Greener Journal of Social Sciences

GJSS ISSN: 2276-7800 Impact Factor 2012 (UJRI): 0.7863 ICV 2012: 5.99

An Analysis of the Factors of Agricultural Potentials and Sustainability in Adani, Nigeria

By

**Chukwuedozie K. Ajaero
Lilian C. Mba
Charles Okeke**

Research Article

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Chukwuedozie K. Ajaero*, Lilian C. Mba and Charles Okeke

Department of Geography, University of Nigeria, Nsukka.

*Correspondence Author: ajaerock@yahoo.com; Tel: +2348037511422

ABSTRACT

This study is aimed at examining the physical and socioeconomic factors that influence agricultural productivity and sustainability in Adani, Nigeria. Household interviews on agricultural potentials and sustainability of the study area were randomly conducted on 240 households in the study area. Furthermore, soil samples were collected at depths of between 10 to 30 cm while rainfall data was obtained from the Center for Basic Space Science University of Nigeria, Nsukka. Descriptive statistics are used to analyze the rainfall characteristics while the Principal Component Analysis (PCA) was used to analyze the socioeconomic factors of agricultural productivity and sustainability. Furthermore, the soil samples were analyzed to determine the particle size and soil types. The results showed that the soil in the study area is generally sandy clay and the rainfall intensity is 42.63mm/yr. Finally, PCA reduced socioeconomic factors to three underlying components that together account for 76.44% of the cumulative variance thus leaving 23.56% of the total variance unexplained due to other factors. The components are access to agricultural capital, availability of motivated agricultural workforce and provision of infrastructural facilities.

Keywords: Adani Town, Agricultural; Nigeria; Factors; Potentials; Sustainability.

INTRODUCTION

Agriculture is one of the most important primary economic activities of man and it is the basis of food supply of the entire population of the world (Smith, 2009). It encompasses the production of food, feed, fibre, fuel and other goods through the systematic raising of plants and animals (Diao, Hazell and Thurlow, 2010). Although the activity is defined variously in different parts of the world, it mostly includes raising of crops and animals (Hubbard and Gorton, 2011). The history of agriculture in the world dates back to thousands of years and its development has been driven and designed greatly by different climate culture and technologies especially in the developing countries such as Nigeria (Olomola, 2007).

In Nigeria, Agriculture has been identified as a veritable tool that could be used to launch the country into a giant economy status if harnessed appropriately. It has also been noted that if Nigeria could attach more importance to the agricultural sector, there would be increased job creation, poverty reduction; sustained food security, increase in foreign exchange savings as well as export revenue and GDP growth. In addition, Agriculture could be used to tackle some of the various security challenges facing the country which are due to the high rate of unemployment among the youth (Akinbola, 2009).

Consequently, a lot of efforts have been made in improving the agriculture practices in Nigeria, particularly in Adani town of Enugu State. Naturally, Adani town is endowed with vast agricultural lands with extensive rainfed flood areas and forest products such as oil palm and timber wood. Agricultural activity in Adani town is predominantly subsistence, except the flood plain agriculture which is based on comparatively large scale cultivation of Rice, Yam and also Fish farming. There have been increases in the number of migrants from the densely settled slow growing and land hungry rural areas of Awka, Orlu, Okigwe, Eastern Onitsha, Ikot Ekpene and Uyo areas, who have moved into the plains to join in exploiting the vast agricultural potentialities of the flood plains which are beyond the capability of the local people (Ani, 2010). Moreover, a number of agricultural enterprises have been established to tap the agricultural potentialities of Adani town. They include the Adarice production (Nigeria) Ltd and the Enugu State River Project which are public production projects. Others are United Palm Produce Ltd and the private enterprise participation which include the Ekenedilichukwu, Chidi Ebere and Umeano rice, Maize and Cassava farms which are very large scale agricultural enterprises all in Adani area. There are also large private fish ponds in the area.

Here in Adani town lie a great potential for profitable investment by local and foreign interests if well harnessed. But the major challenge of this area is the problem of sustainability. A number of these agricultural enterprises have been closed down and dilapidated as a result of mostly human and sometime natural factors. Formation of different farmer's cooperative societies is the major sustenance of some of the surviving agricultural enterprise in this area. It is also regrettable that apart from these farmers cooperative societies, most of the small scale rural poor farmers in this area still engage in non-mechanized farming and lack modern farming techniques which are critical to improved agricultural productivity. Consequently, the common phenomenon now is gross decline in agricultural yield which is giving birth to increased poverty and food insecurity in and around the area.

