

SPATIAL DEPENDENCE IN AGRICULTURAL EMPLOYMENT

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ABSTRACT

The past decade has been one of agro-pessimism. The objective of this study was to investigate the level of participation of males and females in crop farming and examine whether there is any spatial dependence (spill over effect) in the level of participation within geographical locations. Data on employment in crop farming by sex and category of workers was obtained from www.nigerianstat.gov.ng. The simple trend line and multiple bar charts were used for comparative analysis, while Moran's Index and Getis and Ord Statistic were used for spatial analysis. Generally, participation in crop farming is highly dominated by males in the 36 states and the Federal Capital Territory in Nigeria. At less than 1% level of significance the Moran's Index showed high male participation in two states Bauchi and Jigawa, while, female participation was found to be high in Anambra and Ebonyi states. The Getis and Ord Statistic equal 0.08, 0.18 with Z score equal -1.48, 3.07 for male and female farmers respectively. While there is some clustering, the pattern may be due to random chance for male farmers. There was less than 1% likelihood that the clustering of high values could be the result of random chance for female farmers. This suggests employment distribution in crop farming is relatively clustered for male farmers and strongly clustered for female farmers. This study advocates for increased female labour force participation to be addressed as a key component of pro-poor agricultural growth which could translate to higher productivity and poverty reduction in Nigeria.

Keywords: Crop Farming, Labor Force Participation, Productivity, Spatial Dependence, Statistics

INTRODUCTION

The past decade has been one of agro-pessimism. The promises that agricultural development seem to hold did not materialise. This pessimism seemed to coincide with pessimism about Sub-Saharan Africa. Especially for Sub-Saharan Africa, the hope was that economic development would be brought about by agricultural development. After the success of the green revolution in Asia, the hope was that a similar agricultural miracle would transform African economies. But this hope never materialised, agricultural productivity did not increase much in Sub-Saharan Africa; and worse, the

negative effects of the green revolution in Asia became more apparent, such as pesticide overuse and subsequent pollution. Also, in Asia, the yield increases tapered off. The natural resource base on which agriculture depends is poor and deteriorating. Productivity growth is therefore increasingly more difficult to achieve. The integration of rural with urban areas means that healthy young people move out of agriculture, head to town, leaving behind the old, the sick and the dependent. It is often also the men who move to urban areas, leaving women in charge of the farm. This has resulted in the increased sophistication of agricultural markets (and value chains) which excludes traditional smallholders, who are poorly equipped to meet the demanding product specifications and timeliness of delivery required by expanding supermarkets (Meijerink and Roza, 2007).

Specifically, Akintayo et al. (2010 & 2011) emphasized the inability of the Nigerian rice economy to satisfy the domestic demand and the consequent growth of rice import quantity and value remains a cause of concern. It was recommended that the yield potential of cultivated rice varieties should be fully exploited as a first option to meeting the current level of national rice demand because increased rice production towards the attainment of self-sufficiency may well hinge upon the ability of farmers to narrow the gap between current rice yields and yield potentials. Similarly, Zekeri and Tijjani (2013) found evidence on the need for farmers to be encouraged to use variable inputs to get more profit and for the youths to be encouraged to participate in groundnut production in Nigeria.

The global economic crisis which has resulted in weakening economic growth (<http://www.worldbank.org/financialcrisis/>) calls for the need for everyone to be engaged in labour that holds potentials for high productivity irrespective of sex. In Nigeria, the agricultural sector holds the biggest share of overall real GDP with 41.72, 42.01, 42.13, 41.70 and 40.84 percent in 2006, 2007, 2008, 2009 and 2010 respectively and annual growth rates of 7.40, 7.19, 6.27, 5.88 and 5.64 percent respectively (National Bureau of Statistics, 2010). Thus, agriculture has the potentials to make the economy better. Anchored on creating a sound policy environment and investing in critical infrastructure, the country's strategy is to focus on specific growth sectors such as agriculture (African Development Bank, 2012). In particular, the social role of *Moringa oleifera*, its contribution to the reduction of rural poverty and sustainable aquaculture development could be optimized for economic efficiency (Ajayi et al., 2013; Adesina et al., 2013; Olaifa et al., 2013). Also, Izekor and Alufohai (2014) provided facts on the profitability of large scale yam production and Ajiboye et al. (2015) found evidence on the need and possibility of revitalizing cocoa production in Nigeria. Similarly, Abulosoro, Ogunjimi and Abulosoro (2014) placed emphasis on the need for large scale production of tomato.

