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DETERMINANTS OF FOOD SECURITY AMONG FARM HOUSEHOLDS IN TWO SELECTED AGRICULTURAL ZONES OF OGUN STATE, NIGERIA

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Abstract
The study was carried out to assess the determinants of food security among farm households in two selected agricultural zones of Ogun State, Nigeria. A multistage sampling technique was used to select the respondents that were interviewed. In all 168 farming households were interviewed but 160 were selected for analysis after removing the questionnaires which were not properly administered. Food consumption data of 160 households were used for the analysis. The study reveals that majority of the farming households (80%) were found to be food insecure using calories intake method of estimating food security status. Further analysis using the binary logistic regression method identified marital status, education, household size and farm size as important determinants of food security. The study, therefore, recommended improved access to credit for rural households and diversification of household economic activities to include off-farm income generating businesses to improve food security at the household level.

Keywords: Food security, Logistic Regression, Farming Households, Ogun State, Nigeria.

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Introduction

Food is essential in human being's life. Enough food in terms of quantity and quality for all people is an important factor for a nation to continue its development. Lack of food in long terms will lead to hunger and starvation that can cause death. Therefore, enough food is a necessary condition to be well nourished (Sila and Pellokila, 2007). According to World Bank (2001), food security is of three folds, these are food availability, food accessibility and food affordability. Food availability for farming households means ensuring sufficient food for the households through production. However, it should be noted that simply making food available is not enough; one must also be able to purchase it, especially the low income households (Sen, 1981). Hence, food security connotes physical and economic access to adequate food for all household members, without undue risk of losing the access.

The concept of food security has expanded beyond the strict biological requirements of sustenance for survival. Food security does include consuming at a level adequate for physical and mental health and also includes the right to cultural preferences. It also includes obtaining the food in appropriate proportion (Robertson, 1990).

Food is the basic need and necessity of life that must be satisfied before any other developmental issue. Inadequate nutrition is considered as measure of poverty in many societies or synonymous to poverty (Datt *et al.*, 2000). Helen (2002) noted that food security maintains political stability, and ensures peaceful coexistence among people while food insecurity results in poor health and reduced performance of both children and adult. Food security is therefore defined "as a situation when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life" (FAO, 1996). Ironically, farming households are the most affected in terms of food insecurity and poverty in Africa especially the smallholder farming households though the rest of the population depends on their production. According to Cruz (2010) and Valdés *et al.,* (2010), majority (more than 80 per cent) of the smallholder farmers in the world are food insecure and depend on land as their primary source of livelihoods. Three out of every four poor people leave in rural areas and depend on agriculture either directly or indirectly for their livelihood (World Bank, 2008).

In most part of the world and especially in the developing countries, concerns regarding food security and its related issues are vital for poverty reduction. Attainment of food security is core problem confronting farming households, especially women and rural populations due to low productivity in staple crop production, seasonal variability in food supply as well as price fluctuations. These problems facing farming households come about as a result of over reliance on rain-fed agriculture, none or inappropriate usage of chemical inputs as well as inadequate improved varieties of crops and animal species. Food security of farming households is of serious concern if Nigeria wants to consolidate her macroeconomic gains because; farmers who are vulnerable to food and nutritional insecurity have limited capacity to respond to agricultural programmes. Majority of the research works that have been done so far on the issues related to food insecurity in Nigeria are very general and consider the problem from national or regional points of view. While aggregate data are generally available at the national level, little work has been done to understand the food security problem at the household level in specific locations/districts. Having national food balance data is not sufficient to understand the food security dynamics in the country. Most agricultural production comes from millions of rural households.

Despite the increasing global concern of improving food security, the nature and extent of food security at the household level in rural areas is not well documented. The purpose of this study was, therefore, to investigate the critical determinants of food security in rural areas in Nigeria using Ijebu and Ilaro agricultural zones of Ogun state as a case study.
The main Objectives of the study were to:

1. Examine the socio-economic characteristics of farming households in the study area
2. Determine the food security situation among households in the study area, and
3. Examine the principal determinants of household food security in the study area.

Conceptual framework

The Concept of Food Security

Food security is the condition in which all have access to sufficient food to live healthy and productive lives (World Bank, 1986). Food security is dependent on agricultural production, food imports and donations, employment opportunities and income earnings, intra-household decision-making and resource allocation, health care utilization and caring practices **(**Maxwell and Frankenberger, 1992). It is a multi dimensional development issue that needs cross-sectoral integrated approaches. However, because there are concerns that such approaches can be too costly, too complicated or take too long to show results, institutions may not invest their scarce resources in implementing them. Moreover, household food security issues cannot be seen in isolation from broader factors such as physical, policy and social environment(Hoddinott**,** 2001).

The physical factors play a large role in determining the type of activities that can be undertaken by the urban households. Government policies, on the other hand, have a strong effect on the design and implementation of household food security interventions. Likewise, the presence of social conflict expressed in terms of mistrust of other social groups or even outright violence, is also an important factor in the design and implementation of interventions in a given region. The phenomenon of urban food insecurity has been attributed to the following interconnected factors: Income insecurity making an individual or household unable to purchase sufficient food or food with adequate nutrient content to assure food security; spatial factors such as living in a neighbourhood without an affordable grocery store, markets or other outlets; disproportionate income allocation to other areas, such as rent, leaving an insufficient budget for food; and isolation, loss of autonomy or a lack of a social network.

These sources of food insecurity are not related to food availability. Instead, hunger is most often attributed to problems of distribution, with gaps increasing between poor and rich countries as well as between the poor and rich within countries (Maxwell, 1998). Reasons for hunger in cities in the developing world include high rates of population growth beyond productive capabilities, high rates of income inequality, land degradation and soil erosion, as well as a host of institutional and economic factors limiting developing societies from achieving food security (Allen, 1993). Income inequality is one source of food insecurity common to countries in the developed and developing world. Other common perpetrators of food insecurity in developed countries are unemployment and the welfare crisis (Riches, 1998). For instance, for many Canadians, the increasing commodification of food supplies is removing the ability to access adequate and nutritious sustenance. Continued lack of recognition in social policy discourse suggests that these trends are likely to persist (Koc and Dahlberg, 1999). With the increasing role of markets in shaping government policy, welfare systems have changed and governments are ignoring growing urban problems of hunger and food insecurity (Allen, 1999; Riches, 1998).

As social justice is included in the definition of food security, so should it be in strategies to alleviate hunger. In the forefront of any policy to eradicate hunger and promote food security in the country must be the question of "a human right to food" in order to ensure ecological, economic, and social justice (Riches, 1998). Today, most developing countries are net food importers, and their dependence on imports is growing. Combined with persistent constraints, from fiscal to physical, this dependence results in food insecurity for large sectors of the population, particularly the urban poor (Singer, 1997). A growing number of countries have seen a resurgence of urban food production, and this has made

urban food suppliers more self-reliant and urban households less food insecure. This reality is now recognized by more governments and development agencies. As a consequence, urban food production is likely to be promoted and managed in a better way over the next decades. However, recent international studies point to information gaps that must be addressed so that urban food production for consumption and for trade can be timelier and suitably phased into comprehensive urban and agricultural policies for the 21st century. Globalization and urbanization are affecting the food supply of cities in Southwestern Nigeria. The cities have not developed a highly integrated and energy-intensive food supply system.

Food Security Components

Common to most definitions of food security is the elements of availability, access, utilization and stability or sustainability

Availability: In this context, availability refers to the physical existence of food, be it from own production or on the markets. On national level food availability is a function of the combination of domestic food stocks, commercial food imports, food aid, and domestic food production, as well as the underlying determinants of each of these factors. Use of the term availability is often confusing, since it can refer to food supplies available at both the household level and at a more aggregate (regional or national) level. However, the term is applied most commonly in reference to food supplies at the regional or national level (Riely *et al*., 1999).

Access: Access emphasizes on having sufficient resources to obtain appropriate foods for a nutritious diet. It is the way different people can obtain the available food. Normally, we access food through a combination of home production, stocks, purchase, barter, gifts, borrowing or food aid. Food access is ensured when communities and households and all individuals within them have adequate resources, such as money, to obtain appropriate foods for a nutritious diet (Riely et al. 1995). Access depends normally on; income available to the household, the distribution of income within the household, the price of food and other factors worth mentioning are individuals' access to market, social and institutional entitlement/rights.

Utilisation: Utilization has a socio-economic and a biological aspect. If sufficient and nutritious food is both available and accessible the household has to make decisions concerning what food is being consumed (demanded) and how the food is allocated within the household. In households where distribution is unequal, even if the measured aggregate access is sufficient some individuals may suffer from food deficiency.

Stability: Stability or sustainability refers to the temporal dimension of nutrition security (i.e. the time frame over which food security is being considered). In much of the food security literature, a distinction is drawn between chronic food insecurity—the inability to meet food needs on an ongoing basis—and transitory food insecurity when the inability to meet food needs is of a temporary nature (Maxwell and Frankenberger, 1992).

Determinant of Food Security

Determinants of household food security in various developing countries especially in Africa have been documented in some literature and these factors or determinants are most often than not location-

specific (i.e. different study areas were found to have variant attributes as food security determinants with some attributes recurring). The study conducted in Nigeria by Oluwatayo (2008) using Probit model found out that sex of household head, educational level, age and income have positive influence on food security whereas household size has negative influence on household food security. Study by Sikwela (2008) in South Africa using logistic regression model showed that per aggregate production, fertilizer application, cattle ownership and access to irrigation have positive effect on household food security whereas farm size and household size have negative effect on household food security. Babatunde *et al., (*2007) work on food insecurity in Nigeria and Oluyole *et al.,* (2009), examined the food security status among cocoa farming households of Ondo State, Nigeria and employed Cost-of Calorie (COC) function proposed by Greer and Thorbecke (1986). This method was also used in similar studies (Ojogho, 2010; Adenegan and Adewusi, 2007). Babatunde *et al.,* (2007) and Omotesho *et al.,* (2010), examined the socio-economic characteristic of household in Kwara State, Nigeria, using food security index to determine the food security status of each household based on the Recommended Daily Calorie approach. This method (Food Security Index) was also used by several researchers (Khatri-Chhetri and Maharjan, 2006; Omotesho *et al.,* 2006, Arene and Anyaeji, 2010).

Methodology

Study area

The study area for this research is Ogun State. It is one of the six states of the south-west Nigeria located within the rain forest belt of tropical region. It lies within latitude 6°N and 8°N and longitude 2°E and 15°E. The state shares an international boundary with the Republic of Benin to the west and interstate boundaries with Ondo State in the east, Lagos State and Atlantic Ocean in the south and Oyo State in the North. The Population of males in the state is 1,847,243 while that of the female is 1,880,855 and overall total population is 3,728,098 (NPC, 2006). Ogun State is approximately 1.9% (i.e. 16,762 km^2) of Nigeria's 923,218km^2 land area

Sampling Technique and sample size

The sampling technique adopted for this research was Multi-stage sampling technique. The first stage involved purposive selection of two zones from the four OGADEP zones. Ijebu and Ilaro zones were selected, in this respect the second stage involved a random selection of 50% of the number of blocks in each of these two zones, three blocks from Ijebu-ode zone and two blocks from Ilaro zone, using list of blocks in the two zones as sampling frame. The third stages involved random selection of four cells in each of the five blocks from which eight household farmers each from the selected (cell) in each zone were selected, thereby giving a total number of 160 respondents used for the study.

Analytical procedure

The analytical tools used for this research include descriptive statistics for describing this socio-economic characteristics of the selected respondents in the study area. Among the descriptive statistics used for the study are frequency tables, means and percentages Calorie intake estimation model was used to determine calorie intake of the rural household while Logit model was used to examine the determinants of food security status of rural household.

Calorie estimation

Calorie intake estimation was used to determine the calorie intake by the households in the study area. The calorie intake estimation adapted from Akinyele and Oguntona (1995) was used as stated below and each household was converted to its adult equivalent.

$\mathbf{C_j = \Sigma B_{JK} x_k}$..... (1)

Where:

C_j = Household calorie consumption

B_{JK} = standardized food energy content of food commodity k

X_{jk} = weight of food commodity k

Logit model

Logit model was used to investigate the determinants of household food security among the rural households surveyed. The USDA Household Food Security Scale (Revised in March 2000) was used to disaggregate the households into food secure and food insecure households. The dependent variable in this case, food security, was a binary variable which took a value of one if a household was found to be food secure, and zero if otherwise. A variety of models can be used to establish the relationship between the potential determinants and food security. The study employed the logit model in line with earlier researchers.

The logit model was implicit expressed as

$\mathbf{Z_i = \beta X_i + U_i}$.....(2)

Where

Z_i = The food security status of i_{th} household

X_i = Vector of explanatory variable

U_i = The error term

β = Vector of the parameter estimate

The dependent variable (Z_i) is a dummy. It takes the value of 1 if the household is food secure and 0 if food insecure.

The independent variables are:

X_1 = Gender (male =1, female=2)

X_2=Marital status (married= 1, otherwise =0)

X_3 = Age of respondent (years)

X_4 = Year of education (years)

X_5 = farm size (hec)

X_6 = farm experience (year)

X_7 = income (Total monthly income)

X_8 = Household size (Number)

e_i = Error term

Results and Discussion

Socio-economic characteristics of the Farming Households

Respondents' socio-economic characteristics are presented in Table 1. Male household heads constituted majority (88.8%) of the sampled people. The modal age was between 31 and 40 years, indicating that a typical farmer interviewed was economically active. There were more married household heads (94.4%) than those divorced (5%), and single (0.6%). The study revealed that majority (81%) of households surveyed had more than four (4) members implying that the average farming household in the study area had a large household size.

Table 1: Household distribution by Socio-economic Characteristics

Household characteristic	Frequency	Percentage
Gender		
Male	142	88.8
Female	18	12.2
Age		
25-30	2	1.25
31-40	69	43.1
41-50	56	35
51-60	27	16.9
Above 60	6	3.75
Marital status		
Married	151	94.4
Single	1	0.6
Divorced	8	5.0
Household size (Number)		
1-4	56	35.0
5-9	83	51.9
10-14	21	13.1
Educational Level		
No formal Education	72	45.0
Primary Education	67	41.0
Secondary Education	14	8.7
Tertiary Education	7	4.4
Farm size (Hectare)		
1	24	15.0
2	57	35.6
3	32	20.0
4	47	29.4
Total	**160**	**100**

Source: Field Survey 2013

Food security status of Households

As depicted in table 2, majority of the households surveyed (80%) were found to be food insecure and only 20% were food secure.

Determinant of Food Security

Table 3 provides the parameter estimates for the logit model. From the maximum likelihood estimates of the model, the Pseudo R^2 was 0.38 which implies that about 38% of the likelihood of a household being food secure is strongly explained by the independent variables. The marginal effects of the independent variables were estimated because they are very important for policy and decision making. Among the eight variables considered in the model, four were found to have significant impact on

household food security. They included marital status, household size, farm size, and education. Marital status was significant at 10% and the coefficient indicated that households headed by unmarried people are more likely to be food secured than those headed by unmarried people are more likely to be food secure than those headed by married people. This finding was contrary to findings by Haliu *et al.,* (2007) and Kaloi *et al., (*2005), it is quite reasonable, and it may be due to the fact that households with married people as heads may have larger household sizes and thus many mouths to feed.

Education was significant at 5% which means that the higher a household's expenditure is on education, the higher the probability of food insecurity and vice versa. This is plausible as education of children is a priority area, for which the household could deny itself some comfort in the short-run. Households sometimes sell out of their food reserve to provide for this need and as such expose themselves to food shortages.

Household size had a negative and significant relationship with food security at the 10% significant level, implying that the probability of food security decreases with increase in household size. An increase means more people to feed and indirectly reduces income per head, expenditure per head and per capita food consumption. The likely explanation is that in an area where households depend on less productive agricultural land, increasing household size results in increased demand for food. This demand, however, cannot be matched with the existing food supply from own production and this ultimately end up with the household becoming food insecure. This outcome is consistent with the outcome of a study conducted by Sikwela (2008)

Farm size is significant at 10%. According to Van Der Veen (2010), food production can be increased extensively through expansion of areas under cultivation. With large farm size households can produce more and also diversify. This outcome is consistent with the finding from a research conducted by Bogale (2009).

