC - Nigerian Agip Oil Company
MTRM - Monthly Technology Review Meeting
REFILS - Research Extension Farmers Input Linkage System
CSR - Corporate Social Responsibility
FAO - Food and Agricultural Organisation
IFAD - International Fund for Agricultural Development
NGO - Non Governmental Organisation
AFOD - Acceptability, Functionality, Operability and Durability
FTO - Freedom to Operate

CHAPTER 1: INTRODUCTION

In Nigeria, agriculture is the leading non-oil sector and its production is mainly by smallholders in rural communities who use traditional manual technology (World Bank, 1988) {1}. FAO (2005) {2}, reported that processing of agricultural products in Nigeria is as old as farming itself. In Nigeria, traditional foods processed at home or in small-scale cottage operations constitute the principal mode of utilization of cassava. Commercial livestock producers are fast adopting the use of cassava processed by-products in livestock feeding, appreciating its great potential in feed formulations. Cassava is also useful in several other industries, such as baking and brewing but the domestic consumption of cassava products has resulted in a limited availability of cassava products for industrial use. This underscores the importance of adoption of improved cassava production technologies to meet increasing demand for cassava products.

Increasing population densities and the consequent implications on food security and land availability for agricultural purposes according to Axinn and Throat (1972) {3}, have unveiled the need for adequate delivery systems for sustainable agricultural development. One sure way of achieving sustained improvements in traditional agriculture of resource-poor farmers is through effective agricultural extension services.

Extension is a major factor of success in increasing agricultural production and efficiency and for achieving rural development. Ineffective extension delivery will result to non-realization of Nigeria's agricultural transformation agenda and objectives of job creation and food security. The goal of extension education is to enable rural dwellers use relevant information, knowledge and skill to improve quality of life. It is against this background that extension services are evaluated.

Adoption of improved cassava production technologies by farmers in Rivers State, Nigeria had been widely influenced by the extension services delivery system. The system was championed by the Public and Private sectors.

It is important therefore, to deduce individual contributions of the Public and Private sector extension systems in this influential adoption equation of improved cassava technologies in Rivers State, Nigeria. It is against this backdrop that the study was anchored. The Agricultural Development Programmes (ADPs) were responsible for the Public sector agricultural transformation agenda while the Multinational oil and gas companies (SPDC, NAOC and TEPNG) represent the Private sector that are influential, not only in the general economic agenda of Nigeria but also in the rural community transformation agenda of Niger Delta, the seat of oil and gas in Nigeria. Agriculture is treated as Corporate Social Responsibility (CSR) and rural development strategy by the Private sector system as over 80% of Nigerian rural dwellers live on subsistent agriculture and over 90% cultivate cassava. Unfortunately, yields of cassava tubers are fast diminishing as a result of climate change and other human factors especially in the oil rich communities. It became imperative that to sustain food and industrial needs in Nigeria, the cultivation of improved cassava varieties should be enhanced. Technically speaking, technologies to stimulate adoption of improved cassava production ought to be communicated by the Extension officers of the Public and Private sectors.

The effectiveness of supports from these sectors will certainly influence adoption of improved cassava production technologies which is the subject of this study.

The key objective of this study is to compare the influence of the Public and Private sector extension services in the adoption of improved cassava

production technologies bearing in mind the agronomic procedures and effectiveness of extension officers.

CHAPTER 2: CONCEPTUAL MODEL / METHODOLOGY OF THE STUDY

The Public and Private sector extension delivery services to farmers were based on their respective mandates. Whereas the public sector has legislative backup to legitimize its activities in the area of agricultural development, the private sector's mandate was for oil and gas exploration and production, hence extension advisory services were approached from CSR point of view. However, they synergize sometimes to compliment each other's efforts towards empowering cassava farmers in Rivers State, Nigeria, as they commonly target the rural farmers. The overall purpose is a constructive attempt towards bringing the rural farmers to comfortable region through improved standard of living.

Thus, the concept of this study was that comprehension of extension messages delivered to cassava farmers by the public and private sector extension services was demonstrated on component technologies and overall adoption rates. By implication, this would be contributory to increased household income, improved living standard and increased food security, a transformation agenda in Nigerian. It was upon these biases (if you like) that the study was tailored.

2.2 Methodology

The location of the study area was between longitude 5 & 8 degrees East and latitudes 4 & 6 degrees North within the River Niger Delta on the West African coast. Rivers State has an area of 19,420 square kilometers. The major significance of the State in the Nigerian economy is its contribution to the oil and gas production capacity of Nigeria. A long rainy season that lasts from April to October prevails in the area and this has significant impact on agriculture; with a dry season that lasts from November to March with interrupted occasional sporadic rainfall.

Data was collected through pre-tested structured questionnaires and focused group discussions (FGD). The variables on which data were collected included demographic and socio-economic characteristics of farmers, farmers' adoption or otherwise of recommended cassava production technologies including exhibition of known extension skills.

A total of 20 communities known for cassava growing were selected in Rivers State. Eight farmers were selected from each of the communities given preference to farmers that were formed into co-operatives. This was to demonstrate seriousness in working as team to access available resources like farm inputs and credit including emerging technologies to enhance expected farm income. Therefore a total of 160 farmers were selected as respondents with equal distribution of 80 farmers each for the Public and Private Extension agencies.

Agronomic procedures considered in the study as extension technologies were: (a) Cassava varieties (b) Planting date (c) Spacing (d) Weed control method (e) Weeding interval (f) Fertilizer type (g) Fertilizer quantity and (h) Disease control (i) Effective extension skills such as communication, frequency of farm visits, among others.