Since the signing of the Maputo Declaration in 2003, small scale agriculture has increasingly been viewed as the key to broad based development and poverty reduction in Sub-Saharan Africa (Binswanger-Mkhize, McCalla and Patel, 2010; Haggblade and Hazell, 2010). Political ambitions as well as empirical tendencies point to the potential small holder basis of agrarian growth. Yet, some gendered assumptions have emerged in relation to the process of small holder based growth

(Jackson, 2007; O'Laughlin, 2007; Adesiji et al., 2015).

One generalization is the stubborn persistence of gender based resource and income gaps that cut across African production systems and favour male headed households over their female headed counterparts. Such gaps translate into lower productivity and income levels and also serve as explanations for relatively slow productivity increases and persistent income poverty in the African small holder sector as a whole (FAO,2011; IFAD,2011; Quisumbing and Pandolfelli, 2010; World Bank, FAO, and IFAD, 2009). Both growth and poverty dynamics discriminate against female headed households who in their role as the poorest of the poor often serve as a proxy for the most vulnerable households (Chant, 2007). Accumulation among wealthier households is perceived to occur at the expense of weaker ones through polarization processes where female headed households are considered among the most vulnerable groups (Bernstein, 2004; Bryceson, 1999; Havnevik, Bryceson, Birgegard, Matondi and Beyene, 2007; Djurfeldt, Djurfeldt and Lodin, 2013).

From a young age, men and women are socialized into specific gender roles that dictate how they should act. These gender roles then cause men and women to develop gendered preferences for work, or preferences based on the gender norms they have been socialized to accept. These gendered preferences then lead to gendered choices, in which women choose primarily occupations that are both lower in pay and lower in status (Chafetz, 1988). Using data encompassing a large majority of the world's population, Shawn and Glenn (2010) examined trends in recent decades for key indicators of gender inequality in education, mortality, political representation and economic activity. The study found that gender inequality is declining in virtually all major domains, this decline is occurring across diverse religious and cultural traditions. Population growth was observed to be slowing the decline because populations are growing faster in countries where there is the greatest gender inequality.

Factors contributing to the gender earnings ratio, as well as the median earnings of men and women were examined for 271 U.S. metropolitan areas. Gordon, Maura and Michael (2012) showed that occupational segregation is still the leading determinant of gender earnings inequality, that its effects are only slightly diminished by the presence of globalization, and that various aspects of the global economy independently influence the gender earnings gap. The importance of structural change and the need to reduce gender inequality in both wages and labor force participation was shown by Michelle (2013). Similarly, Boris, Stephen and Ziegler (2013) examined the effect of social institutions related to gender inequality on development outcomes. They showed the role of changing labor demand requirements.

The objective of this study is to investigate the level of participation of males and females in crop farming. Secondly, it is to examine whether there is any spatial dependence in the level of participation within geographical locations. In other words, it is to find out if there is any spill over effect of crop farming activities across states in Nigeria. Suppose crop farming incentives are

delivered in a state, does it have any significant impact on neighbouring states? Our findings should enable the orientation of policies targeted towards promoting participation in agricultural activities to enhance productivity and poverty reduction strategies.

MATERIALS AND METHODS

Data

Data on employment in crop farming by sex and category of workers was obtained from the results of the NBS/CBN Socio-Economic Survey on Nigeria 2010 (www.nigerianstat.gov.ng).