Table 2: Food Security Status of the Household

Food security status	**Frequency**	**Percentage**
Food secure	32	20
Food insecure	128	80
Total	160	100

Source: Field survey 2013

Summary, Conclusion and Recommendations

Summary

This study utilized a multi-stage random sampling technique to obtain a sample of 160 farming households, using the Recommended Daily Calorie Required approach (2260) as used by Babatunde *et al.,* (2007). Households whose Daily Calorie Intake were equal or higher than Recommended Daily Calorie Required were considered food secure households and those whose Daily Calorie Intake were below the Recommended Daily Calorie Required were considered food insecure households. The calorie intake estimation adapted from Akinyele and Oguntona (1995) was used, and each household

Table 3: Parameter Estimates of Determinant of Household Food Security

Variable	Estimated coefficient	T- ratio	Marginal effect
Constant	26.792	1.588	
Age	-1.3056	-0.866	-0.043996
Gender	-24.145	0.168	-0.000813613
Marital status	13.737*	1.844	-0.1066
Education	0.324**	2.044	0.0324
Household size	-3.3805*	-1.650	-0.1843
Farmsize	0.277*	1.744	0.0174
Income	0.234	0.245	0.000099103
Farm exp	-0.853	0.616	0.00028753
Diagnostic Statistics			
Log- likelihood Function = -61.248			
R^2 = 0.38366			
Observation = 160			

*Coefficients are significant at *10%, **5%, and ***1% respectively*
Source: field survey data, 2013

was converted to its adult equivalent adapted from Falusi (1985). The study revealed that 20 per cent and 80 per cent of the households were food secure and food insecure respectively. A logit regression model estimated showed that household size, educational status of household head, marital status and farm size were found to determine the food security status of farming households in the study area.

Conclusion

The study has shown that majority (80%) of households in Ijebu and Ilaro agricultural zones of Ogun State were food insecure during the period of the survey. Consistent with *a priori* expectation and findings from previous studies, marital status, and education were found to significantly influence household food security in the study area positively. However, household size was found to influence food security negatively at the household level. Also, households headed by married people were found to have a higher probability of becoming food insecure compared to their counterparts headed by unmarried people. Educational level of the household head was found to be statistically significant in explaining the food security situation at the household level.

Recommendations

In the light of the findings from the study, it is recommended that

1. Efforts to provide access to credit by farmers and the promotion of off-farm activities as alternative livelihood options should be pursued by both local and central government structures in Nigeria to improve the household food security situation in rural areas.
2. Policies that will make micro-credit from government and non-governmental agencies

accessible to rural farmers will go a long way in addressing their resource acquisition constraints and eventually improving household food security in the country.

3. Farmers should be given informal education through extension service with a view to enhance their understanding of modern agricultural production techniques and easy access to improved technologies to boost agricultural production.
4. The poverty alleviation programme of government should focus on how to boost non-farm income of farmers by training the farmers on off-farm businesses so as to boost income and subsequently enhance food security.

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EFFECTS OF ORGANO-MINERAL FERTILIZER APPLICATION ON BIOMASS PRODUCTION AND PARTITIONING OF SWEET POTATO (IPOMOEA BATATAS) ON AN ALFISOL, IN SOUTH- WESTERN NIGERIA

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Abstract

There is paucity of information on growth, biomass production and partitioning pattern of improved sweet potato (*Ipomea batatas)* under organo-mineral fertilizer use. Hence, this study examines the effects of organo-mineral fertilizer on the growth of sweet potato. The methodology involved using over 20 weeks of field investigation on an Alfisol in South-Western Nigeria, to evaluate the effects of different fertilizer types (Organic and inorganic), on biomass production and partitioning of 3 improved sweet potato cultivars (Shaba, Sauti and Cip – Tanz). The treatments were replicated 3 times in a randomized complete block design. Sampling of the plant parts was done at 12, 15, 18weeks after planting (WAP) (tuber bulking) and 20WAP (plant physiological maturity). At each sampling stage, plants were partitioned into component parts; seed stock, petiole, laminae, vine and tuber. Pre-cropping physico-chemical properties of the experimental soil thus showed that the soil pH with 6.03 of medium acidity, low organic matter (18.27g kg-1) with N(2.50g kg-1), greater than critical level (1.0-1.5g kg-1), moderate P (11.48mg kg-1) with 10 – 20mg kg-1 and K (0.10 c mol.kg-1 soil) low, with 1.5 – 2.5 c mol kg-1 soil. The exchangeable bases in order of their abundance were Mg (0.16) > K (0.10) > Ca (0.08) > Na (0.05 c mol kg-1 soil). Low exchangeable acidity (0.40), effective CEC (0.79 c mol kg-1 soil) and Base saturation 49.37%. Loamy sand textural class, with sand (833), silt (88) and clay 79g kg-1 particle size. With respect to fresh tuber yield Shaba (13,747.5) > Cip-Tanz (7081.5) > Sauti (269.4 kg ha-1) and fertilizer treatments, inorganic fertilizer (10,746.7) > OMF II (9,241.3) > control (4,480.7kg ha-1). ANOVA showed the significant ($P < 0.05$) difference occurred in genotypes and fertilizer treatments and in the partitioning of biomass into only seedstock, vine and tuber.

Keywords: Biomass partitioning, organo-mineral fertilizer, sweet potato, Alfisol, Harvest Index.

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Introduction

Sweet potato (*Ipomea batatas*) is an important food crop grown throughout the tropics. Low sugar types, generally predominates, as high starch content is a desired attribute of this staple food (Mok *et al.,* 1997). The succulent, starchy storage roots serve as food for human and animal feeds (Woolfe, 1992). Leaves/Lamina, serves as vegetables (Von Braun *et al.,* 1991) and to a limited extent as raw materials for industrial purposes, such as starch and alcohol production (Collins, 1984). Nevertheless, it is commonly cultivated for the carbohydrate rich tubers (FAO, 1984).

Most of the West African Savannah soils, are low in organic matter and plant nutrients, especially nitrogen (N) and phosphorus (P) (Sanchez, 1981). The low activity clay soils, Alfisols, Oxisols and Ultisols, as well as weakly differentiated coarse textured Entisols and Inceptisols, found within the region, are also low in plant nutrients and low in cation exchange capacity (CEC). This is partly because, Kaolinite, is the dominate clay mineral. The soils are susceptible to rapid nutrient depletion, with intensive farming system, which is fast becoming predominant in this area. Under this situation, high and sustainable crop production required the use of fertilizers. Although, high crop yield can be obtained with judicious mineral fertilizer use, but the commodity is not always easily affordable and available to the resources poor farmers, because of high costs and poor distribution systems in most developing nations.

Continuous use of high rate of mineral N fertilizers, also result in soil acidification. (Swindale, 1980). The use of organic fertilizer, is also limited by the huge quantities required to meet the needs of crops, because of its low nutrient content. Such huge quantities are obviously, not obtainable and even the transportation and handling costs would constitute a major constraint. In view of this, an integrated fertilizer management approach involving a combination of reduced amounts of chemical and organic manures may be a cost effective (economic) and environmental protection strategy. This system may offer a good opportunity to the small scale farmers to maintain yield at reasonable and sustainable levels.

In recent years, organic wastes are being converted into organo-mineral fertilizers (powdered and pelleted) for use in field crop production. The University of Ibadan (Pace-setters organo-mineral fertilizer centre) is involved with the fortification of organic wastes with inorganic materials (especially Rock Phosphates, Single Superphosphate, Potassium Chloride, NPK and Urea) for sustainable agricultural production. John *et al.,* (1990) stated that organo-mineral fertilizer pellets can easily be handled by small scale farmers to carry and use on their farms. They are simple and cheap and with the added advantage of a slow release of nutrients, when applied to the soil. The fertilizer volume is also reduced drastically for easy handling by the farmers. Adeoye *et al*. (1991) observed that compost made from household kitchen wastes supplemented with Urea, yielded large yam sizes.

Akpomujere and Omueti (1991), also reported better performance of combined organic and inorganic fertilizers than sole application of either Farm Yard Manure or inorganic fertilizer. Robinson *et al.* (1992) explained that fertilizer treatment can disproportionately increase growth of specific plant parts, so that their ratios are affected. Excessive vegetative growth in plants generally reduces flowering and ultimately yield (Carvins *et al.* 2003). Regulation of biomass/biomass allocation into the various plant parts may be desirable, since plant growth is closely associated with economic yield (Carvins *et al,* 2003).

This present work evaluated effectiveness of organo-mineral fertilizers, relative to NPK, with respect to sweet potato biomass production and partitioning on an Alfisol in South-Western Nigeria. This study sought to determine the changes in dry biomass of sweet potato, seedstock, petiole, lamina, vine and tuber, at successive growth periods of the crop, compared the influence of inorganic and organo-mineral fertilizers on the fresh tuber yield of three sweet potato cultivars.

Materials and methods

Experimental site and soil

Surface soil samples (0-20cm depth) were collected from University of Ibadan, Faculty of Agriculture and Forestry, Teaching and Research farm, using auger at 20 points in composites, from a plot of about 0.25ha. It is located between, Longitude 3^0 45^1 E and Latitude 7^0 30^1 N,which represented Forest Agro-ecology. Its elevation is 210m above sea level with annual rainfall of about 12550mm per annum. The soil sample collected were bulked, air dried, crushed, thoroughly mixed, passed through 2mm sieve and subjected to routine laboratory analysis as outlined in IITA (1981). Soil pH (1:1 Soil/Water suspension ratio) was measured with glass electrode pH meter, particle size analysis by hydrometer method, Organic C by wet dichromic oxidation method and Organic Matter estimated by multiplying Organic C with a factor of 1.724. Total –N by microkjedahl method. Available P was determined by Bray-1-method, while exchangeable cations were determined by neutral normal NH_40Ac. The K and Na were measured with flame photometer. Mg and Ca were determined with atomic absorption spectrophotometer (AAS).

Experimental design and sampling

The composition of fertilizer materials used were: (Single Super Phosphate (SSP) 7.9%, Potassium Chloride, (KCl), 49.8%, NPK 15-15-15 and Pace-setter Organic fertilizer Grade B- 1.68%N, 1.06%P and 0.60%K). Fertilizer application involving composition of materials include: (1) Control (no fertilizer application), (2) NPK (Inorganic fertilizer) 580 kg ha^{-1}, (3) Organic: inorganic, 1:2 (3200 kg ha^{-1}), Organo-mineral I and (4) Organic: inorganic, 1:5 (2000 kg ha^{-1}), Organo mineral II. Test crop, 3 sweet potato cultivars: (1) Shaba (Highly spreading growth habit, toothed triangular leaves, hairy green vine tips, purple shoot, cream coloured tuberous root and pale yellow flesh), (2) Sauti (Slightly spreading growth habit, thick deeply lobed leaves 5 lobes, cream coloured tuberous root skin and flesh), (3) Cip-Tanz: (Slightly spreading growth habit, thick vines deeply lobed leaves 5 lobes, light green petioles tuberous root skin and flesh)

The fertilizer treatments were applied to each of the three (3) cultivars, which were replicated 3 times in randomized complete block design (RCBD). Each block was split to accommodate 12 plots. There were 36 experimental units; each experimental unit contained 24 plants. The plants were spaced 1m x 0.3m, giving a plant population of 33,333 plants ha^{-1}, gross experimental area 462m^2 and net plot 342m^2. At planting, 25cm long vine, with at least 2 nodes per cutting, were inserted into planting holes at an angle of 45^0, with two third of the length buried beneath the soil. After 12, 15, 18 and 20 (WAP), representative plants, were sampled in sequential destructive sampling and separated into, seed stocks, petioles, laminae, vines and tubers. Plant samples were weighed fresh, 200g Sub-samples oven dried at 70^0C for 48 hours and reweighed again for the determination of dry matter. Dry matter production of different components, were evaluated. Harvest index (HI) was estimated from the relation: HI = Economic yield/Total biomass

Statistical analysis. Data were subjected to analysis of variance (ANOVA), using Statistical Analysis System (SAS, 1992). Duncan Multiple Range Test (DMRT) was used to compare treatment means.

Table 1: Socio-economic Characteristics of Respondents (N=100)

Nutrients	Values
Water	50-80%
Protein	1.7g
Food energy	114kcal
Protein/calorie ratio	15g/1000kcal
Fats	0.4g
Ash	1.0mg
Ca	30-32mg
PEE-C	47-49mg
Fe	0.7-0.8mg
Na	10-13mg
Koko	243-373mg
Thiamine	0.09mg
Riboflavin	0.06mg
Niacin	0.6mg
Ascorbic acid	20-30mg
Nicotinic acid	0.9mg
Carotene	1-12mg
S	30mg
Mg	24mg

Source: Scott *et al* (2000) and Mandal (1993)

Table 2: Some properties of the surface soil

Properties	values
pH H_20 (1: 1)	6.03
Organic Carbon (g kg^{-1})	10.60
SOM (g kg^{-1})	18.27
Total N (g kg^{-1})	2.50
Av.P Bray 1 (mg kg^{-1})	11.48
Exchangeable Cations (c mol kg^{-1})	
Ca	0.08
Mg	0.16
K	0.10
Na	0.05
Exchangeable acidity	0.40
Effective CEC (c mol kg^{-1})	0.79
Base saturation (%)	49.37
Particle size (g kg^{-1})	
Sand	833
Silt	88
Clay	79
Textural Class	Loamy sand

Results and Discussion

Table 1, shows the mineral composition of sweet potato. The popularity of sweet potato in most countries of the world, stemmed from the fact that it could be used for both human and animal consumption. It may be beneficial for diabetes, it helps to stabilize blood sugar levels and to lower insulin resistance and also as an incidental or luxury addition to the diet in many countries. Scott *et al.,* (2000) and Mandal (1993).

Physico-chemical characteristics of the experimental soil

Results of the physico-chemical properties of the experimental soil are presented in table 2. Based on established nutrient critical levels, it was evident N content (2.50 g kg^{-1}) was greater than the critical level (1.0 – 1.5 g kg^{-1}) (Netson, 1961). N was sufficient, while P (11.48 mg kg^{-1}) was moderate with 8 – 15 mg kg^{-1}, established by Adepetu and Barber (1979). Exchangeable K (0.10 c mol kg^{-1} soil) was deficient with 0.18 – 0.2 c mol kg^{-1} soil, by Agboola and Obigbesan (1974), 0.24 c mol kg^{-1} soil, by Agboola and Ayodele (1984). With levels 10.0 – 15.0 g kg^{-1}, Organic C content, (10.60 g kg^{-1}) was considered moderate.

The effects of fertilizer treatments, genotypes and harvest times on dry seed stock, petiole, lamina, vine, tuber and Harvest Index are presented in table 3. Dry seed stock was highest (47.8 kg ha^{-1}) at 18WAP and least at 12WAP (40.0 kg ha^{-1}), while the least in petiole (32.2 kg ha^{-1}) was recorded at 18WAP. For the dry lamina, highest (136.7 kg ha^{-1}) was recorded at 12WAP at the least (70.0 kg ha^{-1}) at 18WAP. Dry vine biomass, was highest (316.6 kg ha^{-1}), at 15WAP and least (186.6 kg ha^{-1}) at 12WAP. For dry tuber, the highest (674.4 kg ha^{-1}) was at 18WAP. With respect to harvest index (HI) of sampling times, the highest production of biomass (0.62) was at 18WAP, 12WAP had (0.42) and the least (0.39) was at 15WAP.

The summary of the effects of fertilizer treatments on dry seed stock (opv), petiole, lamina, vine, tuber and harvest index are presented in Table 3, the analysis of variance, indicated that, there were no significant differences in lamina and dry tuber. However, there were significant ($P < 0.05$) differences among the different fertilizer treatment, as regards dry seed stock (opv) and vine respectively with OMF II application, dry seed stock (opv) and petiole had the highest mean biomass 50 kg ha^{-1} and 75.5 kg ha^{-1}, respectively. Followed by inorganic fertilizer with mean biomass of 42.2 kg ha^{-1} and 65.5 kg ha^{-1}, respectively. While the least mean biomass was with control 37.8 kg ha^{-1} and 50.0 kg ha^{-1}, respectively. With respect to harvest index, mineral fertilizer OMF II recorded the highest with 0.52, with the least 0.41 in the control.