For each respondent, the score from the component technologies were added to obtain the overall Adoption score. It was a maximum score of 8 and a minimum score of 0. The scores were used in describing the degrees of adoption thus;

Score	Degree of Adoption
0 – 3	Low
4 – 5	Moderate
6 – 8	High

Data were analyzed using frequency counts, percentages, means, t-statistics and Pearson correlation. The t-statistics was used to verify differential adoption rates of the recommended cassava production technologies between the farmers advised by Public and Private sectors extension officers.

The study considered the influence of the Public and Private sectors extension delivery on adoption of improved cassava production technologies and not effectiveness. This was because a study on effectiveness would involve a critical analysis of the objectives of each extension system which are very different and hence could not be judged on equal pedestrian. This could be seen as limitation to the study.

A major limitation of the study was the use of t-test in analyzing the differences between farmers served by the public and private extension systems which was based on the sample size used in data analysis of 152. Thus, with t-test, when $N > 130$, findings became less valid and could affect generalization of findings to other areas not contiguous to the Nigerian Niger Delta.

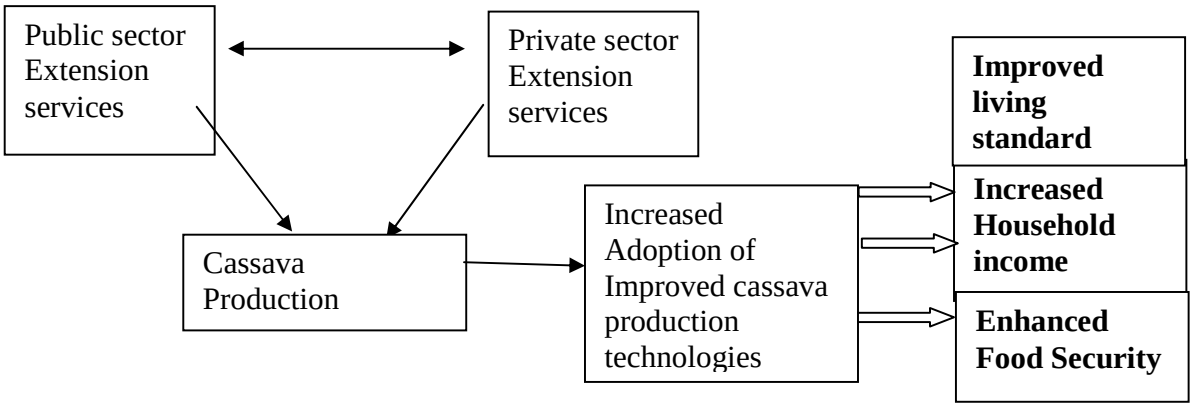

Fig 1. Conceptual model of study

Table 1: Percentage Distribution of Age of farmers served by Public and Private Extension systems

Age category	Public extension farmers (n+74)	Private sector extension farmers (n=78)	All farmers (N=152)
Less than 30 years	8	6	7
30 – 39yrs	31	36	33
40 – 49 yrs	32	32	32
50 – 59yrs	22	22	22
60 yrs and above	7	4	6
Total	100.0	100.0	100.0

Source: Field survey 2010

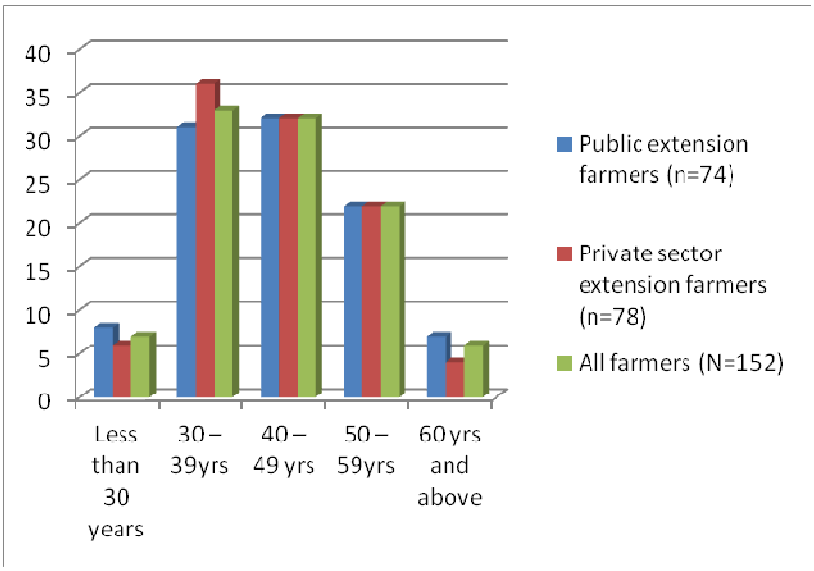

Fig 2. Age distribution of Farmers served by both extension systems

CHAPTER 3: RESULTS PRESENTATIONS AND DISCUSSIONS

This chapter presents and discusses relevant results of the study that were organized into the following;
(a) Socio-economic characteristics of responding farmers (b) Extension messages on improved cassava production (c) Adoption rate based on available technologies (d) Factors that influenced adoption of improved cassava varieties (e) Possible factors that influenced the factors that influenced adoption of improved cassava technologies.

3.1 Socio-economic characteristics

As stated earlier, 152 respondents (78 for Private sector and 74 for the Public sector) were used in the analysis. There appeared to be very low significant difference in the distribution of respondents of both sectors, hence results therefore were generalized.