Comparative Analysis

The simple trend line and multiple bar charts were used for comparative analysis.

Spatial Analysis

Moran's Index

This global measure of spatial dependence was developed by Moran (1948). The index measures spatial dependence based on feature locations and attribute values. The measure evaluates whether the pattern is clustered, dispersed or random. The null hypothesis states that the feature values are randomly distributed across the study area, that is, H_0 : There is no spatial dependence across the study area (random) Vs H_a : There is spatial dependence across the study area (clustered).

When the z - score or p-value indicates statistical significance, a positive Moran's I index value indicates tendency towards clustering while a negative Moran's I index value indicates tendency toward dispersion. The Moran's I statistics is structured as a Pearson product moment correlation coefficient, plus W , the contiguity weights matrix. Y is a covariance matrix, that is, the relation between the spatial units is calculated as $(y_i - \bar{y})(y_j - \bar{y})$.

The obtained measure is scaled by

$$\frac{n}{n-1} \frac{\sum_{i=1}^n \sum_{j=1}^n W_{ij} (y_i - \bar{y})(y_j - \bar{y})}{\sum_{i=1}^n (y_i - \bar{y})^2} \quad \text{Where by convention, } i \neq j \quad [1]$$

As a result,

$$I = \frac{n}{n-1} \frac{\sum_{i=1}^n \sum_{j=1}^n W_{ij} (y_i - \bar{y})(y_j - \bar{y})}{\sum_{i=1}^n (y_i - \bar{y})^2} \quad i \neq j \quad [2]$$

Where y_i the value of variable y on segment i , \bar{y} = the mean of variable y , n the number of segments, w_{ij} a weight indicating if segment i is connected to segment j (e.g. 1) or if it is not (e.g.0).

When two segments connect, a value of 1 represents this, and if not, 0 is entered in the weight matrix. For any set of n segments of a linear route, there will be $2(n-1)$ joins. If the focus of the analysis is not a single linear route, but an entire network, then the connectivity of segments to each other may need to be identified by inspection. Once identified, a binary connection matrix of segments represents the presence or absence of connections.

Getis and Ord Statistic

This statistic measures the degree of association that results from the concentration of weighted points (or area represented by a weighted point) and all other weighted points included within a radius of distance d from the original weighted point. The basis is now

$$G_i^d = \frac{\sum_j W_{ij} Y_j}{\sum_j Y_j} \quad [3]$$

We assume an area subdivided into n regions, $i = 1, 2, \dots, n$, where each region is identified with a point whose Cartesian coordinates are known. Each i has associated with it a value Y_i (a weight) taken from variable Y . The variable has a natural origin and is positive. The G_i^d statistic developed below allows for tests of hypotheses about the spatial concentration of the sum of Y values associated with the J points within d of the i th point.

The statistic is

$$G_i^d = \frac{\sum_{j=1}^n w_{ij} Y_j}{\sum_{j=1}^n Y_j}, \quad j \text{ not equal to } i \quad [4]$$

Where w_{ij} is a symmetric one/zero spatial weight matrix with ones for all links defined as being within distance d of a given i ; all other links are zero including the link of point i to itself. The numerator is the sum of all Y_j within d of i but not including Y_i . The denominator is the sum of all Y_j not including Y_i . We may fix the value Y_i for the i th point and consider the set $(n-1)!$ random permutations of the remaining Y values at the J points. Under the null hypothesis of no spatial dependence, these permutations are equally likely (Getis and Ord, 1992).

RESULTS

Spatial Distribution and Concentration

Participation in crop farming is highly dominated by males in the 36 states and the Federal Capital Territory in Nigeria (Figure 1).