However, a lot of efforts have been exercised in improving the agricultural practices in Adani town. This led to the establishment of Songhai Institute in 2008 in collaboration with Enugu State Government. This research institute due to its scientific and technological advancement, brought new methods of farming in Adani town and its environs which led to the improvement in agricultural productivity of the area between 2008- 2011 (Songhai Institute 2012). However, this Songhai initiative has been brought to a halt of late due to some administrative logistics thereby making Adani town to relapse again into very low levels of agricultural productivity.

Even though a number of studies have been carried out in Adani town such as, the works Amaechina (1995), Agbatekwe, (2005) and Ani (2010), these studies centered mostly on the comparative economic analysis of some selected crops. None of these works has been carried out to examine the agricultural potentials in Adani town with a view to determine the factors responsible for the non- sustainability of agricultural production in this town. This research therefore intends to fill up this gap. The objectives of this research are to highlight the physical factors affecting agricultural productivity in Adani; to analyze the socioeconomic factors of agricultural sustainability in Adani; and to recommend ways of improving agricultural potentials and sustainability in Adani.

MATERIALS AND METHODS

Data collection

The study area is Adani which is a town in Uzo-Uwani LGA of Enugu state. It is located between latitudes 6° 03'N and 6° 44'N and longitudes 7° 01'E and 7° 03'E. it is bounded to the north by Nsukka LGA, to the east by Udi LGA and to the south by Ayamelum LGA in Anambra state. It is underlain by the Imo clay shale and lies within the northern section of the Anambra plain of Nigerian lowlands. The soil is predominantly impervious clay as well as hydromorphic especially during the rainy season, hence water logged conditions tends to prevail (Ofomata, 2002). The study area is well drained by the south flowing tributaries of the Amansea River that form the eastern boundary of Uzo-Uwani communities. The study area has a tropical wet-and-dry climate or Aw climate of Koppen's climate classification. It usually experiences on average eight months of rainfall between March and October and four months of dry season between November and February. On average, rainfall amounts vary between 1800metres and 2000metres, (Monanu, 1975; Anyadike, 2002). The town is sparsely populated and under developed. The traditional economic base in the area is Agriculture with over 70% of the people engaged in farming (cultivation of soil at subsistence level and animal husbandry).

Eight villages in Adani are used for this study. A total of 240 households comprising of 30 households in each of the eight villages were randomly selected and administered with questionnaire comprising questions on agricultural potentials and sustainability. Furthermore, soil samples were collected from these villages at depths of between 10 to 30 cm while the data on rainfall was obtained from the Center for Basic Space Science (CBSS), University of Nigeria, Nsukka.

Data Analysis.

Descriptive statistics are used to analyze the rainfall amount, number of rainy days and rainfall duration. In addition, the rainfall intensity was computed using the formula by Kim et al (2002) as follows:

$$R = 3.85 + 0.35 (P) \dots\dots\dots(1)$$

Where P = Average amount of precipitation per year,
R = Rainfall Intensity.

The soil samples collected was analyzed to determine the particle size and soil types at the Civil Engineering Department, University of Nigeria, Nsukka. Samples were air dried in the oven at 105°C and passed through a set of

sieves. Four particle size classes were determined in this way as a result of the analysis. The textural classification scheme of the United States Soil and Agricultural Conservation was subsequently used to classify the soil samples into various types. Finally, the socioeconomic factors identified by respondents as influencing their agricultural activities were subjected to Principal Component Analysis to determine the underlying components of the factors.

RESULTS AND DISCUSSION.

(a) Rainfall Characteristics

The results of rainfall analyses in Table 1 show the amount of rainfall in millimeter (mm), number of rainy days, rainfall duration and intensity (R) in Adani. Rainy season in the study area from literature starts from April through October with a short dry season in August (Anyadike, 2002). However, in this study, the short dry season was not noticed from the recordings of rainfall data used for this analysis. August was wet which shows that rainfall pattern is slightly different from normal. From the results in Table 1, it can be seen that the total rainfall in Adani for the period of study is 997.60mm. The monthly mean rainfall is 110.80 while the standard deviation is 57.60mm. The calculated R for the area using the data obtained from the period of study is 42.63mm/yr which is strong enough to cause erosion. This means that the higher the rainfall intensity, the higher the rate of erosion occurrences that could wash away nutrients and crops in the area. Climate takes into account rainfall and temperature which can determine whether the farmland is arable or not. Adani is characterized by mean annual rainfall of between 2250mm, average annual temperature of between 22°C and 28°C and humidity of 85%. Two main seasons prevail in the area; the rainy season, which spans from late April to early November and the dry season, which lasts from late November to early April. However, little dry season is usually experienced during the month of August and this is termed the August break. Lowland areas popularly called “Fadamas” are largely available and serve as good sites for rice and dry season vegetable farming.