The summary of the differences in the dry biomass allocation into sweet potato parts and harvest index (Table 3) showed that, there were significant differences ($P < 0.05$), among the genotypes with respect to biomass allocation into plant parts (seed stock, petiole, lamina, vine and tuber). As regards dry seed stock, petiole and vine, sweet potato variety Cip- Tanz, had the highest mean biomass of 52.2, 72.2 and 327.7 kg^{ha-1}, respectively, Shaba had the least seed stock weight (35.6 kg ha^{-1}) and the vine (178.9 kg ha^{-1}), while the least (53.3 kg ha^{1}) petiole was recorded in Sauti. As regards lamina and tuber, variety Shaba had the highest (116.7 kg ha^{-1}) biomass in lamina and tuber (727.7 kg ha^{-1}). Shaba had the highest harvest of 0.34, while Sauti had 0.33 and the least was from CIP- Tanz (0.30).

Table 3: Effects of fertilizer treatments, genotypes and harvest times on the biomass production of three sweet potato cultivars.

		Biomass produced (kg ha $^{-1}$)				
Fertilizer Sources	Rate kg ha^{-1}	Seed Stock	Petiole	Lamina	Vine	Tuber Harvest Index
			(opv)			
			Treatments			
Control 0	37.8b	50.0b	94.4a	222.2a	285.5a	0.41b
Inorganic	580	42.2ab	65.5ab	114.4a	200.0b	522.2a 0.52a
Organo-mineral I	3200	41.1b	51.1b	96.7a	226.5b	411.2a 0.50a
Organo-mineral II	2000	50.0a	75.5a	113.3a	302.2a	570.0a 0.51a
			Genotypes			
Shaba	35.6b	55.6ab	116.7a	178.9b	727.7a	0.34a
Sauti	41.1b	53.3b	90.0 a	257.8b	217.8b	0.33ab
Cip-Tanz	52.2a	72.2a	107.8a	327.7a	361.3b	0.30b
Harvest times (Weeks After Planting)						
12	40.0b	86.7a	136.7a	186.6b	381.2 b	0.42b
15	41.1b	62.2b	107.8b	316.6aa	344.4b	0.39b
18	47.8a	32.2c	70.0 c	262.2a	674.4b	0.62a

Values followed by the same letter(s) are not significantly different at P<0.05. opv old planted vine.

Table 4: Effect of interaction of fertilizer treatments and genotypes on tuber production of three sweet potato cultivars at 20WAP (Physiological maturity)

		Tuber yield (kg ha^{-1})	
Fertilizer Sources	**Rate kg ha^{-1}**	**Fresh**	**Dry**
Control	0	4480.7 b	1703.2b
Inorganic	580	10746.7b	4067.4a
Organo-mineral I	3200	7637.0ab	2893.0ab
Organo-mineral II	2000	9241.3a	4430.7a
Sweet potato cultivars			
Shaba	13747.5a	5126.2a	
Sauti	2694.2 c	1244.3c	
Cip-Tanz	7081.5 b	3449.7b	

Values followed by the same letter(s) are not significantly different at P<0.05.

The dry matter accumulation (DMA) as represented by the weight of the dry biomass, is a measure of the ability of the crop under a given condition to convert the absorbed nutrients into biomass (conversion efficiency). The effects of genotypes yield and fertilizer treatment on fresh tuber yield are presented in table 4. Analysis of variance showed that, there were significant ($P<0.05$) differences among genotypes and fertilizer treatments on fresh tuber yield. Shaba had the highest (13747.5 kg ha^{-1}) tuber yield followed by CIP-Tanz (7081.5 $kgha^{-1}$), while Sauti had the least (2694.2 kg ha^{-1}). As regards fertilizer on fresh tuber yield, with the application of inorganic fertilizer, fresh tuber yield had the highest (10746.7 kg ha^{-1}) followed by OMF II with mean value of 9241.3 kg ha^{-1}, while control had the least (448.7 kg ha^{-1})

Partitioning of dry matter to seed stock (old planted vine)

The partitioning of percent dry matter to biomass distribution unto sweet potato plant parts for each of the three cultivars is presented in table 5. The CIP-Tanz, Sauti and Shaba cultivars, partitioned a smaller fraction of assimilate to seed stock (opv) earlier in the growth season. In case of CIP-Tanz, the seed stock (opv) constituted 6.2% of dry mass at 12WAP. At 18WAP the seed stock (opv) still constituted 5% of the mass. Cultivar Sauti allotted 6.4% of the assimilates to seed stock growth at 12WAP and at 15WAP the seed stock (opv) still contained 7% of the mass. Shaba diverted smallest proportion of assimilates to the seed stock (opv) growth, 3.4% at 12 WAP and 3% at 18WAP. A smaller portion of the plant mass was partitioned to seed stock at an earlier stage of the cultivars' growth

Partitioning of dry matter to petiole

The partitioning of dry matter to petiole (Table 5), in the case of Cip-Tanz, the petiole constituted 12% of the plant mass early in the growth season (12WAP). At 18 WAP petiole still represented 4% of the mass. Shaba diverted the smallest fraction of the assimilates to the petiole. (9% at 12WAP and 3% at 18WAP). Cultivar Sauti with 14% of the assimilates partitioned to the petiole at 12WAP. At 18WAP, the petiole still constituted 4% of the mass.

Partitioning of dry matter to lamina

From the partitioning of dry matter to biomass distribution into sweet potato plant parts in Table 5, it is clear that CIP-Tanz cultivar invested a larger portion of the assimilates in lamina growth than the two cultivars. In the case of Sauti the lamina constituted 29.2-46.4% of plant mass early in the growth season (12WAP – 15WAP). At 18WAP the lamina still represented 38.4% of the mass. Shaba diverted the smallest fraction of assimilates to lamina growth (16.4-20.4% at 12-15WAP and 12.9% at 18WAP. Cultivar CIP-Tanz was intermediate in this regard, with 18.4% of the assimilates partitioned to the lamina at 12WAP. At 18WAP the lamina portion of the plant mass was partitioned to seed stock at an earlier stage of the cultivar growth.

Partitioning of dry matter to vine.

The partitioning of dry matter to biomass distribution into Sweet Potato Plant Parts for each of the three cultivar in table 5, which showed the portion of the dry matter allocated to the vine during the sampling period varied among cultivars. The Shaba cultivar diverted the smallest proportion of assimilates to the vine (16.4%) earlier in the growth season and later increased and dropped again to 12.9% at 18WAP. In the case of Sauti cultivar, the vine constituted 29.3% of the mass at 12WAP. At 18WAP the vine still contained 30.7% of the dry mass. A smaller portion of the plant mass partitioned to vines at an earlier

stage of the cultivar growth.

Partitioning of dry matter to tubers

The partitioning of dry matter to biomass distribution into sweet potato plant parts for each of the three cultivars in Table 5, showed no significant differences between the cultivars in the portion of the dry matter partitioned to tubers. In the case of Shaba, a larger fraction of assimilates ranging from 56.2-76.2% was diverted to tubers from 12-18WAP. For Sauti, the fraction of dry matter allotted to tuber increased from 30.9-54.4%. Although, Sauti allotted less of the available assimilates to storage tuber than Cip-Tanz, a much higher final yield was produced by the Shaba cultivar.

In tropical countries and Nigeria in particular, the problem with use of inorganic fertilizer in Nigerian soil, is that the fertilizers are not obtained at right time and at low price. This might be as a result of shortage or high cost of procurement. Most organic fertilizers are bulky in nature, contain small amount of nutrients and their mean value lies in their supply of organic matter to the soil. They do not contribute much to the soil nutrients unless they are applied in large quantity. However, due to the problem of organic manure and inorganic fertilizer highlighted above, Agboola and Odeyemi (1972) clearly stated that the best fertilizer combination for soil of humid tropics especially in Nigeria is a complementary use of organic and inorganic fertilizers, which is known as organo-mineral fertilizer

Table 5: Effects of harvest times on biomass production into sweet potato plant parts for each of the three cultivars

Weeks After Planting	Sweet Potato Cultivars	Biomass produced (%)			
	Tuber	Seed stock	Petiole	(opv)	Lamina Vine
Shaba	3.4b	9.0b	16.4b	16.4b	56.2a12
Sauti	6.2a	14.0a	29.3a	29.3a	30.9b
Cip-Tanz	7.0a	12.0a	18.4b	28.3a	34.9b
Shaba	3.0c	8.0a	20.4b	23.0b	59.0a15
Sauti	7.0a	7.7a	46.4a	38.5a	36.1b
Cip-Tanz	5.0b	8.5a	9.6c	31.5a	35.1b
Shaba	3.0c	3.0a	12.9b	12.9b	76.2a18
Sauti	7.3a	4.0a	38.4a	30.7ab	42.5c
Cip-Tanz	4.9b	4.0a	6.4c	73.5a	54.4b

Values followed by the same letter(s) are not significantly different at P<0.05.

The results summarized in table 2, showed that N, P and K contents in the soil were 2.50 g kg^{-1}, 11.48 mg kg^{-1} and 0.10 c mol kg^{-1} soil, respectively. The values obtained for N was greater that critical level 1.0 – 1.5 g kg^{-1}, P was moderate, 10 – 20 mg kg^{-1} and K was below critical level, 1.5 – 2.5 c mol kg^{-1} soil. The total N was found to be high, this might have been due to the fact that the plot was under fallow. The soil textural class was loamy sand. Soil pH was 6.03, indicating that the soil is not too acid for sweet potato production.

Significant ($P < 0.05$) genotypic differences occurred in the partitioning of biomass into only seed stock (opv), vine and tuber. Differences were also observed in biomass partitioning into seed stock (opv), and petiole, due to the fertilizer treatment and into all plant parts (seed stocks, petiole, lamina, vine and tuber) at the various harvesting periods (Table 3). The results of this trial revealed that, there was an evident for DM increase, in seed stock, petiole and vine due to OMF II application. Although, there was no significant response to fertilizer treatment with respect to dry mass allocation into tubers. This might be due to slow release of organic fertilizer. This is in agreement with the findings of Levi-Minzi *et al.*(1990), who reported that OMF ability to supply plant nutrients in a slowly available form due to initial delay in the rate of decomposition and mineralization.

It was observed that obvious genotypic differences in biomass allocation into the plant parts. Cultivar Shaba a higher yielding variety in this study might be as a result of the fact that Shaba allocated much of its available assimilates to storage root growth than other varieties. This finding is in agreement with the results obtained by Huelt and O' Neill (1976), Enyi (1977) and Li and Yen (1988), who reported that sweet potato cultivars with higher yields divert large portions of assimilates to the storage roots.

Based on dry matter partitioning, sweet potato generally exhibits three different growth phases. In the initial phase, shoot growth dominates, with a large proportion of dry matter diverted to shoot growth. This is followed by a second phase of constant partitioning of dry matter between shoot and storage root growth. During the final phase, a major proportion of dry matter is partitioned to the storage roots. The percentage dry matter allocation into tubers increased with maturity, although reverse occurred as regards lamina and petiole. This means that, a large portion of the plant dry mass was partitioned to lamina and petiole at an earlier stage of the cultivars growth. This finding is similar to the finding of Enyi (1977), who reported that shoot growth dominates during the first phase of sweet potato growth, with a large portion of dry mass diverted to shoots. This study indicated that most assimilates were partitioned to the leaves at an earlier stage of growth. This finding is in agreement with the result obtained by Belehu (2003).

Conclusions:

Results from this investigation, from the three genotypes and fertilizer treatments. In summary, haba variety is the best for tuber production, while all the three cultivars can be grown for vegetable production. Maximum amount of leaves could be contained on or before the 12^{th} week of growth.

As the dry matter allocation into lamina and the other parts declines, allocation into the tuber increases until maturity. Evident trend for dry matter increase in seed stock (opv), petiole and vine due to OMF II application

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PERCEIVED EFFECTIVENESS OF THE USE OF ELECTRONIC WALLET (e–WALLET) FOR AGRICULTURAL DEVELOPMENT BY FARMERS IN SELECTED RURAL COMMUNITIES OF ONDO STATE, NIGERIA

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Abstract

This study examined the perceived effectiveness of the use of electronic wallet (e–wallet) for agricultural development by farmers in selected rural communities in Ondo State. Purposive sampling technique was used to select two Local Government Areas and one hundred farmers were purposively selected. Data were collected through the use of questionnaire and was analyzed using descriptive statistics. The study reveals that 48.0% of the respondents were between the age of 48-56 years, with a mean age of 50 years, 55% had between 5-7 family size, with a mean of 5 persons, 81% were male, 92% of the respondents were married, 52% had secondary education, 46% had 2-4.5ha of land with a mean of 5.0ha, 84% had less than 25 years of farming experience with a mean farming experience of 15 years, and grand mean of 3.44. The study concluded that the use of e–wallet by farmers has greatly assisted them directly or indirectly in having agricultural information on processing, marketing, producing, innovation and idea for an effective performance in farming. The study concluded that this innovation in extension can help bridge the information gap between farmers and extension

Keywords: Electronic wallet, Agricultural Information, Extension linkages, Ondo State.

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Introduction

The actual information need of the rural farmer is usually in accordance with the challenges confronting them at the time (Jhamtani, 2006). Their needs could be how to control pest and diseases, environmental hazards, seedlings, preservation, finance and/or access to loan. This aligns with the saying that information is power. Consequently, when the information required by the rural farmers is packaged in the language they understand and made available at the appropriate time, it will enhance agricultural productivity and ultimately food security (Oladeji, 2010). The drive to achieve food security, rural economic empowerment and national development objectives makes the strengthening of agricultural production, storage and marketing, research and development imperative to be fortified

through effective information (Akinwunmi, 2015). Amobi (2010) noted that National Food Security Programme is to ensure sustainable access, availability and affordability of equality food to all Nigerians and for the country to become a significant provider of food to the global community.

Electronic wallet (e–wallet) is aimed at subsidizing the cost of major agricultural inputs like fertilizers and seedlings (Jhamtani, 2006). The programme started in May, 2012, and has so far registered about 14 million farmers throughout Nigeria for direct redemption of farm inputs through the e–wallet system (communication with rural farmers via mobile phones, precisely Short Message Sending). This shows that ICT/New media has a significant role in evolving such a paradigm (Jhamtani, 2006). This study therefore examines the role e–wallet plays in the effort to achieve a paradigm shift in agricultural development and rural economic empowerment in Nigeria through provision of timely agricultural information. Hence, the study examined the perceived effectiveness of the use of electronic wallet (e–wallet) by farmers in selected rural communities in Ondo state, Nigeria. Also, the studies assessed the use of e–wallet, perception of the use of e–wallet on agricultural development and determined the constraints of using e–wallet by respondents in Ondo State

Theoretical Framework

E–Wallet refers to an electronic device that allows an individual to make electronic commerce transactions. This can include purchasing items on-line with a computer or using a smartphone to purchase something at a store. Increasingly, e–wallet are being made out just for basic financial transactions but to also authenticate the holder's credentials. For example an e–wallet could potentially verify the age of the buyer to the store while purchasing fertilizer. It is used to approach the term e–wallet not as a singular technology but as three major parts; namely the system (the electronic infrastructure), the application (the software that operates on top) and the device (the individual portion) Grilliches (2008).

An individual bank account can also be linked to the e–wallet. They might also have their driver's license, health care card, loyalty cards and other ID documents stored on the phone. The credentials can be passed to a merchant's terminal wirelessly via near field communication (NFC). Certain sources are speculating that the smartphone “e–wallet” will eventually replace physical wallet. The system has already gained popularity in Nigeria. E–wallet has both a software and information component. The software provides security and encryption for the personal information and for the actual transaction. Typically, e–wallets are stored on the client side and are easily self-maintained and fully compatible with most e-commerce websites. A server side e–wallet, also known as a thin wallet, is one that an organization creates for and about you as a person to maintain on its servers. Server-side e – wallet are gaining popularity among major retailers due to the security, efficiency and added utility it provides to the end-users, which increases the satisfaction of their overall purchase.