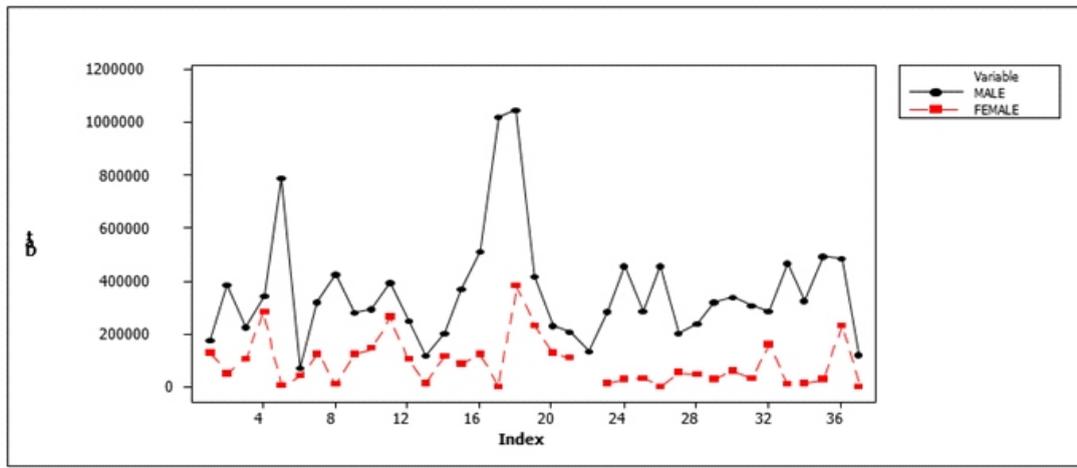


Figure 1: Employment in Crop Farming by Sex and State

Observing the six geopolitical zones across the country, the frequency distribution of male/female employed in crop farming shows more males (yellow bar) involvement in crop farming (Figure 2).

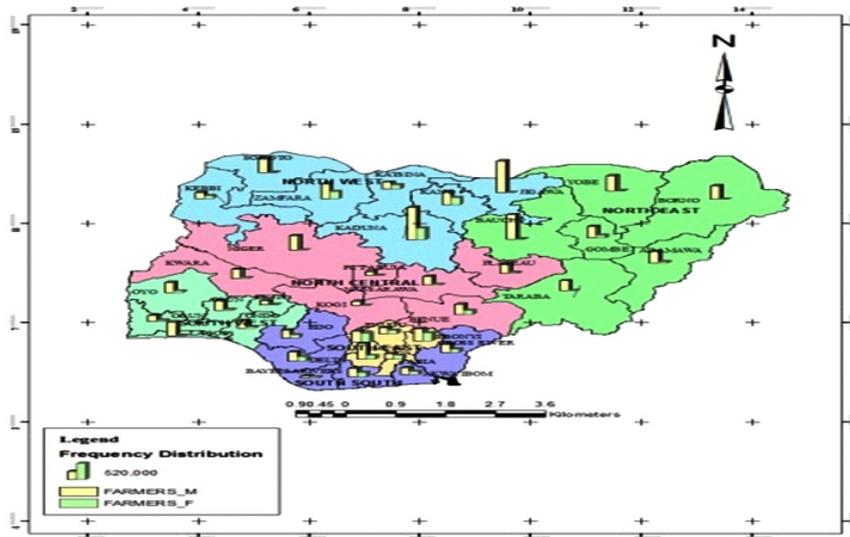


Figure 2: Employment Distribution of Farmers by Sex and Geographic Location

In Figure 3, we examine the spatial distribution of male involved in crop farming. The concentration was highest in Bauchi and Jigawa States.