Table 1: Rainfall Amount, Number of Days, Duration and Intensity in Adani, 2011

MONTH	RAINFALL AMOUNT (MM)	NUMBER OF RAINFALL DAYS	DURATION IN HOURS	RAINFALL INTENSITY(R)in MM/HR)
March	16.00	3	6.50	10.14
April	64.70	10	27	38.82
May	70.30	12	21	43.18
June	127.20	17	36.58	76.32
July	168.30	17	37.32	100.98
August	200.10	20	35	120.00
September	175.50	15	28	86.15
October	100.20	21	37.50	125.75
November	75.30	3	4.67	21.45
	Σ = 997.60	Σ =123	Σ =232.17	

(Source CBSS UNN and author's computation)

Because of the bimodal pattern of rainfall in Adani, it allows for the cultivation of Maize and Rice, twice in a year. The amount of rainfall is usually high in July/August and September which is suitable for Rice and Cassava cultivation. This often leads to flooding and leaching of farmland. The resultant effect of this excess rainfall is low productivity. This is because some crops like Okro, Vegetables, yam, and Maize do not require much water, which could finally result to erosion, thereby reducing the field normal Carrying capacity.

(b) Soil Characteristics

The results in Table 2 show the particle size composition of the soil samples in the study area. It can be seen that in the first village which is Uwenu-Akpa, the particle size distribution showed that the sample consists of sand (33.00%), silt (9.00%), clay (50.00%), and gravel (8.00%). The soil in this study site generally can be classified as sandy clay with some gravel using the textural classification scheme of the United States Soil and Agricultural Conservation (Igwe, 1984). It explains why crops like Cassava, Rice, Vegetable, Maize and others grow well in the study area. This is because clay is known for its alluvial content, which aids in the proper growth of crops.

The soil of Adani, like most of the humid topics is subject to leaching of the basic materials needed for plant growth. However, the annual flooding of the swamps deposits a layer of very rich silt regularly, thereby helping to restore the fertility of the soil at the lowland. The semi-aquatic condition created by the flooding, in addition to field bunds constructed by the farmers help to check the rate of flow of run-off, consequently, erosion is reduced. The light textured soils developed on riverine alluvium and some medium textured soils developed on shale have higher water retentive capacity and are easy to cultivate on. They are therefore suitable for rice and cassava cultivation. It has a high moisture content required by paddy rice and cassava.

The observed values for the structural and chemical properties of the soil indicated that the soil had a high to moderated index rating for particle size composition. Also the texture of the soil (clay soil) is suitable for Cassava, Rice, Yam cultivation among others. Mba, (2006) in her research on processes, factors and effects of soil erosion in Igbo-Eze South reported that improved soil physical properties increases grain yield relatively. In the same vain, the alluvial soil is also suitable for the cultivation of yam which has a chemical composition of the organic material (poultry manure) and NPK fertilizer.

Table 2: Particle Size Composition of Soil Samples in the study area

Village	Sand (%)	Silt (%)	Clay (%)	Gravel (%)
Uwenu-Akpa	33.00	9.00	50.00	8.00
Eziama	16.00	10.00	58.00	16.00
Akutara	22.00	15.00	53.00	10.00
Ajona	28.00	9.00	62.00	1.00
Iykeniga	16.50	10.00	69.00	4.50
Aniocha	19.00	20.00	60.00	1.00
Awutof Amokwe	28.00	13.00	57.00	2.00
Etuguzo	27.00	12.00	47.00	14.00

(Source: Field work and Laboratory Analysis)

(c) Principal Component Analysis of Socioeconomic Factors

The socioeconomic agricultural factors identified by the households as being capable of transforming the agricultural activities in the study area are good transport system(X1), availability of labour (X2), agricultural subsidies(X3), electricity supply (X4) credit facilities(X5), Availability of machinery (X6) farm settlement schemes(X7), cultural integration(X8), education/extension services(X9), good agricultural practices(X10). The myriad of responses to these factors were therefore subjected to Principal Component Analysis (PCA) so as to streamline the major components for effective and sustainable agricultural output from the study area. The results of the PCA are shown in Table 3 below.

