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Agricultural Development in Nigeria: The Constraints and Potentials

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Abstract

Despite numerous attempts by urban and regional planners to develop societies and make their environments conducive for living, livelihood in some parts of the world remains miserable due to chaos and social unrest. The continuous socio-economic and political unrest that enveloped most under developed world has been attributed to poverty. A number of attempts have been made around the world to overcome poverty but mostly have been in vain. This is most likely due to non-utilization of effective means of poverty eradication. History has revealed that agricultural development has been the best approach for improving living standard of the citizenry. Creation of agricultural villages enables the realization of objectives of rural planning by stimulating economic growth, jobs creation and improving living standard.

This research was carried out by reviewing literatures on agricultural development in Nigeria, simple GIS analysis and a simplified survey approach. Problems and challenges of agricultural development in the country was reviewed and analysed. A simple agricultural land use planning model is proposed with case study of a rural planning area selected based on its characteristic so as to determine the practicability of the model. This study area is Igabi Local Government Area in Kaduna State. Detailed descriptions of the area are discussed. All factors that affect assessment of the area are analysed. The first stage was to determine Potential Agricultural Area (PAA). The second stage involves assessment of the past and the existing agricultural practice, the availability of the infrastructure, market trend, the socioeconomic characteristics of the inhabitants and the preferences of the people.

The physical and socioeconomic characteristics of Igabi revealed that the area is very suitable for agricultural development. This is similar to most part of the country due to their similar characteristics. This means that if the effective agricultural practices is adopted, the country will be self-sufficient in food production which will insure food security

Keywords; Poverty, Agriculture, GIS,

Introduction

Over the past few years, economic crises and food security have revealed the urgent need for developing sustainable agricultural systems. The growing trends denote that the world requires a novel approach for agriculture in order to feed the population of the near future. The new vision is required to deliver food security, create economic opportunity and ensure environmental sustainability across the globe. Production of more food with fewer resources is required while the rural economies need to be reinvigorated. This requires

among others, new innovation toward agriculture transformation. This paper analyses the constraints of agricultural development in Nigeria and assessed its potentialities based on a pilot study of a rural development unit.

Agricultural Predicament and Food Security in Nigeria

Population in Nigeria is increasing at the average rate of 2.9% (Magashi, 2007). Agricultural development has been declining at the average rate of 3.7%, while the cost of food importation is increasing at the average rates of 1.5%. GDP of crops has recorded 0.4%, while it's declining contribution to the nations GDP is 9.6% (Jerome, 2012). The Federal ministry of Agriculture's press release of April 2013 reported that over \$11bn worth of wheat, rice, sugar and fish are being imported annually in Nigeria. It was stated in the report that food imports in the country are rising annually at the rate of 11%, which results into domestic inflation (FMARD, 2013).

In the sixtieths, Nigeria dominated the international agricultural trade in some major cash crops (Walkenhorst, 2007). During this period, the country solely depended on agricultural produce, yet it was then the preferred investment destination to Japan (Sanusi, 2013). This has fallen drastically due to low yield (Enete and Amusa, 2010). Nigeria's yield per hectare is presently less than 50% of what is obtained in other developing countries (Akande, 2006, IITA, 2009, Enete and Amusa, 2010). A research work conducted by Doreo-partners in 2011, revealed Nigeria's low agricultural productivity and its decline in five major cash crops between 1961 and 2008. Comparison of Nigeria's crop yield to the leading agricultural countries was made. The research findings revealed that within 47 years of the research period, Nigeria's crop yield only improved by 1.2%. It also revealed that Nigeria's crop yield has not exceeded 13 kilogram per hectare while in some Asian countries, the yield is up to 150 kilogram per hectare.

Nigeria's world market share of shelled groundnut, palm oil, cocoa and cotton in 1961 were 42%, 27%, 18% and 1.4% respectively but declined to zero percent in shelled groundnut, palm oil and cocoa since 1980. This has been attributed to low crop yield among others (Enete and Amusa, 2010; Dere, 2011). The research also revealed that the country loses annual export opportunity, from four agricultural commodities alone that amounts to about 10 billion US dollars, based on the 1961 global market share.