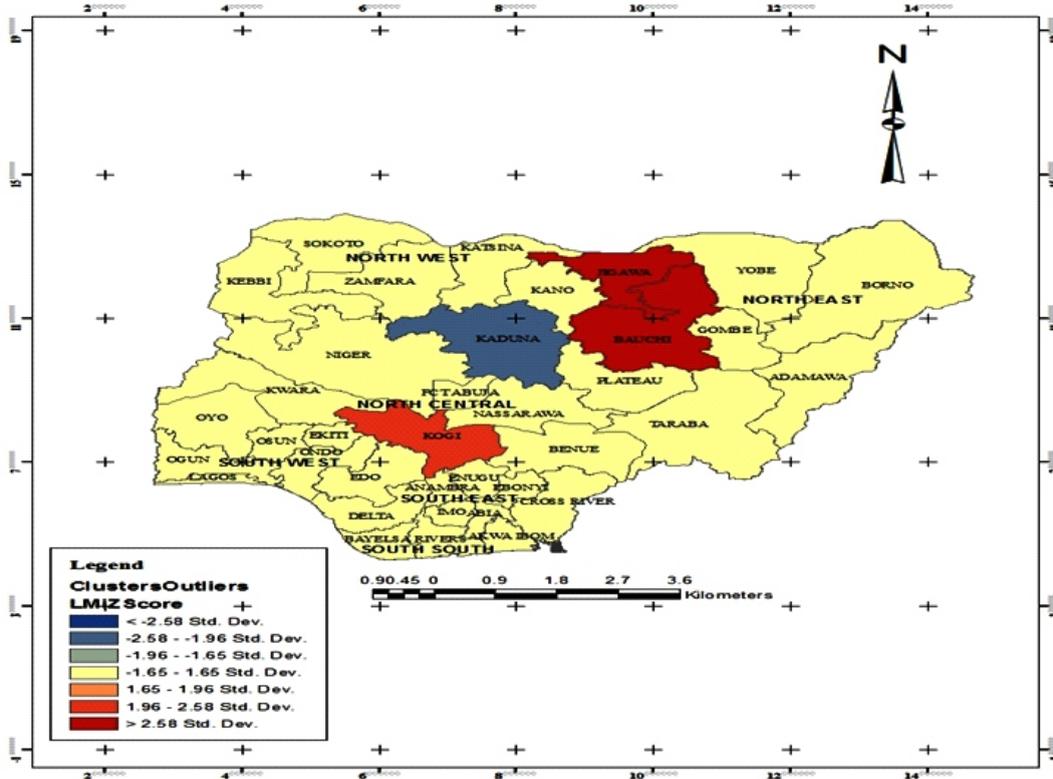


Figure 3: Spatial Distribution of Male farmers in Nigeria (Moran's)

Ebonyi and Anambra States have the highest concentration of female farmers involved in crop farming (Figure 4).