The information component is basically a database of user–inputted information. This information consists of your shipping address, billing address, payment method (including credit card number, expiry date and security numbers) and other information. The key point to take from e–wallet is that they are composed of both digital wallet systems. They are dedicated digital wallet devices such as the biometric wallet by Dunhill, where it's a physical device holding someone's cash and cards along with a Bluetooth mobile connection. Presently there are further explorations for smart phones with Near Field Communication (NFC) e–wallet capabilities. Such as the Samsung galaxy series and the Google's Android operating system and the Apple Inc, Iphone6 and Iphone6 plus utilizing Apple pay (Clark, 2013). E-wallet system enables the widespread use of digital wallet transaction among various retail

vendors in the form of mobile payments systems and digital wallet applications. The M–PESA mobile payments system and micro financing service has wide spread use in Kenya and Tanzania, while the master card pay pass application has been adopted by number of vendors in the U.S and the world. (Nwamze (2010).

Success Story of e-wallet

Success story of e-wallet has been well documented in Africa and in Nigeria at large. According to the leadership Newspaper (2015), there has been indications that the Federal Government are urged to continue with the e-wallet system for fertilizer distribution in order to enhance food security in Nigeria. The system has been implemented in Nigeria in order to enable farmers to have direct access to agro-products at subsidized rate. A significant contribution of e-wallet was that "Federal government had always made efforts to boost agricultural outputs in the country, but these efforts had not been directly channeled to beneficiaries of farmers until the introduction of the e-wallet system."E-wallet, which was introduced by Dr Adesina, a former Minister of Agriculture in Nigeria allowed every farmer to register as a cooperative union to benefit in the fertilizer distribution scheme.

"The scheme allows beneficiaries to pay only 50 per cent on agro-products, while the State and Federal Government pay the balance," he said. It was also documented that the e-wallet fertilizer distribution process had improved agricultural output throughout the country Nigeria as fertilizers were no longer diverted or sold at high rates to the local farmers. It was therefore recommended that the Federal Government should sustain the e-wallet fertilizer distribution process to enable agriculture thrive in the country.(News Agency of Nigeria, 2015). The success story of the e-wallet has brought about an initiative to upgrade it to a banking card. (Gov Technology, 2015). To boost its Agricultural Transformation Agenda (ATA), the Federal Government has upgraded the e-wallet system used by farmers to get farming input.

It was gathered that the government is taking the decision to strengthen its reforms in the agricultural sector. A Presidency source said: "We are upgrading the e-wallet to the National Agricultural Initiative system, so that each card that a farmer has will become a banking card with no fixed amount, for loans, they can save money, they can do insurance, they can transfer money, get anything they want. This will totally change the face of farming in Nigeria." (GovTechnology, 2015). As a result of the successes recorded in Nigeria on e-wallet, the World Bank has promised to scale up Nigeria's agricultural policy on Electronic-Wallet, E-Wallet, and system in Africa, including India, Brazil and China in order to encourage best agricultural practices (Vanguard Newspaper, 2014).

It was also discovered that 5 million people across the African continent utilize e-Wallets, launched by First National Bank (FNB) in 2009 and Macular (2014). The digital monetary app allows users to send and receive money, and more easily access financial services. Initially created for bankers in South Africa, the e-Wallet has seen substantial gains in Nigeria, Namibia, Botswana, Swaziland, Zambia and Lesotho. FNB's chief executive Yolande Van Wyk said in the report that over the past year close to $326 million had been sent via e-Wallets in Africa.

However e-wallet had been hampered by many challenges and limitations. According to Aroko (2007) the major constraints of e – wallet usage in Nigeria are Poor Information Communication Technology infrastructural, high cost of power and high cost of telephone services. Constraints also identified were high call tariff service, erratic power supply, high cost of handsets, cost of recharge cards, network coverage, repair of technical fault and access to recharge purchasing center as constraints to effective use of e–wallet in Nigeria.

Methodology

The Study Area and Sampling Technique

The study was carried out in Ondo state. Ondo State was chosen because farmers in Ondo State have been using the e-wallet system. The farmers involved in the use of e-wallet in Ondo state are the arable farmers and farmers involved in cash crops such as cocoa, coffee, oil-palm among others. Purposive sampling method was used to select two Local Government Areas (LGA's) which are Odigbo and Ile Oluji-Oke Igbo LGA's. Five communities were also purposively selected from each of the LGA's. Ten farmers were purposively selected from each community thus making a total of one hundred respondents. The five communities from Odigbo LGA's are Alapetun, Odowa, Gbelegi, Omifun and Onipanu and the five communities from Ile Oluji-Oke Igbo LGA's are Surulere, Temidire, Lota, Odomikan and Adejayan. Primary data were collected from the respondents through the use of structured questionnaires. Such data includes demographic characteristics such as sex, marital status, family size, level of education, farm size, years of farming experience and annual income among others.

Method of Data Analysis

Data were analyzed using descriptive statistical tools such as frequency tables, percentages and a five point likert rating scale which helped to determine the grand mean of the perception scores.

Results Discussion

The socio-economic characteristics of the respondents are presented in table 1. The study revealed that 48% of the respondents were between the age of 48 to 56 years, with a mean age of 50 years, 55% had between 5 to 7 family size, with a mean of 5 persons, 81% were male, 92% of the respondents were married, 52% had secondary education, 46% had 2 to 4.5 hectares of land with a mean farm size of 5.0 hectares, 84% had less than 25 years of farming experience with a mean farming experience of 15 years. Table 2 revealed that Personal savings (28.0%) leads the list of major source of income available to farmers in the study area, 50% had contact with extension agents through the mobile phones and 56.0% had ADP office and Extension workers as their source of information. This implies that frequency of contact with extension agents have a way of encouraging adoption of e-wallet. This support the finding of Kidane (2001) who noted that access to extension agents, radio and television will have positive influence on the adoption behaviour of farmers.

Table 3 highlighted the perception statement with regards to e-wallet. The grand mean perception score of 3.44 which showed that farmers in the study area agreed that the use of e–wallet had helped them improve in their accessing information, buying of input and overall farming business. This is in line with the finding of Gaurall (2011) who asserted that the use of e–wallet is well perceived by farmers because it enables them to access information from various sources such as research institutes, input dealers, government agencies, agricultural extension officers, veterinary doctors, traders and even consumer of their products. Also, Hudson (2007), indicated that e–wallet is not only adopted for social reasons, but is also perceived by farmers as a tool that will allow for more efficient and informed action to enhance greater productivity which will eventually lead to agricultural development.

Table 1: Socio-economic Characteristics of Respondents (N=100)

Age(Years)	**F (%)**	**Mean**
30-38	9(9.0)	
39-47	24(24.0)	
48-56	48(48.0)	50.0
57-65	16(16.0)	
Above 65	3(3.0)	
Family Size		
2-4	23(23.0)	
5-7	55(55.0)	5.0
8-10	19(19.0)	
Above 10	3(3.0)	
Farm Size (Ha)		
Less than 2	9(9.0)	
2-4.5	46(46.0)	5.0
5-7.5	25(25.0)	
8-10.5	9(9.0)	
11-13.5	4(4.0)	
14-16.5	5(5.0)	
Above 16.5	2(2.0)	
Farm Year Experience		
Less than 25	8(8.0)	
25-29	4(4.0)	
30-34	4(4.0)	
35-39	2(2.0)	
Above 39	6(6.0)	
Annual Income (₦)		
Less than 800,000	95(95.0)	3.8
801,000-1,800,000	3(3.0)	
1801,000-2,801,000	-	
Above 2,801,000	2(2.0)	
Gender		
Male	81(81.0)	
Female	19(19.0)	
Marital Status		
Married	92(92.0)	
Widowed	8(8.0)	
Educational Status		
Primary education	16(16.0)	
Secondary education	52(52.0)	
Tertiary education	25(25.0)	
No-formal education	7(7.0)	

Source: Field survey, 2015.

Table 2: Other source of Income, contact with Extension Agents and Source of Information

(N=100)	
	F(%)
Teaching	16(16.0)
Civil servant	21(21.0)
Politics	12(12.0)
Driver	13(13.0)
Tailor	10(10.0)
Personal savings	28(28.0)
Contact with Extension Agents	
Radio	6(6.0)
Mobile Phone	50(50.0)
Television	38(38.0)
Others	6(6.0)
Sources of Information	
ADP	13(13.0)
Extension workers	31(31.0)
ADP office and Extension workers	56(56.0)

Source: Field survey, 2015.

Table 4 revealed the specific use of e-wallet and the constraints experienced by the farmers about e-wallet in general. The specific use of e-wallet is to obtain information about new varieties of crops/seeds ranked 1st and the major constraint of the use of e-wallet among farmers is fluctuation/shortage of power supply which ranked 1st. This is in agreement with the finding of Maru (2012) who identified high call tariff service, erratic power supply, high cost of handsets, cost of recharge cards, network coverage, repair of technical fault and access to recharge purchasing centre as constraints to effective use of e–wallet in Nigeria.

Table 3 : Distribution of Respondents According to the Perception of the Use of e -wallet Technology. (N=100)

S/N	ITEMS	SA F(%)	A F(%)	U F(%)	D F(%)	SD F (%)	Mean Score
1	The use of e -wallet by farmers in any area improve the standard of farmers	4(4.0)	40(40.0)	25(25.0)	28(28.0)	3(3.0)	3.14
2	Using e -wallet is more effective to pass out information to farmers.	20(20.0)	70(70.0)	3(3.0)	4(4.0)	3(3.0)	4.00
3.	The use of e -wallet is widely accepted among farmers in this area.	13(13.0)	71(71.0)	7(7.0)	5(5.0)	4(4.0)	2.84
4.	The use of e -wallet is beneficial to both young and old.	9(9.0)	86(86.0)	2(2.0)	1(1.0)	2(2.0)	3.99
5.	The use of e -wallet makes agriculture easier to farmers.	4(4.0)	73(73.0)	19(19.0)	3(3.0)	1(1.0)	3.76
6.	The use of e -wallet brings about increase in farmers productivity in the area.	6(6.0)	40(40.0)	21(21.0)	31(31.0)	2(2.0)	3.17
7.	The use of e -wallet does not help to improve farmers' skills.	1(1.0)	24(24.0)	40(40.0)	32(32.0)	3(3.0)	2.60
8.	High quality and quantity of food	1(1.0)	11(11.0)	37(37.0)	49(49.0)	2(2.0)	2.88
9.	The use of e -wallet makes provision for mod ern farming.	4(4.0)	17(17.0)	43(43.0)	35(35.0)	1(1.0)	3.92
10.	The use of e -wallet is well packed to meet the needs of farmers.	18(18.0)	67(67.0)	5(5.0)	9(9.0)	1(1.0)	3.42
11.	The use of e -wallet is just a political propaganda	2(2.0)	8(8.0)	14(14.0)	49(49.0)	27(27.0)	3.12
12.	The use of e -wallet has increased my farm output.	1(1.0)	54(54.0)	32(32.0)	12(12.0)	1(1.0)	3.91
13.	The use of e -wallet should not be encourage to continue.	2(2.0)	15(15.0)	12(12.0)	70(70.0)	1(1.0)	3.53
14.	Farmers do not benefit from e -wallet	1(1.0)	2(2.0)	12(12.0)	76(76.0)	9(9.0)	3.90

Table 4: Specific use of e -wallet and Constraints of using e-wallet (N=100)

Specific Use of e -wallet	**Used E(%)**	**Not used F(%)**	**Rank**
Obtain information on new price	56(56.0)	44(44.0)	3rd
To obtain information about new varieties of crops/seeds	80(80.0)	20(20.0)	1st
To improve efficiency of management	44(44.0)	56(56.0)	4th
To obtain information on how to access various financial services	42(42.0)	58(58.0)	5th
To obta in information on how subsidized electronic voucher for inputs are delivered directly to the farmer	59(59.0)	41(41.0)	2nd
Constraints	**Yes F (%)**	**No F(%)**	
Failure of Internet service	81(81.0)	19(19.0)	2nd
Non-availability of technology personnel	20(20.0)	80(80.0)	5th
Poor basic infrastructure that encourage e-wallet	77(77.0)	23(23.0)	3rd
Fluctuation/shortage of power supply	82(82.0)	18(18.0)	1st
No skilful operation	17(17.0)	83(83.0)	6th
Too costly	25(25.0)	75(75.0)	4th
Inability and sub-standard products in the market	14(14.0)	86(86.0)	7th

Source: Field Survey, 2015

Conclusion

The study concluded that the use of e–wallet by farmers has greatly assisted arable farmers and cash crop farmers directly or indirectly in having agricultural information on processing, marketing, producing, innovation and idea for an effective performance in farming. In order to fast track agricultural development in Nigeria, farmers need to have access to the needed information at the tip of their finger. If this process of e-wallet usage is sustained overtime, there will be encouragement for others (youth and women inclusive) to join the agricultural workforce in Nigeria which will bring about an enviable agricultural development in sub-Saharan Africa and in the world at large.

Recommendations

It was therefore recommended that the Agricultural Development Programme (ADP) as a governmental agency should always organize farmers in groups and encourage them to form farmers association which will afford them opportunity to access information as at when needed. Also, in-house training for farmers group on how to access information with the use of e–wallet should be done regularly to upgrade their knowledge on the use of e-wallet.

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EXAMINING THE POTENTIALS OF COCOYAM FOR AGRIBUSINESS AND FOOD SECURITY IN AFRICA

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Abstract

Cocoyam is usually considered far less important to potatoes, cassava and yam among root and tubers cultivated and consumed in Africa. The paper examined trend analysis of cocoyam hectrage allocation, yield and output from 1970-2011 in Africa and the world using data from FAO statistics. Trend analysis was presented using averages at five years intervals. It found that in Africa, Western Africa leads in world hectare allocation with about 64% and output about 55% while the hectare allocation in Northern and Eastern Africa were less than 1% and 5% respectively. Conversely yield from Northern Africa was highest, followed by Central and Eastern Africa. The paper further compared nutritional value of cocoyam with those of cassava and yam with information from literature and notated that nutritionally cocoyam is superior to cassava and yams as it contains among others 2 to 3% protein, 0.2 to 0.4% fats, 13 to 29% better carbohydrate and 1.0% fibre and is rich in vitamins B and C and minerals. Various uses of cocoyam such as for food-soup, pounded cocoyam, portage with vegetables mixed with beans were discussed. Cocoyam is used for the treatment of difficult cancerous wounds and dews on cocoyam leaves are used in the treatment of high fever in children. The paper made a case for improved value chain of cocoyam through processing harvested tubers into flour and chips. It examined socioeconomic barriers to development of cocoyam enterprises and outlined strategies for overcoming them through agronomic practices. The paper also shared information on the agricultural sector, refocusing attention on the potential of cocoyam production and highlighting its potential for boosting the world economy by concentrating on enterprise dynamics. A number of international organizations interested in poverty alleviation in Africa are finding capacity building in cocoyam production and processing. Africa still needs to increase her value addition in cocoyam in order to meet international standard. This paper recommends continuous increase in cultivation of cocoyam and processing to meet international quality standard.The paper was optimistic that cocoyam has lots of potential as neglected and under crop specie in Africa.

Keywords: Cocoyam, socioeconomic factors, nutrients, value chain, output.

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Introduction

The world has focused entirely on a comparatively small number of crops to meet the various needs for food and industrial services, the consequence of this, is that thousand of plant species with a considerable larger number of varieties fall into category of underutilized or neglected crops (Genus,2010).It has been argued that these crops are marginalized by agricultural and industrial research (Purseglove,1972).One of such neglected crops is Cocoyam which over the years has received minimal attention from stakeholders of interest. Cocoyam has many species. Major cultivated and consumed species in Africa are Colacasia *esculenta* and Xanthosoma *sagittifolium* (Okonkwo,1993).They are the two most common cultivated species that are grown world-wide. There are other seven species of Colocasia *esculenta* that originated from Asia and about 40 species of Xanthosoma *sagittifolium* originated from American continent (Purseglove, 1972; Mwenye, 2009).Cocoyam is known as food crop which provides high yield of roots (corms) and foliage. It is tropical food crop that can be grown under flooded or upland condition (Onwueme, 1999)

It has been argued that the total world production of cocoyam was 10 million tonnes (FAO, 2005). Africa as a continent is the major producer of cocoyam followed by Asia (half of the African production)and Oceania with just a tenth of the total Africa production; the Oceania region surpasses any other region in terms of utilization and dependence on cocoyam for food(Onwueme,1999).Over the years, there has been increased interest in root and tuber production especially cocoyam production due to increasing population, drought and scarcity of foreign exchange to import grains and flour into most African countries(Hahn,1994).Nigeria is the largest producer of Cocoyam in the world accounting for 40 percent of the world total output of cocoyam(Eze *et al*,2003).