The bulk of the poor in Nigeria are farmers who face scenario of catastrophic failures in crop yield, which decrease agricultural productivity, increased hunger, malnutrition and diseases. Yield per hectare which is said to be the driver of agricultural competitiveness has fallen in Nigeria. This situation calls for research work in this regard.

Due to climate change, decline in crop yield in Nigeria has been forecasted to fall up to 50% by 2050 (Jones and Thornton, 2002; Enete and Amusa, 2010). There was increase of in temperature of 1.1 °C and decrease in rainfall by 81mm within the 34 years i.e. from 1971 to 2005 (Bello et al., 2012). The decline in agriculture is attributed to the fact that in Nigeria and Africa in general, agriculture is predominantly rain-fed and therefore basically dependent on the climatic (Amujoyegbe and Elemo, 2011).

Apart from natural constraints to agricultural development such as flood, drought, etc., there are several factors inhibiting agricultural development in Nigeria. These factors

include unimproved farming system (Enete, et al. 2011), inadequate land suitability analysis, inadequate participation of the public in policy formulation regarding agriculture, poor mechanization, unimproved seedlings, inadequate pest and disease control, unimproved irrigation system, inadequate provision of fertilizer and improper planning (Phillip, et al. 2009; Amujoyegbe and Elemo, 2011). Hunger as a result of poverty is at its extreme conditions in most parts of Nigeria particular in the rural areas (Anger, 2010). There is therefore the need for concerted efforts toward tackling this menace.

Other constraints are institutional, such as poor government policies like excess food importation, poor loan service and, inadequate subsidies and investments, (Medugu, 2006; Enete and Amusa, 2010; Ugwu and Kanu, 2012).

The Objective of the Study

The objective of this paper is to assess agricultural practice in a Nigeria rural planning unit and propose a simplified model for the achievement of agricultural development in Nigeria.

The adopted methodology

This research was carried out by reviewing literatures on agricultural development in Nigeria, simple GIS analysis and a simplified survey approach. Problems and challenges of agricultural development in the country was reviewed and analyzed above. A simple agricultural land use planning model is proposed with case study of a rural planning area selected based on its characteristic so as to determine the practicability of the model. This study area is Igabi Local Government Area in Kaduna State. Detailed descriptions of the area are discussed. All factors that affect assessment of the area are analysed.

In third world countries like Nigeria where the rural areas lack basic infrastructure such as constant electricity supplied and the literacy level is very low, the use of highly advance technologies is not feasible. The way forward is to resort to simplified process that requires simple analytical process. Therefore the approach used for the study is a simple method, where geo-physical and socio-economic factors, existing facilities and agricultural practice, as well as the interest of the stakeholders were evaluated to ascertain the most viable agricultural land use in the study area.

The physical data of the area were obtained from literatures, satellite data and maps. Field verification was carried out in selected samples to ensure correctness of the data. These physical data were evaluated in two stages (analytical orders). The first stage was to determine Potential Agricultural Area (PAA). The second stage involves assessment of the past and the existing agricultural practice, the availability of the infrastructure, market trend, the socioeconomic characteristics of the inhabitants and the preferences of the people.

The Background of the Study Area

Igabi is a Local Government Area (LGA) in Kaduna. Kaduna is a state in Nigeria bounded by Kano, Katsina, Zamfara, Niger, Nassarawa, Plateau, Bauchi and the FCT.

Situated at the northern part of Kaduna metropolis, part of the metropolis fall within the Local Government Area (figure 1). It is located between Latitude 10°22'30N to 11°01'40N and 7°09'60E to 8°00'33E with Turunku as the seat of the Local Government Council. It has a total land mass of 3,622 square kilometres. Igabi was selected due to its near central location in the country. During the colonial era, i.e. the period between 1914 and 1960, and six years after the independence, which took place in 1960, Igabi was among the closest rural area to the seat of government for the northern region.



Figure 1: Location of Igabi in Kaduna

The area lies on Precambrian basement complex that consist three types of rocks namely; porphyritic granite found where rock outcrops are few and low lying, basement gneiss and medium grained granite (Olaniyan et al, 2010).