The results of the PCA above reduced the initial ten variables to three underlying components. These three components together account for 76.44% of the cumulative variance, thus leaving 23.56% of the total variance unexplained due to other factors.

Table 3: Rotated component matrix

VARIABLES	COMPONENTS		
	I	II	III
X ₁	0.129	0.310	0.812*
X ₂	0.235	0.702*	-0.095
X ₃	0.647*	-0.063	-0.095
X ₄	-0.314	-0.115	0.621*
X ₅	0.895*	0.322	0.598
X ₆	-0.026	0.610*	0.314
X ₇	0.758*	0.310	0.441
X ₈	-0.082	0.834*	-0.210
X ₉	0.846*	-0.058	-0.075
X ₁₀	0.321	0.603*	0.406
Eigen value	3.964	3.827	2.812
% of variance	39.73%	28.27%	8.44%
Cumulative %	39.73	68.00	76.44

*Significant loadings exceeding 0.60

Component one has an eigen value of 3.964, has a variance of 39.73% and load significantly on four variables. The variables are **credit facilities** (X5) which translates to the farmers having enough money to procure farm inputs, farm implements, enough land and labour easily, **education/extension services** (X9) which helps the farmers to be aware of and conversant with the most recent and productive agricultural innovations, **farm settlement scheme** (X7) is the variable that helps farmers to be well settled to put in their best effort towards improving their agricultural output, and **agricultural subsidies** (X3) which makes it cheaper for farmers to procure farm inputs and machineries at reduced prices. When they purchase agricultural inputs at cheaper prices, the tendency is for them to purchase more input with the left over money that have been taken care of by the subsidy regime, thereby increasing their agricultural outputs. The underlying component then becomes **access to agricultural capital**.

Component two loads significantly on four variables, has an eigen value of 3.827 and a variance of 28.27%. The variables with significant loading are **cultural integration** (X8) which is aimed at embarking on agricultural practices that respect the culture of the people in order to secure their maximum cooperation and labour inputs to agricultural activities, **availability of labour** (X2) which means that for maximum agricultural output, there is the need for availability of labour both in quality and quantity as and when due, **availability of machinery** (X6) which will help the farmers in producing more agricultural products with minimal suffering and stress, and **good agricultural practices** (X10) which ensures that environmentally sustainable and appropriate agricultural practices are utilized in producing agricultural products that are best suited for the environment of the study area. Consequently, the underlying component becomes **availability of motivated agricultural workforce**.

Component three has a variance of 8.44%, loads significantly on two variables and has an eigen value of 2.812. The variables of interest are **good transportation system** (X1) which will help the farmers in transporting their farm inputs products to and fro markets for maximal benefits, and **electricity Supply** (X4) which will help in improving the quality of life of the farmers and also help them in operation of certain farm machinery and activities that depend on electricity to function optimally. The underlying component here is **provision of infrastructural facilities**.

SUMMARY OF FINDINGS AND CONCLUSION.

The findings of this research show that the total rainfall in Adani for the period of study is 997.60mm, the monthly mean rainfall is 110.80 while the standard deviation is 57.60mm. The calculated R for the area using the data obtained from the period of study is 42.63mm/yr which is strong enough to cause erosion if its flow is not properly controlled. In addition, the study area has a bimodal pattern in of rainfall which makes the cultivation of Maize, Cassava and Rice, twice in a year possible. The soil analysis showed that the soil in the study area is mainly sandy clay in nature. Consequently, the alluvial nature of the soil encourages the growth crops such as Cassava, Rice, and Maize.

Finally, the results of the PCA reduced the initial ten socioeconomic variables to three underlying components. These three components together account for 76.44% of the cumulative variance thus leaving 23.56% of the total variance unexplained due to other factors. The components are access to agricultural capital, availability of motivated agricultural workforce, and provision of infrastructural facilities.

The findings of this study has revealed that both physical and socioeconomic factors play important roles; agricultural potentials and productivity of the area, the socioeconomic factors are the major factors militating against sustained productivity in the area. It is therefore suggested that a well motivated workforce with access to agricultural and infrastructural capital is needed to maximize the potentials of the study area. In addition, farmers should endeavor to follow the rainfall pattern and cultivate crops that will grow well in each of the climatic seasons in the study area.

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