Cocoyam ranks third in importance after cassava and yam among the root and tuber crops cultivated and consumed in Nigeria(Udealor *et al,* 1996).Cocoyam falls under a set of crops called neglected and underutilized crop species (NUS) which have since emerged. It may be due to the need to diversify food production to attain food security. The neglected and NUS have potentials for meeting the increasing food nutrients of the growing population (Kimiywe,2009). Africa is yet to fully exploit these new species. Cocoyam is one of these crops, that have convincing potentials for meeting nutritional needs and cheaply available, thus examining the situation and performance trend especially in attracting foreign exchange is a research focus.

Africa is blessed with a lot of crop species that are indigenous and as such adaptable to the environment (Mkpado, 2013).The challenge is sensitizing the populace to see the nutritional and organo-leptic attributes of such crops through creating awareness. This will create an opportunity to increase in demand of such crop for investment which will yield good dividends. Thus, it could go a long way in sustaining Africans self-food sufficiency. It is because it has been noted that the neglected and underused plant species are part of a rich economic, social and cultural diversity. Many have the potential to play a much important role than they do today in sustaining livelihoods and human well-being and stability (Genus, 2010)

Nutritionally, cocoyam was reported to be superior to Cassava and Yam in the possession of high protein, mineral and vitamin as well as digestible starch. Past studies have identified eating of Cocoyam to diabetic patients and the aged to reduce the sugar level in their body, children with allergy and other persons with intestinal disorder (Plucknet, 1970). Cocoyam can be used as an industrial

material in manufacture of drugs for curing illness and alcohol (Okwuonu, 2000).The food energy yield of cocoyam per unit land area is high (Parkinson,1984). Cocoyam products have shown considerable potential in different industries. In livestock production, cocoyam leaves have proven to be useful as replacement for soya-bean flour mixes and flour has shown potential as raw material for production of larger beer (Uchegbu *et al*, 2010). Recent studies have revealed that cocoyam starch is fine and contains small granules, a property required by many industries (Onwuka, 2012).A mixture of wheat and cocoyam flour can be made into pasta and consumed as food (Arnaud *et al,* 1999).

A high degree of production variability, relatively low crop yield and dependency on primary exports with low income elasticity and high volatility characterize myriads of problems of African agriculture. Relative to other developing regions, African's agriculture is undercapitalized, uncompetitive and under-performing (Mkpado, 2013).The sector is relatively weak as its productivity lags behind other regions. The system is of declining performance due to myriad challenges it faces. Hence, this calls for improvement in agricultural capacity development through improving the value chain of cocoyam products. Cocoyam has been argued to be an underutilized crop species (Onwubuya *et al*, 2012).The food security need of Africa amidst climate change can require strategic use of certain underutilized crop species such as Cocoyam. Cocoyam can be a good candidate for improving food security needs, because of its high nutrition values in terms of caloric and vitamins content. In-spite of the much potential and advantages of cocoyam production, the crop is still treated as a minor crop. No serious study has deliberately given attention to address its research and development. It has also received low research priority in all regional agricultural centers and therefore, its contribution to food security and economy is underestimated. Consequently, there is paucity in information about cocoyam yield, hectare allocation and upgrading its value-chains for future production. Information and data on Cocoyam are required to evaluate these potentials for possible development of the crop.

Consequently, the study examines the ecological, nutritional, industrial and other agribusiness uses of cocoyam in Africa. Examine production trend in Africa, challenges and prospects of upgrading cocoyam in Africa is justify to improve the cultivation of cocoyam and make it a utilized crop. Thus, the usefulness of cocoyam in Africa will help to assess it sustainability as a crop for implementing new agenda for agricultural transformation and poverty alleviation in Africa. It is necessary because strategic planning for sustainable agriculture requires taking a stock of trend of some available agricultural assets and performance trend. This paper will serve as a tool to share information on the agricultural sector, to refocus attention on the potential of cocoyam production and highlighting its potential for boosting the world economy by concentrating on enterprise dynamics.

Methodology

The study focuses on Africa, with reference made to other parts of the world or countries where possible for comparison analysis. Africa data were in most cases presented along the sub regions such as Northern, Western, Southern, Eastern and Central (Middle) Africa. This shows experiences of the sub-region instead of having only the holistic approach. Secondary data and information on Cocoyam were collected from Food and Agriculture Organization; (FAO) statistics. Purposive Sampling technique was used because data on cocoyam was source from (Food and Agriculture Organization; FAO) 2013 statistics. Data from 1970 to 2011 were used to examine performance trend of cocoyam. Descriptive analyses were employed to analyze data collected and these were averaged for five-year period. Statistical package for Social Sciences version 14 was used for data analysis. The use of means

allows the study for equitable comparison of data across African zones; because the zones have different number of countries. The performance indicators were adopted with the concept of environmental determinism in mind in order to achieve differences within Africa and world ecology.

Review of Relevant Literature and Conceptual Approach

The ecology of cocoyam in Africa

Where and when can cocoyam grow in Africa? It has been a research agenda for quite some-time now, it has been argued that Cocoyam thrives better on well drained sandy loam soil (Williams *et al,*2002). It produces yields when planted in fertile soil with a good water retention capacity. It is cultivated in all sub regions in Africa namely Eastern, Central, Southern, Northern and Western Africa respectively. It is planted on the crest of ridges 1m apart on row. Planting depth should be 10-15 cm with the cut surface of the sett faces upwards in a slanting position. A whole corm or cormel can be cut into set for planting. The sett or corm is normally not too big or too small. Fertile soil may not be fertilized for cocoyam but it may be needed if the soil has been depleted. Immediately rain is steady, cocoyam can be planted in the area suitable for its cultivation, plough twice at 15 days interval. Spacing will depend on the water regime of the soil. Heaps or ridges can be made at 1m?l m apart depending on the availability of water in the soil.

Cocoyam seed-rate is 10,000corms/ha. The weeding of cocoyam is only necessary in the early stages of growth because as soon as the leaves expand, they provide enough canopy that shade off weeds. The young cocoyam depends on the food reserve of the planting material during the first 12 weeks after planting. Fertilizer should therefore be supplied at about 14 weeks when its growth is at peak. Split doses of nitrogen at 6 and 12 weeks after planting have also been recommended. The rates are 60kgP_20_5 and 60K_20/ha applied at planting and 40kgN/ha applied split at 6 and 12 weeks after planting (Uguru, 1996).It has been revealed that fungus attacks cocoyam plant, leaves turns yellow prematurely and the entire plant becomes wilt (Tambe, 1995). White ants also cause damage on the tubers at any stage of development or even on storage. Leafhoppers are major insect pests of taro which are controlled by spraying with any systemic insecticide.

Other pests of cocoyam include rodents that eat the corms and cormels on the field. Most cocoyam varieties mature in about 8-12 months of planting. Maturity indicator for cocoyam is yellowing of leaves. It is important to harvest as soon as the crop matures; otherwise the corms and cormels will begin to sprout or rot depending on the moisture content of the soil. Bruising the corms during harvest provides entry points for rots. This should be avoided as much as possible. Harvesting is done by shaking up the plant and uprooting it and bringing out cormels while those cormels remains in the soil dug-out.Cormels are cleaned but not washed. They are arranged on raised plat forms where they may remain in good condition for up to 3-4 months. After harvest, corms and cormels should be kept in an airy shed for 2-3 days for any form of wound to dry and seal up. On the fourth day, the corms are transferred into pits or raised open rafters with overhead shade. Other storage techniques include packaging on spots and dusted with wood-ash or leaving on heaps/ridges un-harvested for 2-3 months but sprouting should not be allowed.

Cocoyam offers insurance against total crop failure since it thrives even in soil with low fertility (IITA, 1996). It also helps farmers to maximize use of marginal land since it can strive on poor soils more than

any other crops. In sub-Sahara Africa (SSA), cocoyam is mainly a subsistence crop grown by women for food. It grows well in poor soils with limited requirement. It provides food security during conflicts when the invader cannot easily destroy or remove the crop since it conveniently grows underground. Cocoyam tolerate shade, the crop is usually intercropped with vegetables, plantation crops such as coconut, oil palm and coffee, yam, maize, melon, groundnut and other legumes.

Some problems associated with cocoyam cultivation in Africa include rot. Rot is one of the major post-harvest problems associated with cocoyam (Nwauzor,2001).The disease is controlled by use of uninfected planting material, crop rotation with maize and deep planting of corms. The best form of check of the rot disease is to process the harvested cocoyam into some of flour. Others include prolonged drought due to variability in rainfall pattern (IITA, 1996).

Nutritional Consideration

The major challenge in the production of fresh Cocoyam has been argued to be that of output, it can easily decay under high temperature. Cocoyam can be used as food, eaten in various forms. They can be boiled or roasted like yam. In Nsukka-Nigeria, the most popular form of preparation of cocoyam in the zone is the processing into "achicha" forms; dried cocoyam chips (Obiechina *et al*, 1984). It was noted that "achicha" has long shelf life and provide food all year round especially during the lean planting season. Nutritionally, according to Scott (2000), cocoyam contains 2.0g of protein while cassava has 0.9g of protein, this shows that the nutritional level of cocoyam is greater than cassava in terms of protein content. Cocoyam has been noted to be very rich in vitamin B_6 and magnesium; vitamin B_6 helps the body in properly metabolizing glucose and preventing infections while magnesium prevents high blood pressure.

Cocoyam flour is an emerging industrial product. Cocoyam fufu is traditionally made from cocoyam by boiling cocoyam after peeling off the covering, pounded in a mortar and beat with pestle until it appears smooth and then rolled into balls that can be swallowed, served with delicious African soup. There is a wide range of cocoyam value added products for human consumption. NCRI classified industrial uses of cocoyam as to include its emerging numerous applications in the food and non- food industry such as cocoyam crisp/flakes, soup thickener powder, flour(for confectionary) and starch as raw material in the textile industry. Cocoyam flour can be used as a base for preparation of secondary foods such as cakes, chin-chin, strips and pancakes (Aniedu, 2006).The underground cormels provide digestible starch and the leaves are nutritious spinach like vegetable, which give a lot of minerals, vitamin and thiamine (Tambong *et al*, 1997).A mixture of wheat and cocoyam flour can be made into pasta and consumed as food (Arnaud *et al*,1999).

Result and Discussion

All the land mass of the world is not cultivable for cocoyam production. But what is cultivable of the crops varies from country to country (Mkpado, 2013).African accounts for the highest proportion of land devoted to cocoyam cultivation in the world; this fact is verifiable from table 1. The range of hectares allocated for Cocoyam production ranged from 84.3 percent from 1970-1974 to 86 percent between 2010 -2011(FAO, 2013).The sub-region that had the highest hectare allocation was West Africa. Her hectare allocation ranged from 60.35 percent to 64.5 percent for the period under study (see Table1).Close to this performance is the record of Central Africa ranged from 20.71 percent to 16.7 percent. Generally, an increasing trend has characterized hectare allocation of cocoyam in Africa

especially in Western Africa where the crop is produced highest in the world. The increasing trend from western Africa outweighed the decreasing trend of other sub regions in comparison to the world data. Thus, Africa is blessed with land resources that have a lot of potentials for agricultural transformation (Klaus *et al*, 2011).

Cocoyam yield in Africa is very encouraging because Africa still has most of its cultivable soil still fertile, thus encouraging cocoyam production. Western Africa has maintained over half of the yield index in the world. On the average Africa currently account for 77.2 percent of the yield index. Central Africa accounts for 16.1 percent of the yield index while Northern Africa had the least yield index of 1.2.The yield index is very much related to the ecological adaptability of the crop. It is because sub regions with very high yield index showed that the crop adapt very well there as in Western Africa.

Table 1 Hectarage allocation to cocoyam cultivation in Africa

Area	1970-1974	1975-1979	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009	2010-2011
World	6074854	5012734	4239597	4761666	5538043	6144130	7377069	7595797	12986785
Africa	5122564 (84.32)	3950947 (78.81)	3140580 (74.07)	3738421 (83.35)	4615797 (78.51)	5265448 (83.35)	6459013 (87.56)	6650358 (87.55)	11280334 (86.86)
Eastern Africa	192017 (3.16)	185707 (3.70)	197488 (4.66)	238141 (5.00)	372614 (6.73)	394500 (6.42)	386551 (5.24)	399597 (5.26)	726384 (5.59)
Middle Africa	1255723 (20.68)	966430 (19.28)	612000 (14.44)	814100 (17.10)	1076980 (19.45)	1135365 (18.48)	1287015 (17.45)	1289323 (16.98)	2172551 (16.73)
Northern Africa	8400 (0.14)	13652 (0.27)	14883 (0.35)	17220 (0.36)	17610 (0.32)	14880 (0.24)	13625 (0.18)	19502 (0.26)	35027 (0.27)
Western Africa	3666424 (60.35)	2785158 (55.56)	2316209 (54.63)	2668960 (56.05)	3148593 (56.85)	3720703 (60.56)	471822 (64.69)	4941936 (65.06)	8346372 (64.27)

Source: FAO (2013) Values in parenthesis are percentages with reference to World value

Challenges of cocoyam production and improved value chain in Africa

Cocoyam production in Africa has faced a lot of constraints during its period of production due to rainfall variability pattern. Also limited access to planting materials, scratching nature of cocoyam, poor soil fertility and lack of land for its cultivation especially among female Cocoyam farmers. This is due to land laws restricting women from owning land in Africa (Aidoo *et al*, 2000).This has resulted in the limitation of the realization of the full potential of the crop in terms of its utilization especially in West Africa where cocoyam is seen as women crop (Onwubuya, 2012).The marketing of cocoyam is also constrained by inadequate storage system resulting to heavy losses due to high levels of

Table 2: Yield of cocoyam in Africa

Yield	1970-1974	1975-1979	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009	2010-2011
World	226613	221046	248567	254080	251889	313873	349172	370301	671548
Africa	174642 (77.06)	146520 (66.28)	155757 (62.66)	180680 (71.11)	192221 (76.31)	264503 (84.27)	308381 (88.32)	332485 (89.79)	595217 (88.63)
Eastern Africa	267074 (117.86)	266495 (120.56)	271472 (109.21)	281741 (110.88)	244138 (96.92)	217794 (69.39)	270051 (77.34)	274884 (74.23)	503167 (74.92)
Middle Africa	158879 (70.11)	168524 (76.24)	181943 (73.19)	201685 (79.38)	198474 (78.79)	246840 (79.64)	266861 (76.43)	337546 (91.15)	658032 (97.99)
Northern Africa	1212301 (534.97)	1441913 (652.31)	1652807 (664.96)	1521684 (598.89)	1677801 (666.09)	1603424 (510.85)	1342293 (384.42)	1610610 (434.94)	2867004 (426.92)
Western Africa	173142 (76.40)	126572 (57.26)	129768 (52.20)	157663 (62.05)	176088 (69.91)	271305 (86.44)	319732 (91.57)	331547 (89.53)	577520 (86.0)

Source: FAO (2013) Values in parenthesis are percentages with reference to World value

Table 3: Output of cocoyam in Africa

Production Per tonnes	1970-1974	1975-1979	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009	2010-2011
World	2725225	22121381	20823902	2415621	27895830	38665416	51540021	5621345	96850156
Africa	1789359 (65.01)	116922787 (52.86)	9590698 (46.06)	13501497 (55.89)	17759005 (63.66)	27998628 (72.41)	39860971 (77.34)	4427479 (78.76)	74793772 (77.2)
Eastern Africa	1026723 (3.73)	989994 (4.48)	1071631 (5.15)	1342280 (5.56)	1778668 (6.38)	1658737 (4.29)	2088678 (4.05)	2194095 (3.90)	4055571 (4.19)
Middle Africa	3972902 (14.3)	3199140 (14.46)	2228600 (10.70)	328100 (13.57)	4277985 (15.31)	5586363 (14.15)	6860570 (13.31)	8517517 (15.15)	15591586 (16.09)
Northern Africa	203000 (0.74)	394391 (1.78)	491596 (2.40)	523000 (2.20)	590090 (2.12)	486251 (1.26)	376886 (0.73)	629727 (1.12)	118475 (1.15)
Western Africa	12693734 (46.7)	7109262 (32.14)	5798871 (27.85)	8356117 (34.59)	11112262 (39.59)	20267277 (52.42)	30534837 (59.27)	32933454 (58.59)	54028140 (55.78)

Source: FAO (2013) Values in parenthesis are percentages with reference to World value

perishability. In addition to sprouting of corms during storage, infestation of pest and disease, limited trust in the supply chain and distance from farmland to market. According to (Selfa *et al*, 2002) the bitter, astringent taste and scratchiness of cocoyam in the mouth and throat is also a palatability problem of cocoyam. More so, market power of cocoyam often lies more on cocoyam traders than producers who are usually low small holders with limited capacity with intention of disposing their produce at lower price during market glut. These constraints constitute a serious impediment to Cocoyam production, processing and consumption.