Igabi experiences two distinct seasonal periods which changes between cool to hot dry and humid to wet (Tomlinson, 2010). The rain usually starts with less intensity in April which rises gradually to a peak in August and ends in October. The maximum rainfall months are July and August when it usually exceeds 1,300mm a year. The spatial and temporal distribution of the rain is about 1015mm in the area.

With exception of Harmattan period and rainy days, the area experiences high temperature all year round, which is a characteristic of the tropics. Average mean monthly temperature over the area has been between 24 and 38°C. The Harmattan months, the period between November February are usually cool, with monthly mean temperature in the range of 20 to 24°C. The relative humidity ranges between 18% and 38% in the dry season and 65% to 70% in the rainy season. The area experiences high evaporation during the dry season. The wind speed in the area can be as high as 29 mph and as low as 3 mph.

Evaluation of Geo-Physical Characteristics

The purpose of any land suitability analysis is to determine whether the study area is physically suitable or not. In doing this, the geo-physical characteristics have to be accessed. These features include the land use and land covers in the area, the edaphic factors, climatic factor. The land uses are all the uses that every piece of land in the area is put to, while the land covers will include vegetation, water bodies, bare soil, rock surfaces and settlements. The edaphic factors are the soil characteristics. The climatic factors include temperature, rainfall and humidity.

1st Analytical Stage; assessment of PAA

The 1st analytical order involves Land Inventory (LI) to PAA after eliminating all constraint. In doing this, the following data were obtained. They include land use and land cover data produced in 1995, spot satellite image of 5 meter resolution captured in 2011, NigeriaSat-X with 20 meter spatial resolution captured in 2013, topographic map of 1 in 50,000 scale and Ikonos map of 1 meter resolution captured in 2013 from Google earth. These data were processed, geometrically corrected, interpreted and the following features were extracted. They are contour lines, settlements, roads, various vegetation, rocky outcrop and water bodies. The land use and land cover (LULC) data of 1995 served as the base data. It was updated with the features extracted from satellite imageries. The outcome of these processes is up-to-date LULC data of the area. Field work was carried out to verify the features extracted from the satellite imagery. Constraints were extracted from the updated LULC data to produce the PAA. The eliminated constraints are; built up areas, existing developments, water bodies, forest reserves and mountainous regions.

2nd Analytical stage: Assessment of Existing Agricultural Practice and Socio-Economic characteristics

As highlighted early, the second stage involves assessment of the past and the existing agricultural practice, the availability of the infrastructure, market trend, brief on the socioeconomic overview of the inhabitants and the preferences of the people. The socioeconomic overview of the area was similarly obtained from two sources. These sources include the existing documents and through the qualitative surveys. This survey technique was adopted because precise and more reliable responses can better be achieved with limited resource. Other aspects included in the interview include the available facilities in the area, market trend and the preference of the people.

To carry out the qualitative surveys, the study area was divided into 9 zones (Figure 2) based on natural features in the area. The adopted natural boundary is the rivers in the area (Figure 3). This is based on the scientific findings on land formation which states that a block of land is most likely to have uniform characteristics. All analysis were conducted for each zone except the climatic factor, which is the same at the entire study area. Secondly, people of common ethnicity living in settlements that are closely located are likely to share common sociocultural values if no physical barrier exists between them. The surveys was conducted inform of group discussion held in the major settlements in each of the 9 zones.