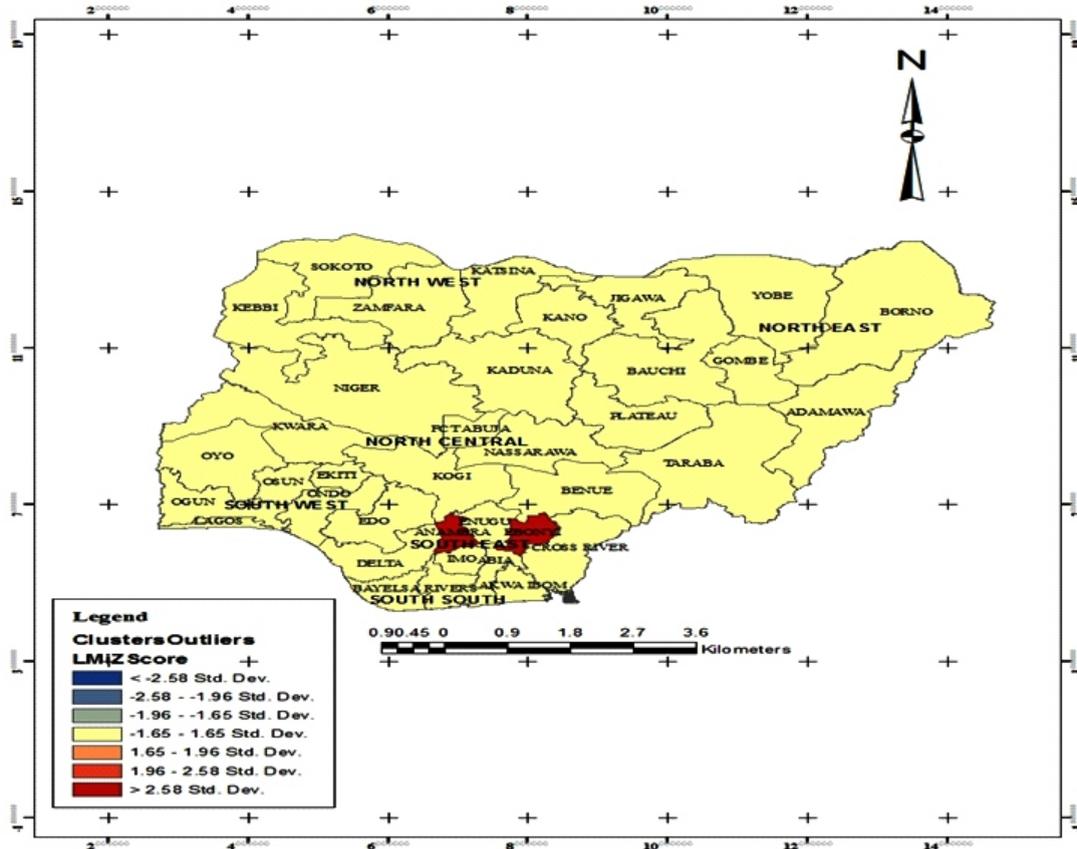


Figure 4: Spatial Distribution of Female farmers in Nigeria (Moran's)

In Table 1, the Cluster and Outlier Analysis (Moran) show highest concentration of male crop farmers in Bauchi and Jigawa States, while Kaduna State has a high concentration which is tending to low concentration and the lowest concentration was detected in Kogi State.

Table 1: Concentration of Males in Crop Farming in Nigeria

State	Geopolitical Zone	LMiIndex	LMiZScore	LMiPvalue	Concentration Type
Bauchi	North East	4.20	3.61	0.000	HH
Jigawa	North West	4.83	4.89	0.000	HH
Kaduna	North West	-1.76	-2.10	0.035	HL
Kogi	North Central	3.33	2.22	0.026	LL

Key: HH=high high; HL=high low; LL=low low; LMi=Local Moran's Index; LMiZScore=Corresponding Local Moran's Z Score; LMiPvalue = Corresponding Local Moran's P Value

Table 2 shows highest concentration of female crop farmers in Anambra and Ebonyi states.

Table 2: Concentration of Females in Crop Farming in Nigeria

State	Geopolitical Zone	LMiIndex	LMiZScore	LMiPvalue	Concentration Type
Anambra	South East	7.02	3.20	0.001	HH
Ebonyi	South East	7.02	3.44	0.001	HH

Key: HH=high high; HL=high low; LL=low low; LMi=Local Moran's Index; LMiZScore=Corresponding Local Moran's Z Score; LMiPvalue = Corresponding Local Moran's P Value

Spatial Dependence

The Getis and Ord Statistic equal 0.08 with a Z score of -1.48, while there is some clustering, the pattern may be due to random chance for male farmers. For the female farmers the Getis and Ord Statistic equal 0.18 with a Z score of 3.07. There was less than 1% likelihood that the clustering of high values could be the result of random chance. The spatial pattern of employment distribution in crop farming is relatively clustered for male farmers and strongly clustered for female farmers. This suggests an existence of spatial dependence in crop farming across states in the six geopolitical zones of Nigeria.

The spatial pattern of employment distribution in crop farming is relatively clustered for male farmers (Figure 5) and strongly clustered for female farmers (Figure 6).