Prospects of upgrading cocoyam value chain in Africa

Cocoyam is yet to maximize its full potentials in terms of production and processing due to several constraints that this study has identified that still limit its production. It is possible that the production of cocoyam can be commercialized to harness its potentials. Cocoyam can be a good alternative source of carbohydrate in this era of food insecurity; efforts can be made to boost its production base on the following:

- The notion that cocoyam is a poor man's or women crop is prevalent and needs to be dispelled through extension teaching of proper information about the crop.
- Recycling of planting materials (corms/cormels) year by year results in accumulation of pathogens in them and this leads to yield decline with time. Generation of 'clean' planting material through meristem tip culture and multiplication of these will not only stop this process but increase yield. But many farmers are not aware of this technology, thus there is need for effective information in that direction.
- Government should encourage cocoyam based research on genetic improvement of cocoyam especially the grown species.
- There should also be researches on other industrial, pharmacological and medicinal use of cocoyam.
- Recent developed technologies such as practicing growing of cocoyam with other arable crops, selective timing of planting and harvesting should be disseminated and extension agents should help cocoyam farmers in the adoption of these technologies. These technologies should be packaged and integrated into Agricultural Development Programme (ADP). Women unit for training on cocoyam production should be encouraged.
- Formation of groups or co-operative society should be encouraged among Women through the assistance of Women in Agriculture (WIA) unit of ADP to ensure high yielding and resistant variety of cocoyam gets to farmers to boast their productivity.
- Cocoyam farmers especially women should not be discriminated against in land acquisition so as to enable them cultivate more land area for the crop as well as others crops.
- There should be public enlightenment using radio and television by extension agency in teaching new and improved practices for cocoyam production, processing and utilization in every ecological suitable environment.

Conclusion

The examination of cocoyam niche in sub Saharan Africa has been reveling with lots of potential as an alternative source of achieving household food security. It thrives well in very poor soils. The study found out that its cultivation on marginal soils will yield the highest profit compared with other crops.

It is a source of carbohydrate staple which can be easily be prepared as a mixture with other food stuff such as vegetable and palm oil for balanced diet. Cocoyam is an emerging food crop in Africa. Thus, there is need to increase cocoyam production, consumption and marketing to increase income derived of cocoyam farmers. The study also identified that adding cocoyam in the diet (which is cheap to source and prepare) can help in reduction in malnutrition of children since it contains more nutrients than yams and cassava which are consumed by these children. The study also revealed that improvement in processing as well as storage of cocoyam and converting it to chips for children can reduce post - harvest losses.

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AN EVALUATION OF MARKETING EFFICIENCY OF PINEAPPLE FARMERS IN DELTA STATE NIGERIA.

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Abstract

The study examined pineapple marketing in Delta State using Ethiope West Local Government Area as a case study. Objectives of the study were to determine the marketing margin, assess the determinant of marketing margin in the study area, estimate the cost and also returns of the pineapple marketers. Data were collected purposively from fifty pineapple marketers through a well structured questionnaire and were analyzed using descriptive statistics, marketing margin and regression analysis. Majority (76%) of the respondents were females, 84% were below 50 years of age while 44% were singles, only 4% had no formal education. Marketing margin of N25.9, Efficiency Ratio of 5.26 and Profitability ratio of 3.6 were obtained and this implies that the pineapple marketing is profitable and the marketing operation is efficient. The regression result shows that 84.8% variations in the marketing margin are being accounted for by the independent variables in the specified model, Cost of transportation (X_6) and cost of rentage (X_7) were significant at 5%, implying that they are important factors determining marketing margin in the study area. Some problems affecting the efficiency of pineapple marketing include perishability of fruits, lack of storage and processing facilities, insufficient capital. It was therefore recommended that to improve on marketing efficiency of pineapple marketing, pineapple farmers should form cooperative group to enable them access enough credit facilities and government should also provide storage facilities to reduce the rate of spoilage of fruits.

Keywords: Evaluation, Efficiency, Multiple regression model, perishability, Delta State, Nigeria.

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Introduction

Pineapple (*Ananas comosus*) is the third most important tropical fruits in the world after banana and citrus, important producing countries are Brazil, India, China, Nigeria, Mexico and Columbia (FAOSTAT, 2011). Nigeria ranked 7th on the list of world producers and leading producers in Africa. It has been estimated that the production of fresh fruit is 1,400,000 MT annually. Nigeria has been argued to have the largest land area of about 180,000ha for pineapple production in the world, and yield 77778tons/ha (FAOSTAT, 2011). Pineapple is a wonderful tropical fruit having exceptional juiciness, vibrant flavour and immense health benefits (Joy, 2010). It is grown both for the fresh and processed market, which makes it an important food which can be eaten fresh or eaten in a processed form (FAO, 2009). In developing countries like Nigeria, most of the fresh pineapple produced are sold in domestic market and bought for domestic consumption (Spore Magazine, 2008). Also the fruit juice market

(Pineapple) in Nigeria had witnessed a tremendous growth since 2002 (Manufacturing Today, 2011).

In the Delta region of Nigeria, pineapple production is one of the major agricultural occupation of the people especially those living in the rural areas. This is due to the variability of the climatic condition witnessing in the area which favours the growth of the crop (Pineapple). Hence there is the need for a link between the pineapple farmers and the demand. The link between the producers and the consumers is the market. Marketing therefore plays a central role in developmental process. However, the marketing system of Nigerian food and staple products have failed to address efficient pricing that affect price stability from time to time. It was learnt that information asymmetry which has led to pineapple marketing segregation (Mafimesebi, 2002).

Despite Nigeria position and potential in pineapple production in the world and the enormous comparative advantages the country has over the crop its yet to regain its efficiency in marketing. Nigeria has the lowest productivity of 7 tons/ha when compared with the other countries involved in pineapple production. This estimates is a small share (5%) of the world pineapple production (FAOSTAT, 2010, Mark, 2010). Thus, this is the gap the study has identified in pineapple production in the country (Mark, 2010).

Although Nigeria's position on the list of world pineapple producer is encouraging, majority of the harvested produce is wasting due to production inefficiencies, post harvest losses, low level of technology to facilitate processing of quality pineapple products and most importantly inefficient marketing system (Ivan *et al,* 2011). Also there are others problems such as lack of transportation and inadequate infrastructural facilities have contributed immensely to the low level of marketing of pineapple in Nigeria. Reviewed of past studies have identified most affected areas in Nigeria is in Delta State particularly Ethiope West Local Government Area. Therefore this study intends to look at pineapple marketing with a view to increase production and marketing efficiency of pineapple marketing, to achieve this, the study examined the socio-economic characteristics of the marketers, estimate the cost and returns to pineapple marketing and ascertain the factors influencing pineapple marketing inefficiencies in the area of study.

Theoretical Framework

Literatures have argued that marketing involves all those legal, physical and economic services which are necessary to make products from the producer available to the consumers (Olukosi and Isitor, 2004). The more efficient the marketing functions are performed, the better the marketing system to both the farmers, food marketing firms, consumers and the society at large. Marketing efficiency is the maximization of the ratio of the output to input in marketing (Olukosi and Isitor, 2004). Despite the significant roles of marketing in agricultural development, over the two decades, the world has witnessed a land slide movement towards market liberalization and this movement has affected both international and domestic markets (Onu and Iliyasu, 2008).

Marketing as applied to agricultural produce consist of all the processes and services used in moving the produce, from the producer to the final consumers. This include, not only the physical movement to the point where the conduct wanted, but also the efficiency of such operation Moreover marketing has been defined as the sum total of business activities involved in the movement of commodities from production to consumption (Adekanye, 1998).

It is therefore obvious that marketing serves as a link between sellers and buyers. It helps to monitors consumers preference by indicating the need of consumers to producers. This in turn encourages the producers to improve and take up production opportunities in response to demand and supply. The main marketing function of a typical agricultural commodities are buying and selling, sorting, packaging, processing, grading, transporting, advertising and storage. Every agricultural product that is really for market must pass through all these stage in order to command good price (Abbott and Makeham 1990).

Marketing encourages research into food aimed at improving quality of products. Efficient marketing system can also encourage the development of agricultural related industries most especially in pineapple production. Marketing efficiency creates employment opportunities for skilled and unskilled labour in such area of operation like storage, transportation; it also leads to provision of infrastructural facilities like feeder roads boreholes and storage facilities (Kohls, 1995).

Methodology

This study was carried out in Ethiope West Local Government Area of Delta State. The major occupation of the people are farming and trading. The climate favours the growth of various food and cash crops such as cassava, yam, pineapple, cocoyam, plantain, oil palm and rubber. The major markets in the Local Government are Jesse market, Oghara market and Mosogar market.

Method of Data Collection

Data was collected from (50) fifty marketers purposively selected from the major markets in the study area. Primary data were generated from the respondents using a well-structured questionnaire. Socio-economic characteristics of pineapple marketers such as educational background, age, household size as well as cost and returns were among the information gathered from the respondents.

Method of Data Analysis

Descriptive statistics such as the frequency distribution Tables, percentages, mean e.t.c was used to describe the socio-economic characteristics of the pineapple marketers, while Marketing and Operational Efficiency were used to measure market performance of the marketers.

The marketing margin formula as specified by Olukosi and Isitor, (2004) is given by

Marketing Margin:- $\frac{\text{Selling Price} - \text{Purchase Price}}{\text{Selling Price}}$

(i) Efficiency Ratio (ER) = $\frac{TR}{TVC}$

(ii) Profitability Ratio (PR) = $\frac{TR}{TC}$

Where TR = Total Revenue
VC = Variable Cost
TC = Total Cost

When ER >1 and PR >1 then the marketing evaluation is operationally efficient and vice-versa.

Regression model was used to estimate the variable that determines the marketing margin of pineapple marketers and the model is stated thus;

$Y = F(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10,} e)$
Y = Marketing Margin
X_1 = Age
X_2 = Gender
X_3 = Source of Supply
X_4 = Distance from Source of supply
X_5 = Cost of purchasing and average size of pineapple
X_6 = Cost of transportation
X_7 = Cost of rentage
e = Error term.

Estimation Technique
The study adopted Ordinary Least Square (OLS) technique is its estimation technique and the results are presented under the results of Multiple regressions analysis.

Results and Discussion
From table 1, 76% of the pineapple marketers are female while 24% are male, this implies that pineapple marketing is majorly dominated by the female in the study area. Also 30% of the marketers are within the age of 20 – 29yrs, 16% are within the age of 30 – 39 years while 26% are within the age of 40 – 49years. This implies that the marketers are still in their active age and will be able to cope with the stress and commitment needed in the business.

Table 1 also shows that 44% of the respondents are single, 38% are married while 8% are separated. This implies that pineapple marketing is usually engaged by singles and they may use the opportunity to generate a lot of income to sustain themselves and their families. Table 1 reveals that majority of the respondents (96%) are educated ranging from primary education to tertiary education with secondary education having the highest percentage (54%). This implies that the marketers can read and write thus will be able to have access to marketing information and utilize such information to advantage.

Table 1 reveals that majority of the pineapple marketers (44%) get their capital from personal savings, 36% gets their capital from cooperative society while 20% gets their from other means such as family relations, e.t.c. The reason for this could be that the fund they need for pineapple marketing is not big enough and maybe the farmers do not have enough collateral to secure fund from banks.

Table 1: Socio-economic Characteristics of the Marketers

Variables	Frequency	Percentage (%)
Gender		
Male	12	24.0
Female	38	76.0
Age		
Less than 20yrs	6	12.0
20-29yrs	15	30.0
30-39yrs	8	16.0
40-49yrs	13	26.0
50yrs and above	8	16.0
Marital status		
Single	22	44.0
Married	19	38.0
Divorced	2	4.0
Separated	4	8.0
Widow	3	6.0
Level of Education		
No formal Education	2	4.0
Primary Education	7	14.0
Secondary Education	29	54.0
Tertiary Education	14	28.0
Source of capital		
Personal savings	22	44.0
Cooperative society	18	36.0
Others specify	10	20.0
Total	**50**	**100.0**

Source: Field Survey, 2014

Table 2 indicates that 58% of the pineapple marketers obtained their information from fellow marketers, 22% obtained information from friends, 18% obtained information from other sources such as family members, relative's e.t.c. While 2% obtained their information from the radio/media. The reason why majority gets their information's from fellow marketers may be that the marketers have more marketing experience in running the business. Table 2 also shows the type of information needed by the marketers, 82% needs marketing information, and the marketing information need include market concentration, pricing regulation. This implies that the marketers required recent and updated information about the markets this will enable them sell their products on time.

Table 2: Types and Sources of Information of the Marketers

Variables	Frequency	Percentage (%)
Source of Information	1	2.0
Radio	11	22.0
Friends	29	58.0
Fellow marketers	9	18.0
Others specify		
Types of Information Needed	7	14.0
Financial Information	1	2.0
Technical Information	41	82.0
Marketing Information	1	2.0
Others specify		
Total	**50**	**100.0**

Source: Field survey, 2014

Result of Cost and Return

$$MM = \frac{SP - PP}{SP} \times 100$$

SP = N12220

PP = N9050

$$MM = \frac{N12220 - N9050}{N12220} \times 100$$

$$MM = \frac{N3170}{N12220} \times 100$$

MM = N25.9 per unit

Measure of market performance

(i) Efficiency Ratio (ER) = $\frac{TR}{TC}$

TR = N2124500

TC = N403860

$$ER = \frac{N2124500}{N403860}$$

ER = 5.26

This shows that pineapple marketing operation is efficient in the study area.

(ii) Profitability ratio (PR) = $\frac{TR}{TC}$

Where TR = N2124500

TC = N590010

$$PR = \frac{N2124500}{N590010}$$

PR = 3.6

This shows that pineapple marketing operation is profitable in the study area.

Result and Discussion

The outcome of cost and return analysis as a measure of marketing margin for pineapple marketing operation was N25.9 per unit. The total revenue generated annually was N212, 450,0. The size and positive value of marketing margin and profitability ratio obtained confirmed that pineapple marketers in the study area were able to cover the operation expenses of their pineapple business.

Measure of marketing performance

(i) Efficiency Ratio:- The estimated efficiency ratio for pineapple marketing operation was greater than 1 (efficiency ratio > 1), it implies that marketing operation is efficient in the study area.

(ii) Profitability Ratio:- The estimated profitability Ratio for pineapple marketing operation was 3.6, The profitability ratio was positive hence the pineapple marketing operation is profitable in the study area.

Result of Regression Analysis

$$Y = 135.147 + 29.1724 X_1 - 47.982 X_2 - 53.572 X_3 + 20.476 X_4 + 0.126 X_5 + 0.022 X_6^{*} + 0.000 X_7^{*}$$

(132.021) (11.988) (29.310) (35.745) (23.899) (0.574) (0.004) (0.002)

$R^2 = 0.848$

$R^{-2} = 0.797$

F value = 16.753

*** significant at 5%**

Regression Result and Discussion

The regression result shows that R^2 is 0.848 which means that 84.8% variation in Y (marketing margin) is being accounted for by the independent variables in the specified model. From the result, it can be seen that variables like cost of transportation (X_6) and cost of rentage (X_7) were significant at 5% level, implying that they are important factors determining marketing margin in the study area. The positive sign associated with age (X_1), distance from source of supply (X_4) cost of purchasing on average size of pineapple (X_5), cost of transportation (X_6) and cost of rentage (X_7) implies that the higher the variable the higher the marketing margin.