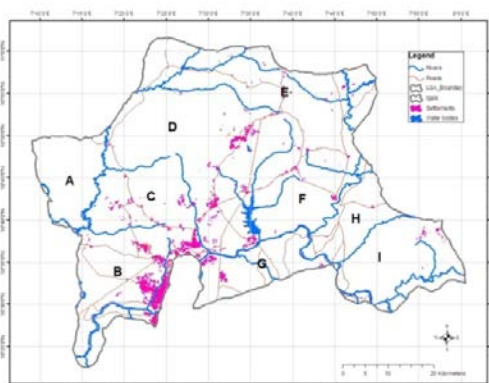


Figure 2: Subdivision of the area with rivers

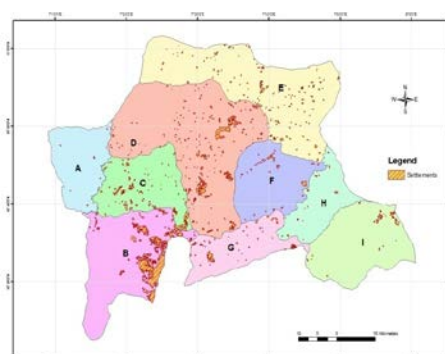


Figure 3: 9 subdivided zones

The aim of the surveys on the existing agriculture and the past experience is to evaluate the existing agricultural practice in the area in order to determine its appropriateness, and to propose an appropriate agricultural land use planning model taking into account the stakeholders' interest and the market trend. The surveys cover the availability of facilities, utilities and services in the area. The information collected was on;

- Problems facing agricultural activities in the and potentialities,
- Availability of agro-allied industries and possibilities of developing them, agriculture infrastructure, services, loan facilities, interest rate, financial aid and subsidies.
- Farmers' reaction to proposed economic measures including credit and/or subsidies, extension services, taxation and rental reductions, farming equipment and materials, innovative marketing arrangements, etc.
- Constrains to farm ownership and farm development, farm size, fragmentation, optimism, pessimism, fear of risk, etc. Level of cooperation in agriculture.
- Soil conservation or protection practices.
- Need and preference of the people in terms of services to be provided, such as provision of roads, domestic water supply, irrigation water, housing, commercial facilities, marketing arrangements, recreation facilities, health facilities, etc.
- Views of the people on the development and management of the environment, level of awareness in terms of problems facing the area and their causes.
- The constraints or problems of development from an economic point of view, including land tenure system, existing land policy, land rental, capital, knowledge, labor, prices, markets and transportation services, etc.

The overview of the socio-economic characteristics of the inhabitant was meant to establish whether it could support and sustain agricultural development. The questions asked include the types and nature of the economic endeavor of the people, social way of life which include their faiths and beliefs amongst others, prospects and potentialities of the people, possible constraints to economic activities, likelihood of supporting new innovations and developments, migration trends (likelihood), some demographic issues, which may have any impact on the rate of resource use, prospects of innovative technology, general level of education, Influence of social structures, systems, class strata on economic activities, rate of unemployment, availability and status of extension services, norms, customs, beliefs and habits, responsibilities of women in the society, youth behavior (willingness to work, ability to work, the type of work they want to do), the present type of economic activities, problems, constrains and potential, the potential for economic improvement or development, including farmers' capabilities (labor, resources and technology), non-farm employment opportunities,

Detailed inventory were also carried out on the existing infrastructure in the area which include, availability and condition of public facility, utilities and services such as schools, medical centers, public toilet, recreational facilities, nature of housing, (availability and types), transportation facilities, roads condition, availability of commuter service, sources of water and energy supplies.

Analyses of the Physical Data

From the information extraction exercise, 659 settlements were identified and extracted. Figure 4 shows the settlements overlaid on the land cover map of the area. The analysis shows that out of the undeveloped area of 1169.13 Km², 266.28Km² is put to

agricultural activities. This is about 22.8% of the undeveloped land in the area. In addition, uncultivated areas that can be put to agricultural use are the trees, shrub and grasses zone. This covers 247.52Km² which is 21.2% of the area. The table below shows the classification of the land cover in the area (table 1). The land area covered by each of the land covers is shown in Table 1.