3.1.1 Gender

Cassava production in Nigeria in general was regarded as women crop. However, the tradition of land ownership affected ownership of such crop especially when interests are focused on it. Recently, Nigerian government had revamped agricultural transformation to ensure food security through a number of favourable policies. Thus, the males had rekindled their interest on the crop; a perceived disadvantageous scenario for most women in developing countries. According to FAO (2005) {4}, women play prominent role in agricultural production. The extent of their involvement in agricultural production and their contribution to the household food basket varies from one ethnic group to the other. IFAD (1994){5}, reported that overall, women play a central role in cassava production, contributing about 58 percent of the total agricultural labour in the southwest, 67 percent in the southeast and 58 percent in the central zones, with involvement in virtually all activities, hoeing, weeding, harvesting, transporting, storing, processing, marketing and domestic chores.
The study therefore recorded 76% and 62% of famers served by the public and private sectors extension delivery system as male while the females were 24% and 38% respectively. This is very close to the affirmative action in Nigeria where the females asked for at least 35% of every elective and appointive position in governance.

3.1.4 Membership of Co-operative Groups

Membership of farmers' co-operative groups could influence mass adoption of improved farm practices. New and improved cassava production technologies could be learned in the groups and subsequently put into practice by various farmers in their respective farms. Table 3 indicates that only 14% of the farmers served by Public extension belonged to co-operative groups. Conversely, the Private sector had over 80% of contact farmers as members of co-operative groups. These results seem to suggest that the private-sector extension service is effective in organizing farmers into co-operatives; a poser that will enhance mass adoption.

One factor that affected this was that the men thought the study would attract some monetary rewards by government to cassava farmers; a situation that could be used to adjudge what the rural women goes through in their respective homes. This scenario may have negative influence on data generated except that the presence of the duo was needed during the focused group discussion (FGD). It therefore has to be recommended that conscious efforts be made towards formation of all women farmers co-operative societies in the rural communities of Rivers State to ensure direct empowerment for the women.

3.1.2 Age

Age is a factor that is usually considered in agricultural production as it may or otherwise influence the farmers' agricultural activities as Nweke, (1996) {6}, Adesope and Nwankwo, (1996) {7}, Asiabaka and Bamisile, (1992) {8} recorded.
The age of respondents ranged from less than 30 to over 60 (Table 1). About 32% of farmers served by each extension system were aged between 40 – 49 years. Only 7% and 4% of farmers served by the public and private extension system respectively were aged above 59%. It could therefore be inferred from the results presented on Table 1 that the farmers served by extension organizations are not mostly old people as it is often alleged. Thus from the age distribution, the majority of the respondents could undertake the arduous task of cassava production.

3.1.3 Level of Formal Education

Approximately, 15% of the farmers served by the private sector extension had not been to any formal school. About 38% of farmers served by the Public sector had a primary school education; suggesting that the private sector was more grass-root oriented (Table 2). Education may however have implications on understanding extension massages and by extension effect on adoption rate of improved cassava technologies. It could be seen to have direct effect on food security and could serve as a veritable tool in the transformation agenda of the Nigerian government, hence the huge budget allocation in the 2012 budget. It could also be concluded that educational level has significant effect on the adoption of improved cassava technologies to with regard to comprehension of extension messages.

Table 2: Percentage Distribution of Farmers by Level of Formal Education

Educational level	Public Sector Farmers (n=74)	Private sector Farmers (n=78)	All Farmers (N=152)
No formal education	0.0	15.4	7.9
Primary education	37.8	47.4	42.8
Secondary education	32.4	29.5	30.9
Post secondary education (Diploma)	24.3	2.6	13.2
Post secondary education (Degree)	5.4	5.1	5.2
Total	99.9	99.9	100.0

Table 3: Percentage Distribution of Farmers by Membership of Co-operative Groups

Co-operative membership	Public Extension Farmers (n=74)	Private Farmers Extension (n=78)	All Farmers (N=152)
Member	14	81	48
Non-member	86	19	52
Total	100.0	100.0	100.0

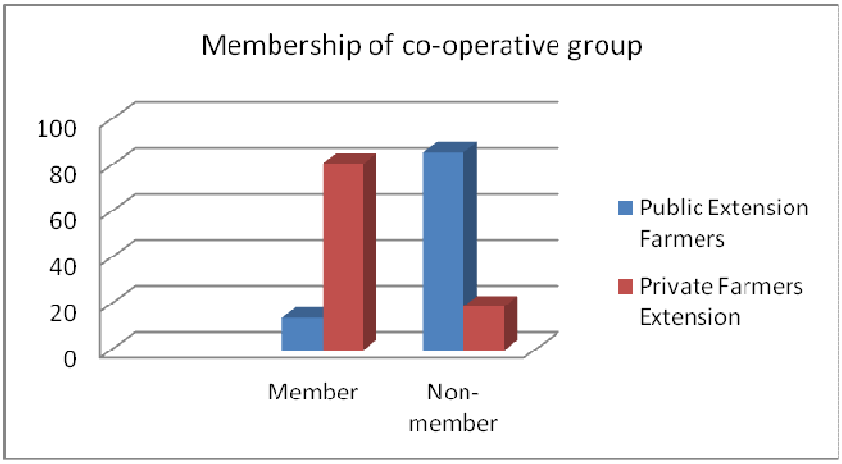

Fig 3: Co-operative group adoption strategy

3.2 EXTENSION MESSAGES ON IMPROVED CASSAVA PRODUCTION

Agricultural extension is problem solving mechanism aimed at empowering the farmers to improve their well being. Any agricultural advisory service that does not add value to farmers' knowledge along the value chain is not extension. Therefore, extension as a major input towards agricultural transformation requires its supply value chain.