Figure 5: Spatial Pattern of Male Farmers in Crop Farming in Nigeria

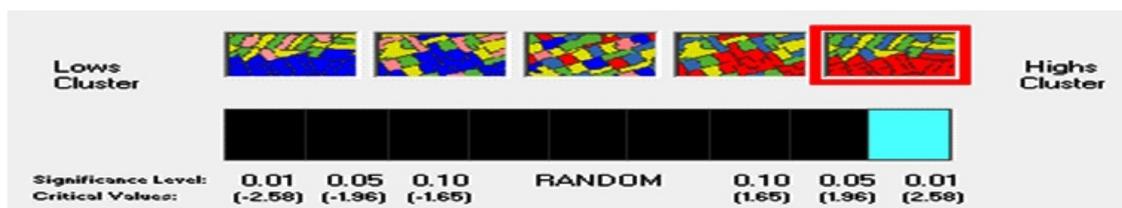


Figure 6: Spatial Pattern of Female Farmers in Crop Farming in Nigeria

DISCUSSION

Generally, participation in crop farming is highly dominated by males in the 36 states and the Federal Capital Territory in Nigeria. The results suggest of the 36 states and the Federal Capital Territory, active participation in crop farming is significant in two states (Bauchi and Jigawa) for male farmers. Similarly, active participation for female farmers is significant in Anambra and Ebonyi states. Apparently, there is low involvement in labour force participation for crop farming by males and females in most states in Nigeria. This has caused significant levels of poverty to remain because the demanding product specifications and timeliness of delivery required by expanding supermarkets cannot be satisfied (see Meijerink and Roza, 2007).

The clustered pattern of employment distribution in crop farming for both sexes suggests spatial dependence indicating spill over effect of events across the study area. For male farmers, while there was some clustering, the pattern may be due to random chance. However, there was less than

DISCUSSION

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The clustered pattern of employment distribution in crop farming for both sexes suggests spatial dependence indicating spill over effect of events across the study area. For male farmers, while there was some clustering, the pattern may be due to random chance. However, there was less than 1% likelihood that the clustering of high values for female farmers could be the result of random chance. This suggests employment distribution in crop farming is relatively clustered for male farmers and strongly clustered for female farmers. For instance, if the number of female farmers engaged in crop farming increases by reason of government intervention, incentives or increased advocacy in Kogi state, there is a high tendency that similar increase will occur in the states that are contiguous to Kogi state. Thus, efforts to promote crop farming in a particular state will have a multiplier effect on the neighbouring states.

The Federal Republic of Nigeria Country Strategy Paper, 2012-2016 notes that the structure of the Nigerian economy is predominantly primary product oriented in agriculture and crude oil production (African Development Bank, 2012). Agriculture accounts for about 40% of the nations GDP and employs 70% of the labour force despite infrastructure, production and marked support services constraints. The oil industry is a capital intensive virtual enclave that generates very little employment. Nigeria has the potential for a strong agricultural base. Nigeria's yield per hectare is 20% - 50% of that obtained comparable to developing countries. The government needs to tap the

country's comparative advantages to enhance the competitiveness of the agricultural sector. This has the potential for a strong manufacturing/industrial base given the government's aim of developing the agricultural sector. For instance, in 2009, the Government adopted the vision 20:2010 to become one of the top 20 economies in the world by the year 2020. This would require an annual economic growth of 13.8% and a transformation of the primary products oriented economy to an industrial, manufacturing and services oriented economy. This overly ambitious vision would be difficult to realize in 2020 because of the lack of capacity to carry it through.

CONCLUSION AND RECOMMENDATION

Similar to World Bank, FAO, and IFAD, 2009; Quisumbing and Pandolfelli, 2010; FAO, 2011 and IFAD, 2011 this study advocates for increased female labour force participation to be addressed as a key component of pro-poor agricultural growth. The strategy has a very strong potential for economic growth which could translate to higher productivity and poverty reduction in Nigeria.

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