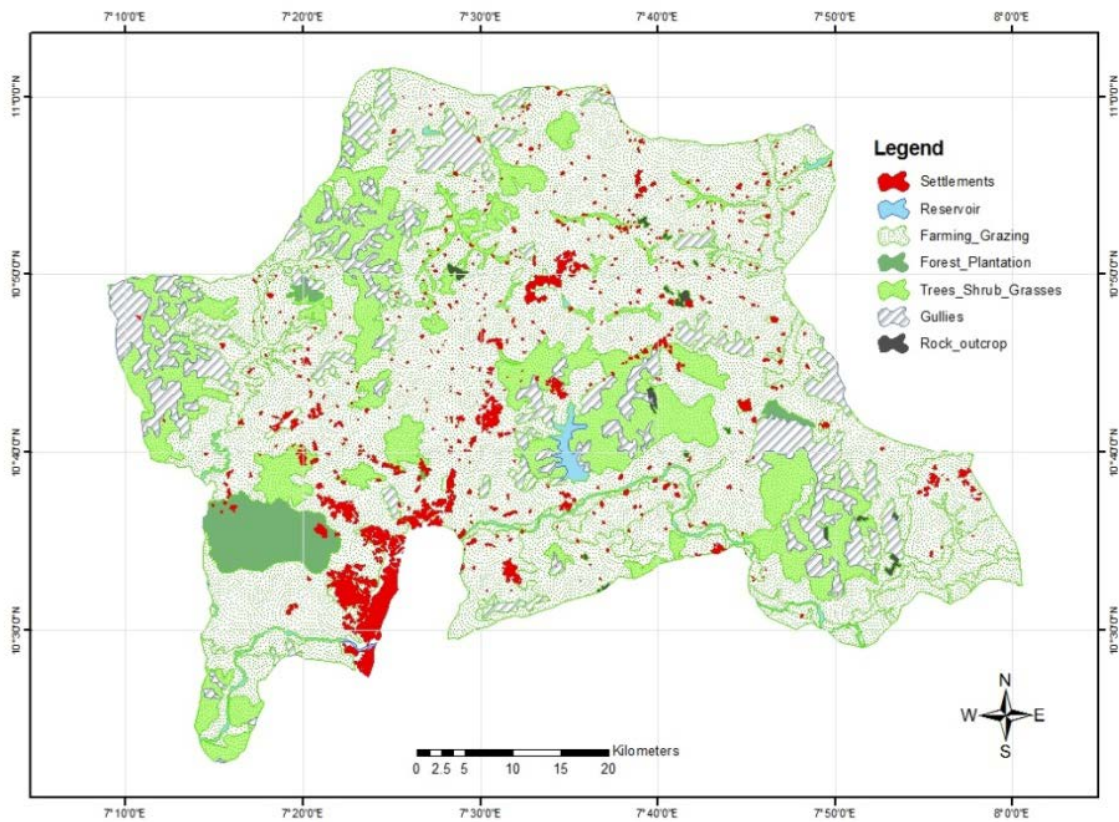


Figure 4: Settlements and other land covers

Table 1: Land covers in the study area

	Farming/Grazing	Forest	Trees, Shrub, Grasses	Reservoir	Gullies	Rock
Area Km ²	266.28	29.87	247.52	29.87	479.96	115.64
%	22.8	2.6	21.2	2.6	41.1	9.9

Findings from Field verification exercise

The area is generally flat of less than 40 meter interval, traversed by wide shallow streams with gentle sloping valleys that drain into the major rivers. The major rivers are River Kaduna, Galma, Riyawa, Rigasa and Kangimi. The streams are mashy alluvial floodplains used for irrigation. As depicted by the contours (figure 5) and verified using GPS, the altitude of the area is between 640 and 680 meters above sea level. There are few dots of inselbergs of not more than 80 meters above the general surface. The satellite imageries were downloaded from Google Earth while the photographs were taken during field surveys.

This area consists of scattered trees and woody shrubs of different species. The shrubs are found almost everywhere with the exception of areas where cultivation is been carried out. The trees are generally moderate in size of less than 15m high. Interviews with the people show that the area suffers anthropogenic disturbance because the major source of heat energy in the area is fuel wood that are obtained from cutting of trees in the area. The land uses of the adjacent land to the river are mostly for agriculture while housing is also encroaching into the flood plain. This is adversely reducing the density of the vegetation.