Thus, the value chain extension services entail added value in planning with the farmers, execution with the farmers, monitoring with the farmers and evaluating with the farmers. The farmers should know the sources and prices of various agricultural inputs to reduce dependence on the extension officers and research.

Best practice should be explored aimed at increased household income, improved standard of living and availability and affordability (security) of food.

It therefore means that extension messages should be built on technologies that had been tested and proven to reduce efforts by extension officers to encourage mass adoption. The extension officers ought to be conversant with the characteristics of improved cassava varieties. Extension messages should be built around these characteristics so that advocacy on adoption will be less labourious.

Agricultural Extension value chain will improve the do-ability and sustainability of adoption of technologies using Research-Extension-Farmers-Input-Linkage system (REFILS) inclusive of Processing and Marketing to improve the LINKAGE structure. Extension as a dynamic, living subject should always explore avenues to address ever increasing problems facing rural dwellers not only in agriculture but also in other socio-economic spheres of life. In this regard, I submit that contemporary agricultural extension programmes should be "Exploratory" towards re-engineering the psyche of rural dwellers to maintain the value system that encourages systematic and sustainable activities for wealth creation – agriculture, fisheries, health and other neighbourhood economic development initiatives that could gainfully engage the youths. By so doing, extension services would be seen not only as avenue to improve food security but also for job creation to engage the teeming population of idle youths that hitherto engage in militancy and terrorist attacks in Nigeria.

3.3 ADOPTION RATE BASED ON AVAILABLE TECHNOLOGIES

There are certain technologies that could activate adoption of improved cassava varieties in Nigeria. These technologies are tangible and some intangible. Factors also exist that could accelerate the use of these technologies. The bottom line is that adoption rate is increased. When these factors are positively significant to adoption, extension messages are built around them to accelerate adoption, when otherwise they will be down-played to avoid discouraging farmers.

There exist positive relationship between adoption and improved standard of living of the rural populace; hence some policies can revolve around such scenario as rural development strategy that could be practiced within a transformation agenda, Abrew (2003) {9}, Birkhaeuser, Evenson and Feder (1988) {10}, Alex (2002) {11} and Beets, Rivera, Moore, Yang and Hu (1996) {12}. Therefore, it is imperative in this study to understand which of these factors could influence or vice versa public and private sectors extension system. The reason was to identify factors that either of the extension system has comparative advantage based on various degree and disposition of influence towards adoption of improved cassava technologies.

3.3.1 Rank of Cassava among crops grown

In Nigeria and indeed Rivers State, cassava is usually grown in mixture with crops such as yam, maize, sweet potato and plantain. Table 4 gives the percentage distribution of respondents by rank of cassava among crops grown. Cassava production sustains livelihood in developing countries and also supports income generation as deduced by Dexon, Gulliver and Gibbon (2001) {13}, Christoplos (2003) {14}, Ellis (1999) {15} and FAO (1999) {16}. While 69% of the Public extension system farmers ranked cassava their number one crop, only 37% of the Private extension system ranked it same. The crop was ranked second by 24% and 17% of the public and private extensions respectively. The mean ranks of 1.38 (public) and 2.37 (private) indicate that cassava was considered more important by the public extension served farmers than the private extension farmers. The reason for this could be differential emphasis on cassava by the extension organizations. The farmers served by the private extension service in addition to improved cassava varieties also preferred other crops that the sector placed incentives on; for instance gadaba (Plantain) and ginger. It was important to note that both public and private sectors extension ranked cassava as number one; hence any decision taken would influence its adoption. Therefore, it could be concluded that the Public sector extension with regard to convincing farmers to grow cassava was more effective than the private sector extension.

Table 4: Percentage Distribution of Farmers by Rank of Cassava among crops grown.

Rank of Cassava	ADP Farmers (n=74)	SPDC Farmers (n=78)	All Farmers (N=152)
1	69	37	53
2	24	17	20
3	7	29	18
4	0	11	6
5	0	3	1
Below 5	0	3	1
Total	100	100	99.9*
Mean	1.38	2.37	1.88

*Figures summation is < or > 100due to round-off errors
Source: Field survey, 2010

Table 5: Percentage Distribution of Farmers by farm size devoted to improved cassava

Farm size (ha)	Public Extension Farmers (n=74)	Private Extension Farmers (n=78)	All Farmers (N=152)
Less than 0.6	10	15	13
0.6 – 1.0	15	34	25
1.1 – 2.0	37	27	32
Above 2.0	39	24	31
Mean (ha)	2.35	1.66	2.01

Source: Field survey, 2010

Table 6: Percentage Distribution of Farmers as Influenced by Adoption of some Recommended Cassava Production Technologies.

Production Technologies	Public Extension Sector Farmers (n=74)	Private Extension Farmers (n=78)	All Farmers (N=152)
Planting date	74	91	83
Spacing	78	90	84
Weed control	100	100	100
Appropriate fertilizer	76	69	72
Appropriate Fertilizer quantity	38	27	32

Source: Field survey 2010

Table 7: Percentage Distribution of Farmers by Overall Adoption Level of Recommended Cassava Production Technologies.