For instance, the younger the age of the marketers (X_1) the more energetic, active and longer distance they can cover during marketing hence making room for more profit and increasing the marketing margin. For distance from source of supply (X_4), the closer the source of supply the more regular and easier the marketers gets that pineapple for sales hence giving room for regular profit and increasing the marketing margin as well. For cost of transportation (X_6), the lesser the cost spent on transportation the lesser the expenses incurred in running the business hence making the marketers to maximize profit and also increasing the marketing margin. For cost of purchasing an average size of pineapple fruits (X_5), the lesser the amount the marketers purchases their fruits, the more chances of making profit hence increasing their marketing margin for cost of rentage (X_7), it implies that the lesser the amount of money spent in renting stores/store the lesser cost incurred in the business hence minimizing cost and in turn improving the marketing margin.

On the other hand the negative sign associated with gender (X_2) and source of supply (X_3) indicates that these variables does not affect the marketing margin in the study area. For instance, Gender (X_2), this means that whether the respondents are male or female it has nothing to do with the marketing margin obtained in pineapple marketing business. For source of supply (X_3), this also does not affect the marketing margin whether the respondents' gets their pineapple fruits directly from farmers, wholesaler, commission agents or retailers it has no affect or effect on the marketing margin of the business.

Conclusion

Pineapple is the third most important tropical fruits in the world after banana and citrus, the fruit is rich in a lot of vitamin and minerals. The marketing of pineapple, serves as source of employment and income generation to marketers. The findings shows that pineapple marketing is highly profitable and stable source of livelihood to many Nigerians thereby reducing the unemployment rate and poverty in the country. However, the potential of this enterprise could only be maximized in Nigeria and particularly in the study area (Ethiope West Local Government area of Delta State) if the major challenges identified are such as perishability, lack of storage and processing facilities high cost of transportation, insufficient capital and cost of rentage are addressed by the government and other relevant stakeholder.

Recommendations

To improve the efficiency and profitability of pineapple marketing business in Nigeria the following are therefore recommended.

(i) Government should improve on the road condition and network to reduce the cost of transportation incurred by the pineapple marketing.

(ii) Marketers should form themselves into cooperative society to be able to have access to subsidized credit, storage and processing facilities and other support.

(iii) Government and non governmental organizations should assist the marketers by building stores and subsidizing the cost of rentage.

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DO WORLDWIDE GOVERNANCE INDICATORS AFFECT AFRICAN CLIMATE CHANGE FUND ALLOCATION AND DISBURSEMENT?

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Abstract

Africa began to access Climate Change Fund (CCF) since 2003. For about seven years now what has been the African experiences to the fund allocation and approval? Using secondary data, the paper attempts to examine CCF allocation and disbursement to African sub regions namely Eastern, Central, Northern, Southern and Western Africa respectively. It employed regression analysis to examine factors that influence the CCF allocation and disbursement in Africa using individual country data. The paper estimated the effects of worldwide governance indicators rating on CCF allocation for Africa, using over 50 countries data. CCF portfolio approval estimation had a goodness of fit at 56% with a significant F-ratio at one percent probability level. Fund portfolio allocation/approval was influenced positively by previously disbursed fund, corruption control and regulatory quality. The goodness of fit value of the fund disbursed estimation was 58% with a significant F-ratio at one percent probability level. Positive factors that influence value of fund disbursed were; value of previously approved fund, planted forest and accountability. Political stability had negative relationship with fund disbursement which indicates that the more conflict a state experiences, the less the fund to be disbursed to them. The paper concludes that African government needs to be more focused and increase their performances in worldwide governance. These indicators will increase access to CCF. The paper also noted that there is urgent need to enhance Africa's capacity to mobilize access and implement CCF. Funds that can be accessed by efficient performance include those for global economy, mixed economy and 'unknown' or unnamed economy which access depends on good implementation of disbursed fund.

Keywords: Climate change fund, Political stability, regulatory quality, performance indices.

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Introduction

It was estimated that by 2020, between 75 and 250 million people were projected to be affected by water shortages due to climate change (IPCC, 2007). Also in some countries, yields from rain-fed agriculture could be reduced by up to 50 percent. Agricultural production, including access to food, in many African countries was projected to be severely compromised by climate change. This would have a further adverse effect on the supply of food and would exacerbate malnutrition (IPCC, 2007). By 2080, an increase of 5 to 8 per cent of arid and semi-arid land in Africa was projected under a range of climate scenarios. Towards the end of the 21st century, a projected sea level rise will affect low-lying coastal areas with large populations (IPCC, 2007 in Mkpado 2013a). The cost of adaptation could amount to at least 5 to 10 per cent of gross domestic product (GDP) (Tamiotti et al 2009; IPCC, 2007).

Financial support to developing countries for mitigation and adaptation to climate change is essential to achieving the millennium development goals in Africa. Such funds can finance green technology, innovation development and the transfer, as well as forest development for carbon sequestration and capacity building are critical to ensuring universal survival. Hence, funding, mobilization and participation of people is required to effectively address challenges of climate change mitigation and adaptation. Estimates put the required financial support in tens of billions of dollars (German Watch, 2010). Mobilization of this sum is challenging (Igbokwe and Mkpado, 2011).

Past studies argued that access to climate funds (UNFCCC funds, multilateral and bilateral funds, and carbon markets) provides an opportunity to mobilize more resources, with a view to bridging the current financial gap with respect to what a state can provide to stomach adverse effects of climate change (UNECA-ACPC, 2011). Fighting effects of climate change, mitigating and adapting to it is one of the major challenges facing Africa (Mkpado, 2013). In fact, adequate handling of climate change problems has been posing as one of the issues beyond 2015 agenda for sustainable development goals (Lucy and Shepherd, 2011). Africa would not have been in need of climate change fund if they have the financial capacity to do so or climate change has not become a case of market failure. In addition, those countries that pointed the African climate, need to assist Africa to cope with its effects. Climate change and its effects have become a case of market failure and as such the need for climate change fund for mitigation and local adaptation. Schalatek *et al* (2012) aptly noted that Sub-Saharan Africa is responsible for only 4% of annual global greenhouse gas emissions; it is the region most susceptible to the dangerous effects of climate change.

African agriculture has the low capacity to adapt to climate change because of millions of poor small scale farmers, who do not have the capacity to invest on climate change adaptive technologies (Igbokwe and Mkpado, 2011). The limited literacy level of the farmers possess some constraints on their ability to fully understand the concept and issues of climate change hence the need for skilled extension service staff for informed consent (Igbokwe, and Nicholas, 2010). Urama *et al*, (2010) reported that a recent analysis shows that scientific and technological skills on the African continent still trail behind the rest of the world. Similarly Mkpado (2013b) argued that poor proportion of arable land equipped with irrigation facilities in Sub Saharan Africa (SSA), use of very little quantities of fertilizers, paucity of greenhouses for agriculture exist in Africa. Apart from agriculture, the health sector is also affected in Sub Saharan Africa, hospitals and medical institutions are not equipped to handle effects of climate change incidences such as induced stress, diseases, environmental and sanitation upsurge.

Schalatek *et al* (2012) reported that current levels of Climate Change Fund finance directed to SSA are insufficient to meet the region's need for sustainable adaptation. World Bank estimated that SSA countries need at least USD 18 million per year until 2050 to resolve these issues. The most disenfranchised and vulnerable people in the region have received limited support so far (Schalatek *et al*, 2012). Past studies have noted that there is a significant barrier to investment which are transaction costs of the small-scale projects, in addition to difficulty of designing and implementing such programs in ways that are financially viable and replicable (Stigliz,1990). Studies have argued that public sector grants financing play a crucial role in realising the positive and significant environmental, developmental and social including gender, could bring sustainable benefits with respect to climate change actions (Mkpado, 2013b; UNECA-ACPC, 2011).

The question should not be only whether the size of climate change fund is enough to handle global challenges, but more essentially is Africa's accessibility and adequacy to the climate change fund. UNECA-ACPC, (2011) noted that with respect to climate change fund in the African context, the issues that are yet to be fully addressed are: (i) the need to stimulate effective domestic demand for climate adaptation and mitigation funds; (ii) the need to improve the absorptive capacity of African countries to effectively deploy climate funds; (iii) the need to strengthen and/or create financial frameworks to absorb funds from external sources and create enabling environments for private sector investment in Africa. Intrinsic to African performance in accessing climate change fund is the governance performance in Africa. The quality of governance indicated by the scores in World Governance Measurement Parameters affect every aspect of the economy including domestic performance, international perception and rating of the economy/country as well as assessment of international resources such as climate change fund. Thus, the paper is poised to investigate the effects of governance indicators and forest development on assessment of Climate Change Fund in Africa.

Methodology

The focus area is Africa (see appendix), however; references were made to other parts of the world or countries where possible so that comparisons can be made, lessons could be learnt and mistakes avoided. African data were in most cases presented along the regions such as Northern, Western, Southern, Eastern and Central Africa to give a sound view of the situation. Data set on governance is from Wgidataset (2012). The Wgidataset is a world bank governance indicator that ranked countries based on their percentage scores on the selected variables. The Worldwide Governance Indicators (WGI) are research dataset summarizing the views on the quality of governance provided by a large number of enterprise, citizen and expert survey respondents in industrial and developing countries.

These data are gathered from a number of survey institutes, think tanks, non-governmental organizations, international organizations, and private sector firms. The WGI do not reflect the official views of the World Bank, its Executive Directors, or the countries they represent. FAOSTAT.org database was the source of data on agricultural land area and planted forest and the *www.climatefundsupdate.org* for climate fund data. Data were analysed using descriptive statistics and regression analysis. Regression analysis was used to examine factors that influence the CCF allocation and disbursement in Africa using individual country data (either the countries did well and lessons could be learnt from them or they did not do well and the mistakes need to be avoided) to examine the case of Africa. The regression analysis was performed using EViews 7 statistical software. They are good for secondary data analysis. A cross section approach was adopted with over 50 African countries data because of data limitations.

The estimable model was built on the premise that CCF for adaptation and mitigation involve the use of agricultural land, the quality of governance, access and effective use of the fund. Also, efficient performance in use of the fund will increase the likelihood of access to more funds. Cob Douglass regression model was adopted due to its ability to handle any non linear relationship that might arise between the dependent and independent variables. Also, it has the ability to maintain constant returns to scale and the coefficients are presented at marginal values (Akanni, 2010).

The theoretical framework for this study is based on the Solow (Neoclassical) Growth Model. Using a Cob-Douglas production function of the form

$$Q = AK^{\alpha} L^{1-\alpha} \quad \text{.....(1)}$$

Where: Y is output, K is capital, L is labour, and A is a parameter meant to capture the technological state or total factor productivity (TFP), and $0<\alpha<1$. The function is assumed to exhibit constant return to scale and smooth substitutability also and the coefficients are presented at marginal values that vary continuously with K and L. (Akanni, 2010). Considering the capital-labour ratio expression of the function, the marginal product of capital labour ratio is given as:

$$\frac{dQ}{dK} = \alpha A (k)^{-(1-\alpha)} \quad \text{.....(2)}$$

where $k = K/L$ .....(3)

Studies such as those of Hall and Jones (1999), Klenow and Rodriguez-Clare (1997), and Gournichas and Jeanne (2006) in the literature emphasize the importance of TFP or performance on growth. Given that output is negatively related to marginal product of capital-labour ratio, the growth rate of output (fund allocation and disbursement) is dependent on the growth rate of capital per unit of labour (performance), which is endogenously determined within the model. The perception of investors who are at the heart of capital formation, about the conduciveness or governance or the effectiveness of institutions and implication for productive economic activity and the state of the technology influence the investment portfolio decision of investors (Akanni, 2010). This therefore leads us to capital accumulation process, which describes how capital stock evolves over time. The capital and labour can be represented by economic activities and institutional or government reputation as these can represent materials and human efforts. Thus, it is possible to show that governance or performance indicators can affect capital accumulation. The estimable models are:

$$LnY_1 = b_0 + \ln Y_2 + \ln b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8 + e$$

.....(4)

$$LnY_2 = b_0 + \ln Y_1 + \ln b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + b_8 X_8 + e$$

.....(5)

Five (5) years average data of the independent variables were used for a cross section analysis while for the dependent variables (and) all data were taken from 2003 to 2013. This gives a composite view of the situation in Africa. It also helps to deal with data limitations on the subject.

Explanations of the variables

Portfolio or previously approved CCF, (lnY1) = the gross sum of fund approved for disbursement to African countries from 2003 to 2013 in US Dollars (www.climatefundsupdate.org, 2014)

Disbursed CCF (lnY2) = the gross sum of fund disbursed to African countries from 2003 -2013 in US Dollars.

Land Area (lnX1) = Total cultivable agricultural area in Africa in hectares from 2009 - 2013

Planted forest (lnX2) = The total hectarage of agricultural land covered with plantation agriculture which include timber and other plantation cash crops such as cocoa, oil palm, coffee, etc, from 2005-2011

Voice and accountability (lnX3) = the average voice and accountability ranks of countries in Africa in percentage, from 2005-2011.

Political stability (lnX4) = the average political stability ranks of countries in Africa in percentage from 2005-2011.

Government effectiveness (lnX5) = the average government effective ranks of countries in Africa in percentage from 2005-2011.

Regulatory quality (lnX6) = the average regulatory ranks of countries in Africa in percentage from 2005-2011.

Rule of law (lnX7) = the average rule of law ranks of countries in Africa in percentage from 2005-2011.

Control of corruption (lnX8) = the average corruption control ranks of countries in Africa in percentage from 2005-2011.
e = is s error term; while ln = natural logarithm

Note: The percentage is derived from Percentile rank among all countries
(ranges from 0 (lowest) to 100 (highest) ranks from the given data.

Results and Discussions

Over 50 countries in Africa (see appendix) provided data used for the analysis. Available data on CCF approval and disbursement started in 2003 (Schalatek *et al* 2012; www.climatefundsupdate.org). Few African countries that were among the first to receive such fund are Eritrea, Tanzania, Mauritania, Malawi, Ethiopia, Comoros and Sudan with US$0.2m each ; while Lesotho received US$ 0.19m and in 2004 Uganda, Djibouti, Central African Republic Togo, Burkina Faso and Senegal were listed. Ever since inception, CCF spending in Africa has been very small compared to other regions (see Table 1). The table illustrates global CCF spending from 2003 to 2011 in million dollars. Asia and Pacific region have approximately 50 percent of the gross spending of what was received. Sub Saharan Africa had about 14 percent and Middle East and North Africa had about 5 percent. Literature and studies are yet to justify such uneven allocation, access and spending rationale.

Table 1: Global Climate Change Fund spending from 2003 to 2011(Dollars)

Region	*Spending climate change fund (CCF)*	*Percentage*
Asia and Pacific	10668.349993	49.84372
Europe and Central Asia	1315.765997	6.147405
Global	1379.819998	6.446673
Latin America and the Caribbean	2858.919993	13.35719
Middle East and North Africa	1137.56	5.314807
Mixed	28.35	0.132454
Sub-Saharan Africa	2989.335995	13.96651
Unknown	1025.499999	4.79125
Total	21403.60198	100

Source: Authors derivation from *www.climatefundsupdate.org*, Aug., 2014

FAO (2011) noted that six countries (Australia, France, Japan, Norway, the United Kingdom and the United States of America) collectively agreed to dedicate US$3.5 billion as initial counterpart funding towards slowing, halting and reversing deforestation in developing countries. As of 2010, over 37 developing countries and economies in transition were beneficiaries of the programmes. Programmes of the United Nations Collaborative Programme on REDD (UN-REDD) or REDD (Reducing Emissions from Deforestation and Forest Degeneration) readiness programmes under the World Bank's Forest Carbon Partnership Facility (FCPF) lend their technical and expertise on sustainability of the CCF.