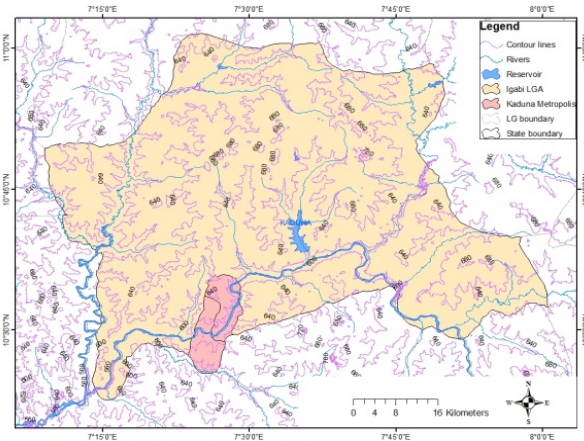


Figure 5: Topography of Igabi LGA



Figure 6: Landscape of Igabi

Findings from Group Discussion; Socioeconomic background and Agricultural Practice

The group discussions reveal that the inhabitants are Muslims and mostly Hausa – Fulani by tribe. Crop cultivation is the major economic endeavor in the area. Other activities include livestock rearing, poultry, vocational works, trading and crafts making.

Except the flood plains areas, farming in the study area have similar characteristics. Apart from few people who invest in large scale farming thereby producing large quantity of agricultural products, most of the farmers practice farming at low scale level due to lack of capital. Farming in the area is generally seasonal particularly during the rainy season, though dry season farming by means of irrigation is been practiced in the area at very few places particularly by the people living close to the rivers and streams being referred to as Fadama. The main crops grown in the uplands are maize, cassava, guinea corn, beans, yam, groundnut, potatoes, while in the flood plains, rice, vegetables, tomatoes, okro, pepper, onions, sugar-cane and pepper are being cultivated. Genetically modified seeds are used when available. Draft power is the main employed tillage option due to high cost of tractors. Apart from beans, modern fertilizer is applied to most crops. Manure is used were when the modern fertilizer is not available. Herbicides, insecticides and pesticides are generally used. Farm labor is employ in most cases except where the farming is at subsistence level.

Tomato is found to be the crop with the highest market risk due to its high rate of price fluctuation. Maize and pepper also have some risks but maize is due to yield variability. Apart from these three crops, farming in the area if profitable, but their yield depends on effective management. The profit of most crops is more than fifty percent of the total input. Responses from all the groups as well as the GIS processes reveal that there is enough land for agricultural activities but not all the people own land. But there is enough to

rent. Another important occupation in the area is animal rearing mostly carried out in form of mixed farming with the exception of the Fulani in the area who depend largely on cattle rearing. Aside from being a source of income and direct consumption, organic manure is obtained from the animals for the farm lands. The predominant animals reared in the area are cattle, goats, sheep and poultry. Trading is also highly engaged by most farmers engaged as their second source of income.

The major problems hindering agricultural development in the area include; lack of capital, loan facilities with low interest rate, financial aid, subsidies, processing industries particularly for tomato, agriculture infrastructure and services. The settlements in zone A, C, G and I are besieged by poor accessibility. The particular problem of the settlement in zone A is bridge across river Riyawa. According to the people of Riyawa, lack of accessibility the major obstacle for agricultural development in the area. Within the last 20 years, the only natural disaster that faced the area is flood which occurred on two occasions. This affects the areas close to river Kaduna and Galma.

The farmers have shown interest in any kind of innovation that will improve agriculture in the area.

Conclusion

The physical and socioeconomic characteristics of Igabi revealed that the area is very suitable for agricultural development. This is similar to most part of the country due to their similar characteristics. This means that if the effective agricultural practices is adopted, the country will be self-sufficient in food production which will insure food security. It is a known fact that spatial distribution of economic activities influences urban and regional growth. Development of suburban and rural lands has economic and environmental benefits. Cost of livelihood is relatively cheaper in rural areas and they provide better natural outdoor recreation opportunities, scenic vista, rural livelihood, as well as promoting environmental quality. Physical development in rural areas buttresses economic opportunities to farmers by providing off-farm jobs. It also enhances revenue for local authorities through generation of higher tax and demand for local agricultural products. These are valuable benefits as a result of improved development that add community welfare. There are other advantages of agricultural land that may not be mentioned in the market value for land, some of which include preservation of open spaces, maintaining environmental quality in terms of soft landscapes, green surroundings and serenity, as well as minimizing the emission of greenhouse gases.

There is need for further research on sustainable economic activities and stimulation of economic growth in the region. The new inventions for improving agricultural development in some part of the world, such as precision agriculture where precise analyses are made are required in Nigerian rural societies.

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