Adoption Level	Public Sector Extension Farmers	Private Sector Extension Farmers	All Farmers
Low	34	26	30
Moderate	58	60	59
High	8	14	11
Total	100.0	100.0	100.0

Source: Field Survey 2010

3.3.2 Farm Size Cultivated with Improved Varieties

Table 5 showed that 50% of the private extension farmers did not have cassava farms that were more than a hectare. The corresponding response among the public extension farmers was 25%. A total of 39% of the public extension farmers had above 2 hectares while only 24% of the private sector extension farmers cultivate above 2 hectares. The means of 2.35 hectares for the public sector and 1.66 hectares for the private farmers indicates that more land was devoted to cassava by the public sector farmers. This was not surprising given that cassava ranked higher by the public sector farmers among crops grown. It could suggest that more return on investment (ROI) from the cultivation of improved cassava varieties would have triggered a lot of interest among the public extension farmers as opined by FAO (2001) {17} and FAO (2002a) {18}.

The means also conform to a priori knowledge that farmers in Nigeria are largely small scale and generally cultivate less than 5.0 hectares, according to Nwaru, (1993){19}.

Conclusively, if the recent fight against food insecurity in Nigeria would be meaningful, farmers' holdings would need to be increased especially on improved cassava based on expanded demand in recent times; not only to meet domestic needs but also to meet advocated industrial needs.

3.4: General Adoption of Recommended Production Technologies based on Influences of the Public and Private Extension Systems

Technologies were based on approved agronomic procedures that were peculiar with characteristics of improved cassava varieties. A typical example among others was reduced weeding of farm as a result of early canopies formed by the improved cassava varieties to suppress emerging weeds. Thus cost was saved including other characteristics of high yield and disease resistance.

Few technologies considered in the study were (a) Spacing (b) Planting date (c) Weed control (d) Appropriate fertilizer and (e) Appropriate Fertilizer quantity

Table 6 refers. The public and private sector extension services competitively played major roles towards influencing adoption of recommended technologies on improved cassava varieties.

It was deduced that it was as a result of synergy between the two extension systems in River State that existing level of adoption was recorded regardless existing constraints. The Monthly Technology reviewed meetings (MTRM) usually organized by the public sector was being attended by the private sector extension officers. By extension, they started inviting the farmers served by them. It was also obvious that the co-operative strategy paid off because co-operative formation was based on enterprises and location (communities) and not on the extension system. Thus there was free-flow of information among farmers regardless the extension services that provided them with technologies. This system obviously had implication on the overall adoption of improved cassava varieties in the region. The implication of this was that sustainability indices of Acceptability, Functionality, Operability and Durability - AFOD (Ogueri and Nnadi 2010) {20} were enhanced.

However, due to climatic change associated issues of oil and gas exploration and exploitation in the oil rich Niger Delta, the private sector extension farmers started mounting pressure to organize their own farmers co-operative system. To avoid the effect of refusal on the "sustainable Freedom to operate - FTO", the multinational oil and gas companies agreed to that with some specific incentives. Thus, the farmers served specifically by the private sector extension services felt privileged to receive some incentives as inputs. This attitude however created dichotomy that had persisted till date.

However, the sustainability of the incentives by the private sector extension system had become worrisome as some of them were scaling down operations in this regard while developing plans to handover agricultural activities to local community foundations to manage. This move had been observed to have a serious effect on the expanded use of cassava produce as advocated by the Federal Government of Nigeria.

3.4.1 Overall Adoption Level of Cassava Production Technologies

A summary of farmers' adoption of the composite production technologies pooled together as overall adoption was presented on Table 7. The table showed that the majority of the farmers of public and private sector extension systems were moderate adopters of production technologies as evidenced by 58% and 60% for the public and private sectors extension systems respectively. It followed a trend in their adoption of various technologies as delivered by each of the extension systems in Table 6 above. The implication to be drawn on the table was that there was selective adoption of component technologies either as a result of input-supported extension delivery system and or effective communication due to professionalism of the extension officers.

Secondly, the 14% high level adoption of the private sector extension system against 8% of the public sector could be attributed to associated inputs as incentives. These included availability and subsidized appropriate fertilizers, logistics assistance in the conveyance of inputs to farm sites (a system that had defrayed some part of production costs), among others.

Conclusively, the synergistic approach employed by the public and private sector extension services in Rivers State had yielded positive influence on the adoption of improved cassava varieties. Therefore, instead of playing competitive roles, the complimentary roles that had helped adoption should be encouraged. It is good to point out that while the public sector extension system has a legislative framework as a result of originality of their mandate, the private sector extension system operates without a legislative framework. This phenomenon appears dangerous as some private extension system were winding down their activities like Shell Petroleum Development Company Nigeria Limited (SPDC). Total Exploration and Production Nigeria Limited is de-emphasizing improved cassava distribution to assumed contact farmers that were not organized while Nigerian Agip Oil Company (Green River Project) thought they have reached saturation point in the distribution of improved cassava varieties.

It therefore behooves on government to ensure non-extinction of private extension system in Nigeria by establishing legislative framework to guide non-core activities of the private sector. The private sector under good governance stands to gain a lot if the extension system activities are legitimized as it could attract tax and royalty rebate to the extent of degree of compliance.

3.4.2 Factors that Influenced the Influence of Public and Private Sector Extension Systems in the Adoption of Improved Cassava Production Technologies

The study brought to limelight certain factors that influenced the public and Private sector extension systems in the overall adoption. Using Pearson Correlation analysis, the factors were shown in Tables 8 and 9 below for the private and public sectors extension systems respectively. It was therefore deduced that factors like educational level, Farming experience, number of years as contact farmers, membership of co-operatives, rank of cassava among other crops, size of farm, number of visits of extension officers, skills of extension officers and appropriate agronomic procedures influenced the adoption of improved cassava production technologies. Thus, the extension agents from both public and private sectors were at home with these factors to influence overall adoption of improved cassava varieties.