Examining CCF in details, allocation in Sub regions of Africa is very informative. Eastern Africa has the highest proportion of disbursed CCF; the region accessed about 4.6 percent of CCF that were disbursed in Africa and 13.06 percent of her regional fund allocation (Table 2).

**May include disbursement of Middle East and North Africa as the disbursed is higher than the approved.
+ included disbursement to Africa region and Pacific region which had higher allocation.
*+ the allocation for this category is very small.
++ does not give the true picture in Africa.

Source: Authors computation from *www.climatefundsupdate.org,* Aug., 2014
Western Africa accessed about 3.24 percent of all CCF allocation in Africa and about 20.14 percent of her allocated fund in Africa. CCF for Middle East and Northern Africa occurred together; in order to show African experiences, efforts were made to isolate those of Northern Africa by using the countries involved in primary CCF allocation and disbursement. Northern Africa had relatively high proportion of CCF allocation (US$943.67million) but access only about 4.42 percentage of it; similar experience

Table 2: Detailed African Climate Change Fund Approval and Disbursement from 2003 to 2013

Type of allocation	*Regions*	*Approved (US$ in millions)*	*Disbursed (US$ in millions)*	*Percentage disbursed in Africa*	*Percentage disbursed in African sub region*
Primary allocations	Eastern	1370.75	179.02	4.6976	13.06
	Central Africa	308.86	55.03	1.4440	17.81713
	Northern	943.67	41.74	1.0953	4.423156
	Southern	573.56	30.72	0.8061	5.356022
	Western	614.06	123.65	3.2446	20.13647
	Sub Total	3810.9	430.16	11.2876	11.28762
Other allocations	Africa Transaction	3.18	0	0	0
	Mixed Africa	3.866	11.77	12.3548	**
	Regional Africa	20.18	0	0	0
	Africa and Pacific	21.2	19.95	20.9260	+
	Sub-Saharan Africa	46.91	19.95	20.9660	42.5282 *+
	Sub Total	95.336	51.67	54.1978	++
Gross Total	Total	3906.236	481.83	++	++

is depicted in Southern Africa. Generally, Africa has accessed just about 11 percent of her primarily allocated CCF and about one percent of other CCF (funds for other climate needs and special projects not specified, see Table 2).

What is happening to 88 percent of all CCF meant for Africa? And what of other funds that can be accessed? (due to efficient use of previous allocated funds); this, however do not give a true picture of the magnitude of fund flowing to Africa. Although Africa shares these sources with other regions, yet this continent has not taken full advantage of it.

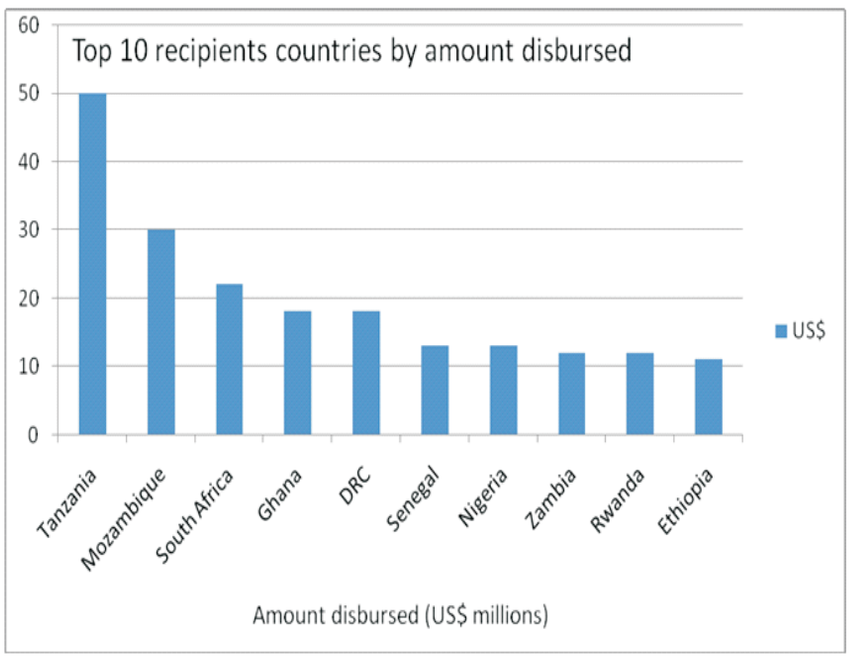

Fig. i: Some recipients of climate fund
Source: Adopted from Schalatek*et al,*2012

Fig i revealed that ten major recipients of the CCF by hierarchy were Tanzania, Mozambique, South Africa, Ghana, Democratic Republic of Congo, Senegal, Nigeria, Zambia, Rwanda and Ethiopia, with Tanzania (in East Africa) having the highest access of the fund, thus most of the fund went to Eastern Africa. Schalatek et al (2012) reported that since 2003, USD $2.094 billion has been approved for over 350 projects and programs throughout the region and that the total amount approved for projects in SSA has increased to about USD $300 million since 2011.

The rank of African sub regions appeared to be very small when compared with data on the Wgidataset (2012) data set. A country like Germany was ranked 90.4 in voice and accountability, 89 in political stability, 94 in governance effectiveness, 91 in regulatory quality, 94 in rule of law, and 95 in corruption control; while Portugal scored 96.15, 89.0, 85.0, 90.0, 98.0 and 91 for the same parameters. It is evident that the low scores and ranks of African sub regions were not encouraging. But, do these justify the level of climate change fund allocation and accessibility in Africa?

The mean of planted forest was highest in Central Africa, followed by Eastern Africa, and values for Northern and Western Africa were about half of the value for Eastern Africa; while the least was in Southern Africa (Table 3). With respect to planted forest, Mkpado (2013c) reported that Africa is among parts of the World having very small proportion (5.9%) of planted forest; while Asia-Pacific region, Europe and North America have 41.6%, 28.9% and 12 % respectively. The proportion of World's natural forest in Europe, Latin America and Caribbean, Asia Pacific, North America and Africa were 24%, 21.7 %, 18%, 16.5% and 16% respectively in 2010. Generally, a decreasing trend characterised analysis of status of natural forest in the world.

Table 3: Percentage Means of Governance Indicators Ranks and Forest Resources in Africa, 2005-2011

Variables	*African Sub Regions*				
Governance indicators	Eastern	Central	Northern	Southern	Weste rn
Voice and accountability	30	18	15	49	36
Political stability	36	29	28	58	32
Government effectiveness	32	11	34	53	24
Regulatory quality	31	15	31	49	30
Rule of law	33	13	35	53	29
Control of corruption	37	13	31	64	30
Planted forest (‘’000 ha)	12.189	14.196	7.887	0.355	5.9657
Agricultural area as proportion of total land area (‘’000 ha)	54.134	26.457	36.3287	64.6986	47.227

Source: Authors computation from Wgidataset 2012; FAOSTAT 2014

Regression Analysis Results

The estimation of factors influencing CCF portfolio or allocation is acceptable because of its significant F-ratio (5.415), low standard error (S.E.) of regression (0.923) and relatively high coefficient of determination (0.555). The coefficient of determination showed that the model accounts for over 56 percent variations on CCF allocation in Africa. The shortfall may be as a result of other factors such as population, green house gas emission, level of green technology innovations among others. Fund portfolio allocation/approval has positive determinants as were disbursed fund, corruption control and regulatory quality, while political stability had negative effect (Table 4).

The coefficient of previously disbursed fund is 0.329 while its t-statistics is 4.404 which is significant at one percent probability level. It means that countries with more previously disbursed fund will invariably get higher fund allocation.

Regulatory quality had a coefficient of 1.118 and a t-value of 2.847 which is significant at five percent probability level. It means that countries with high regulatory quality will receive higher CCF allocation. An adjustment was made on the variable X_8 (control of corruption), since most African countries ranked very low due to their performance, an inverse of the variable indicates a reversal in the trend. Corruption has continued to be a major challenge to African development. The positive relationship recorded is an indication that if African countries improve in their control of corruption, they can get more CCF allocation. The coefficient of the variable is 0.484 while its t-value is 1.965 which is significant at five percent probability level. Political stability coefficient is -0.236 while its t-value is 1.309 which is significant at ten percent probability level.

The results indicate that the more African countries get involved in political unrest the less CCF they will get. Most African nations have challenges in their political affairs. Within the past two decades,

Table 4: Estimation of Effects of Governance Indicators on Climate Change Fund Allocation/Portfolio

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Disbursed CCF ($\ln Y_2$)	0.329438	0.074810	4.403658	0.0001
Land Area ($\ln X_1$)	0.075309	0.214714	0.350739	0.7277
planted forest ($\ln X_2$)	-0.034767	0.066985	-0.519018	0.6067
Voice and accountability ($\ln X_3$)	-0.201229	0.236519	-0.850797	0.4001
Political stability ($\ln X_4$)	-0.325537	0.248740	-1.308740	0.1983
Government effectiveness ($\ln X_5$)	-0.246569	0.270090	-0.912916	0.3669
Regulatory quality ($\ln X_6$)	1.118106	0.392721	2.847077	0.0070
Rule of law ($\ln X_7$)	0.005012	0.281685	0.017794	0.9859
Control of corruption [$\ln(1/X_8)$]	0.484279	0.246436	1.965129	0.0566
C	1.731828	0.971664	1.782332	0.0825
R-squared	0.555489	Mean dependent variable		3.514246
Adjusted R-squared	0.452910	S.D. dependent variable		1.248147
S.E. of regression	0.923199	Akaike info criterion		2.857960
Sum squared residue	33.23953	Schwarz criterion		3.244046
Log likelihood	-60.02002	Hannan-Quinn criteria.		3.004440
F-statistic	5.415214	Durbin-Watson stat		2.185571
Prob (F-statistic)	0.000082			

Source: Authors computation

transition from military rule to civilian rule and democratic rule has experienced a lot of turmoil. This accounted for the low rank in political stability and associated negative effect on CCF portfolio.

The estimation of determinants of CCF disbursement is acceptable because of its significant F-ratio (6.219), low standard error (S.E.) of regression (1.676) and relatively high coefficient of determination (0.583). Over 58 percent variations of CCF disbursement is predictable by the model (Table 5). Positive determinants of value of fund disbursed were value of previously approved fund, planted forest and accountability while political stability had negative effect.

Previously approved fund coefficient is 0.831 while the t-value 3.995 which is significant at one percent probability level. The higher the value of approved fund the higher the value of possible disbursed fund to African countries. The coefficient of planted forest is 0.242 while the t-value is 2.063 which is significant at five percent probability level. CCF is an avenue for increasing planted forest. Many of the CCF in Africa are for carbon sequestration projects which mainly deal with afforestation. Rohit and John (2008) reported that there are about 23 carbon sequestration projects across 14 African countries in 2008. These projects are expected to sequester 26.85 million tCO_2 beyond the baseline situation. Nine out of 23 carbon sequestration projects are located in three East African countries namely Kenya, Tanzania, and Uganda.

Table 5: Estimation of Effects of Governance Indicators on Climate Change Fund Disbursement

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Portfolio or previously approved fund, (lnY_1)	0.831087	0.208041	3.994823	0.0003
Land Area (lnX_1)	-0.208390	0.384475	-0.542012	0.5908
planted forest (lnX_2)	0.242489	0.117520	2.063374	0.0456
Voice and accountability (lnX_3)	0.466625	0.372063	1.254155	0.2171
Political stability (lnX_4)	-0.943823	0.361306	-2.612254	0.0126
Government effectiveness (lnX_5)	0.581668	0.538040	1.081086	0.2861
Regulatory quality (lnX_6)	-0.696662	0.768008	-0.907102	0.3698
Rule of law (lnX_7)	0.800285	0.605185	1.322382	0.1936
Control of corruption (lnX_8)	-0.167429	0.135832	-1.232613	0.2249
C	0.280002	1.759243	0.159161	0.8743
R-squared	0.583197	Mean dependent variable		1.127667
Adjusted R-squared	0.489416	S.D. dependent variable		2.345840
S.E. of regression	1.676224	Akaike info criterion		4.047821
Sum squared resided	112.3891	Schwarz criterion		4.430226
Log likelihood	-91.19553	Hannan-Quinn criteria.		4.193443
F-statistic	6.218721	Durbin-Watson stat		1.625639
Prob (F-statistic)	0.000019			

Source: Authors computation

The coefficient of political stability is -0.943 while the t-value is 2.612 which is significant at five percent probability level. It is possible that political instability will result in poor disbursement of CCF, because war and violence can easily erode development and development initiatives. The result has some implications to conflict and fragile states in Africa. UN-OHRLLS (2013) noted that over the past several years, donors' response to the challenges these countries face has been translated in increased aid to them. While Leo *et al* (2012) noted that World Bank Group recognizes the changes of conflict and fragile state and the unique needs and constraints present in fragile environments. It has publicly expressed a plan to develop an organization-wide strategy tailored specifically for fragile and conflict-affected situations. At the same time, private businesses often are not able to operate in the absence of stable, well-established governments and therefore can present donor organizations with an attractive pro poor growth opportunity in conflicts and fragile states. The fact is that political instability is negatively related to development movements. Africa can revise the trend in Africa with concerted efforts.

Conclusion

Worldwide governance indicators definitely affected CCF allocation and disbursement in Africa. Over 50 African countries data were used in the analysis. The Worldwide Governance Indicators project constructed aggregate indicators of six broad dimensions of governance: Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption. The paper examined the mean ranks of African economies in these variables from 2005 to 2011. It also examined the mean value of planted forest represented as plantation agriculture and area of arable land under cultivation.

Results showed that approved CCF to different regions globally are: Asia and Pacific 49.8%, Sub-Saharan Africa 14%, Latin America and the Caribbean 13.4%, Europe and Central Asia 6.2%, Middle East and North Africa 5%, Global 6.5%, Mixed 0.1% and Unknown 4.8%. Total approved CCF in Africa were: Eastern US$1370.75m, Western US$614.06m, Central US$308.86m, NorthernUS$943.67m, Southern US$573.56m and other allocations US$95.336m; while total disbursement to Africa was 11.3% of approved fund with Eastern 4.6%, (179.02) Western 3.2%, (123.65) Central 1.4% (55.03) Northern 1.1% (41.74) and Southern 0.8% (30.72) of their approved funds respectively accessed these funds. Thus, Africa has accessed about 11.3 % of her primary allocated fund. Her performance in accessing other funds will depend on the efficient use of previous allocated funds, thus, the continent needs to improve on the usage of primary allocated funds to compete favourably with other regions for accessing future funds.

The paper estimated the effects of worldwide governance indicators rating on CCF allocation for Africa. CCF portfolio approval estimation had a goodness of fit of 56% with a significant F-ratio at one percent probability level. Fund portfolio allocation/approval had determinants as previous disbursed fund, corruption control and regulatory quality. The goodness of fit of mode for estimation of determinants of value of fund disbursed was 58% with a significant F-ratio at one percent probability level. Positive determinants of value of fund disbursed were value of previously approved fund, planted forest and accountability, while political stability had negative effects of CCF allocation and disbursement. Thus, African government needs to increase their performances in worldwide governance indicators. These indicators are: control of corruption, accountability and political stability, also increases in hectarage of agricultural products and forests or areas under plantation in order to justify increase in accessing CCF.

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APPENDIX: REGIONS/COUNTRIES USED FOR THE STUDY

Eastern Africa	Middle Africa	North Africa	Southern Africa	West Africa
Burundi	Angola	Algeria	Botswana	Benin
Comoros	Cameroon	Egypt	Lesotho	Burkina Faso
Djibouti	Central African Republic	Libya	Namibia	Cabo Verde
Eritrea	Chad	Morocco	South Africa	Côte d'Ivoire
Ethiopia	Congo	Sudan	Swaziland	Gambia
Ethiopia PDR	Democratic Republic of the Congo	Sudan (former)		Ghana
Kenya	Equatorial Guinea	Tunisia		Guinea
Madagascar	Gabon	Western Sahara		Guinea-Bissau
Malawi	Sao Tome and Principe			Liberia
Mauritius				Mali
Mayotte				Mauritania
Mozambique				Niger
Rwanda				Nigeria
Seychelles				Senegal
Somalia				Sierra Leone
South Sudan				Togo
Uganda				
United Republic of Tanzania				
Zambia				
Zimbabwe				

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