The lesson to be learnt here is that every crop has factors that influence its adoption. To ensure improved adoption of species of crop, the Extension Officers (Public and Private) should be familiar with factors that influence adoption of a particular crop, get acquainted with the merits and demerits of such factors and develop extension messages around such factors. With effective communication ability, this could be a panacea to adoption problems.

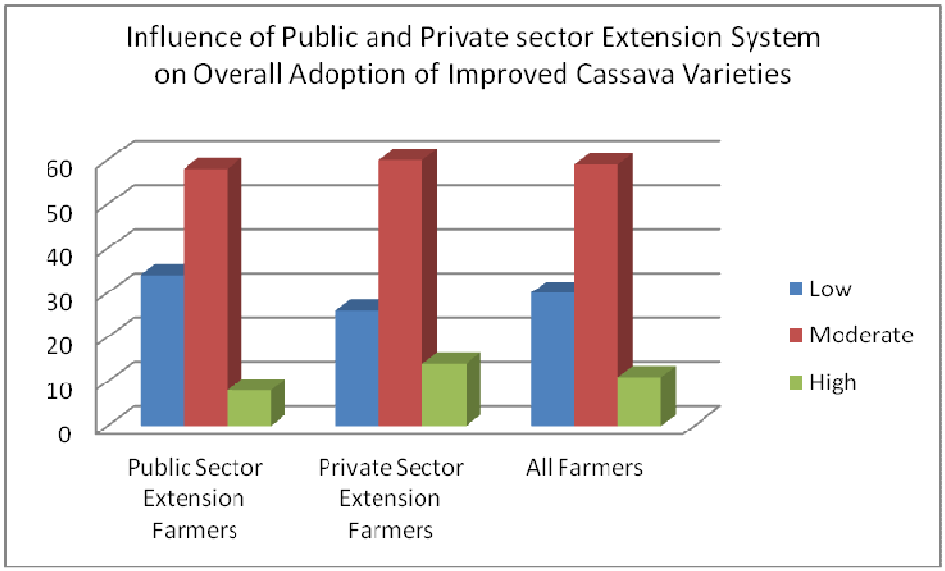

Fig 4: Influence of public and private extensions on overall adoption

Table 8: Correlation Matrix showing Relationships Between Variables among farmers served by the Private sector Extension system

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	1.00																
2	**-0.28	1.00															
3	-0.14	*-0.23	1.00														
4	**0.60	0.05	*-0.27	1.00													
5	0.19	-0.06	-0.10	**0.42	1.00												
6	-0.03	-0.17	**0.44	-0.08	-0.02	1.00											
7	-0.19	**0.43	*-0.23	**0.38	**0.35	-0.13	1.00										
8	0.08	0.08	0.21	0.13	*0.23	0.17	0.03	1.00									
9	*0.23	**-0.35	-0.04	*0.25	**0.38	-0.01	-0.01	-0.05	1.00								
10	0.06	0.07	-0.07	0.11	0.13	-0.11	0.07	*-0.24	-0.08	1.00							
11	-0.01	0.19	**-0.36	*0.25	0.10	*0.30	**0.40	-0.03	0.17	-0.02	1.00						
12	-0.14	0.09	-0.21	0.02	-0.03	*0.23	0.06	0.00	0.13	0.09	0.03	1.00					
13	0.20	0.10	0.05	0.00	* -0.29	0.12	**-0.37	0.01	*-0.28	0.18	-0.09	0.03	1.00				
14	0.14	0.16	-0.07	**0.34	-0.09	-0.13	0.11	-0.09	0.17	**0.34	*0.25	0.04	0.05	1.00			
15	-0.06	0.18	-0.02	0.22	**0.42	0.02	*0.24	0.05	**0.39	0.12	*0.29	0.03	-0.08	0.19	1.00		
16	0.11	**-0.05	0.13	0.05	*0.28	0.11	*0.24	-0.20	**0.68	0.15	-0.07	0.04	*-0.28	-0.01	*0.23	1.00	
17	**0.35	**0.30	-0.09	**0.34	**0.40	0.00	-0.04	-0.11	**0.69	-0.08	-0.02	-0.08	**0.23	0.09	0.01	**0.40	1.00

*shows coefficient is significant at P<=0.05

** shows coefficient is significant at P <=0.10

Variable definitions

1. = Age, 2. = Gender, 3. = Educational level, 4. = Farming experience, 5. = Number of years as contact farmer, 6. = membership of co-operative group, 7. = Rank of cassava among crops grown, 8. = size of cassava farm, 9. Overall adoption, 10. =number of extension visits 11.= skill of the extension officer, 12.= availability of planting material, 13. = availability of fertilizer, 14. = planting date, 15.= spacing, 16.= fertilizer type, 17.=fertilizer quality

Table 9 Correlation Matrix showing Relationships Between Variables among farmers served by the Public sector Extension system

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	1.00																
2	-0.12	1.00															
3	-0.08	*-0.26	1.00														
4	**0.60	-0.16	*-0.09	1.00													
5	**0.40	-0.05	**-0.33	**0.43	1.00												
6	*0.24	-0.13	-0.01	**0.41	0.21	1.00											
7	0.02	-0.15	-0.02	0.04	0.10	0.02	1.00										
8	-0.01	-0.16	-0.07	0.17	-0.07	-0.07	0.03	1.00									
9	-0.15	-0.1	-0.02	-0.05	0.06	-0.04	-0.06	0.22	1.00								
10	-0.01	0.11	0.05	-0.13	-0.17	-0.22	0.02	*0.24	0.14	1.00							
11	-0.03	0.07	**0.30	-0.19	**0.31	-0.22	-0.03	-0.12	*-0.25	0.17	1.00						
12	0.15	0.03	0.02	0.11	0.03	-0.15	-0.15	0.07	0.07	0.05	0.23	1.00					
13	0.18	-0.17	-0.03	*0.25	0.13	**0.39	-0.14	-0.05	0.07	-0.16	-0.07	0.18	1.00				
14	0.15	0.12	-0.01	-0.08	-0.11	0.05	-0.04	0.14	**0.65	0.00	-0.08	0.04	0.08	1.00			
15	-0.10	0.07	-0.04	-0.13	-0.03	*0.25	0.16	*0.24	**0.57	0.19	0.11	-0.02	0.02	*0.59	1.00		
16	-0.06	0.03	-0.23	0.13	*0.24	0.05	-0.10	0.12	**0.64	0.12	**0.36	0.05	0.11	**0.32	*0.24	1.00	
17	0.05	0.08	**-0.46	0.22	0.22	-0.12	0.02	**0.33	**0.45	0.11	-0.16	0.02	0.23	0.14	0.14	**0.44	1.00

*shows coefficient is significant at P<=0.05

** shows coefficient is significant at P <=0.10

Variable definitions

1.= Age, 2. = Gender, 3.= Educational level, 4.= Farming experience, 5. = Number of years as contact farmer, 6. = membership of co-operative group, 7.= Rank of cassava among crops grown, 8. = size of cassava farm, 9. Overall adoption,10. =number of extension visits 11.= skill of the extension officer, 12.= availability of planting material, 13. = availability of fertilizer, 14. = planting date, 15.= spacing, 16.= fertilizer type, 17.=fertilizer quality

CHAPTER 4: SUMMARY, RECOMMENDATIONS AND CONCLUSION

4.1 Summary

There were certain factors that influenced adoption of improved cassava production technologies. These factors could be dynamic based on the species of improved cassava especially with regard to agronomic procedures.

Effective Extension system calls for understanding of these factors so that Extension messages could be built around them for enhanced adoption of technologies.

The influence of male folks on crops that hitherto were not prominent but gained prominence as a result of government policy or incentives should be checked. The land tenure system operating in Nigeria had denied most women ownership of land while their farming activities could go ahead on the said land. The implication of this denies the females voice to make claims even on their crops. This was more prominent in the private extension system where extension services were as a result of long time oil and gas exploration in the region; hence incentives were attached to influence adoption.

Extension is effective communication hence basic formal education contributed to realizing the levels of adoption recorded. However, it could be doubtful if such basics could make meaningful contribution towards food security in Nigeria. Commercialized agriculture would require professionals to embrace recent technologies towards feeding the ever-growing population in Nigeria. However, this is not the case in Nigeria due to high illiteracy level.

Famers' co-operative groups help in resource utilization in the adoption process. Economy of scale and access to opportunities are few advantages of co-operative systems and extension officers should be brave enough to grab these opportunities when they call. It could be another way towards pursuing peace in Nigeria thereby reducing the wanton destruction of crops and other social vices among the Fulani herdsmen and farmers in various parts of Nigeria.

Effectiveness of extension officers in the adoption of improved cassava production technologies in Rivers State, Nigeria is a function of the sector providing the service (public or private) and an index of associated incentives. However, this factor (associated incentives to extension officers) did not influence the attitude of extension officers towards influencing adoption of improved cassava production technologies. This was a good attitude that should be capitalized on to ensure that extension whether public or private continues to be interested in farmers instead of incentives. In this regard, the public sector extension was excellent not to have allowed private sector dwarf their influence on farmers served by them, given the attractive incentive scenario of the multinational oil and gas companies, the current operators of the private sector extension system in the Niger Delta.

The moderate adoption in the overall adoption scenario by both the public and private sector extension system was an indication of the level of synergy that existed between both extension systems. The complimentary role of each system was admirable. However, the incentive backed-up system of the private sector induced a higher category of overall adoption by the private sector than the public sector.

4.2 Recommendations

The study makes the following recommendations based on prevailing conditions in the Niger Delta region of Nigeria where both public and private sector extension is dominant.

(a) The land tenure system in Nigeria and most communities in Rivers State are very gender insensitive. The rights of women to own land are being denied yet cassava production was regarded as women crop. The men claim ownership of the land and by implication, the crops therein hence the rural women lives under serious threat in this regard. Special awareness campaign is hereby advocated.

It is also recommended that all women farmers' co-operative groups be formed to ensure that the interests and rights of women are protected

(b) The study revealed a relationship between educational level and adoption of technologies. It is therefore recommended that Farmers schools (formal adult education) be established in some agrarian communities to encourage adult learning that will accelerate assimilation of extension messages.

(c) Public and Private sector extension systems in Rivers State, Nigeria should continue to complement each other through organization and attendance of Monthly Technology Review Meeting (MTRM) with the subject matter specialists and research fellows in attendance. This development will help to enhance food security through adoption of improved technologies

(d) The Private sector extension as operated by the multinational oil and gas companies in the oil rich Niger Delta currently operatives as corporate social responsibility. Some of the operators of the scheme had threatened to withdraw supports to farmers. This

situation is a threat to food security in Nigeria as the public sector extension system cannot meet the demands of Nigerian farmers. It is therefore highly recommended that legislative backing be accorded to the private sector extension services especially the multinational oil and gas companies. This will rekindle interest in extension activities and perhaps stimulate participation in the scheme by other private agencies including NGOs.

(e) Extension staff of the private sector extension system should be integrated into core structure of their organizations as they are the frontline staff that ensures freedom to operate (under normal condition). A situation where they were mostly employed as contract staff creates doubt bearing in mind the climatic change conditions of the oil and gas companies

(f) A special improved cassava technology adoption campaign should be mounted to meet expected increase in the demand as occasioned by the industrial requirements of cassava by-products. Otherwise, demand for cassava produce would be far higher than supply; a situation that would warrant unpatriotic Nigerians to call for importation of cassava produce.

(g) Finally, farming system (including extension services) should be made attractive to Nigerian youths. It was done in years past for footballers and today Nigerian youths are struggling to be noticed as good footballers. Making agriculture rewarding will naturally attract the youths into the business as entrepreneurs. A typical example is by value chain linkage where sugar cane, oil palm and pineapple farmers to supply inputs to Bacita Sugar industry, Lever Brothers and Dana fruit canning industries respectively.

4.3 Conclusion

The Public and Private sector extension systems worked together to influence adoption of improved cassava production technologies in Rivers State, Nigeria.

However, while the public sector extension system operates under legislative framework under the Agricultural Development Programmes (APDs), their private sector counterparts operate as corporate social responsibility (CSR) without legislative framework. This is because the latter is not directly associated to the core business of oil and gas production operations. This situation is dangerous and a threat to food security in Nigeria.

Conclusively, the Federal Government employing its legislative apparatus should institutionalize framework to legitimize the operations of the private sector extension system in Nigeria. This phenomenon would not only create goodwill among the operators but in addition increase commitment towards rural development in Nigeria especially now that climate change conditions are imposing serious threats to food security in Nigeria.

References

[1] Abrew, S. 2003. Uganda: Promotion and Strengthening of sustainable Farmer Groups and Associations. FAO/TCP/UGA/2904(T). FAO/TCP. Rome

[2] Adesope, O.M. & Nwankwo, C.1996. “Factors Responsible for Multiple Cropping Practices among Compound Farmers in Omoku, Rivers State”. Journal of Technology and Education in Nigeria, vol.1 (1), pp.34-42.

[3] Alex,G., W.Zijp & D. Byerlee. 2002. Agricultural Extension Investments: Future Options for Rural Development. The World Bank. Washington, DC.

[4] Asiabaka, C.C.and A.I. Bamisile, 1992. “Evaluation of Constraints Affecting the Performance of Extension Agents in the Lagos State Agricultural Development Project in Nigeria”. Trop.Sci. 32,pp. 421 – 428.

[5] Axinn, G.H.& S.Throat.1972. Modernising World Agriculture: A Comparative Study of Agricultural Education System. Praeger Publishers, New York.

[6] Beets, W.C., W.M.Rivera, R.C. Moore, Q.L.Yang and Y.Hu. 1996. Final Report. Mid-term Evaluation of Arid and Semi-Arid Agricultural Development in Northwest Chin (CPR/91/110)

[7] Birkhaeuser,D., R.E. Evenson & G. Feder. 1988. The Economic Impact of Agricultural Extension: A Review. The World Bank and New Heaven, CT: Yale University, Economic Growth Centre. Washington DC.

[8] Christoplos, I.2003. Extension, Poverty and Vulnerability in Nicaragua; in W.M. Rivera and G. Alex (eds). Development of Rural Economies; Inter-American Development Bank. Washington, DC.

[9] Dexon,J., A. Gulliver; & D.Gibbon. 2001. Farming Systems and Poverty: Improving Farmers’ Livelihoods in Changing World. FAO and World Bank. Rome and Washington, DC.

[10] Ellis, F. 1999. Rural Livelihood Diversity in Developing Countries: Evidence and Policy

Implications. ODI, Natural Resource Perspectives, London.

[11] FAO. 1999. Special Programme for Food Security (SPFS): Rationale, Objectives and Approach. SPFS/Doc/4-Rev.1. Rome.

[12] FAO. 2001. Livelihood Support Programme: Improving Support for Enhancing Livelihoods of the Rural Poor (GCP/INT/UK/803). Rome.

[13] FAO. 2002a. Independent External Evaluation of the Special Programme for Food Security (SPFS). Eighty-seventh Session, 6-10 May 2002. Rome

[14] FAO. 2005. The Special Programme for Food Security: Responding to New Challenges. Rome

[15] FAO. 2005. ibid

[16] IFAD, 1994. Multi-State Agricultural Development Project: Interim Evaluation Report. 2 Volumes. International Fund for Agricultural Development, Rome, Italy.

[17] Nwaru, J.C.1993. Relative Production Efficiency of Co-operative and non-co-operative Farms in Imo State, Nigeria. Unpublished M.Sc Dissertation, Dept of Agricultural Economics and Extension, Federal University of Technology, Owerri. 83p.

[18] Nweke, Felix I.1996. Processing Potential for Cassava Production Growth in Sub-Sahara Africa. COSCA Working Paper No.11. Collaborative Study of Cassava in Africa. IITA, Ibadan, Nigeria.

[19] Ogueri, E.I. & V. Nnadi. 2010. Sustainable Rural Development in Nigeria: Issues and Facts – Sharing Initiative of Total Exploration and Production Limited); OIDA International Journal of Sustainable Development. Vol 2, No.3. pp65-76. Available at SSRN:http://ssnr.com/abstract=1711608

[20] World Bank, 2002. Summary Report of the World Bank/USAID/Neuchatel International Workshop on “Extension and Rural Development” held at IFPRI. Washington, DC.