EFFECTS OF FARMERS’ LEVEL OF SOCIAL PARTICIPATION IN LOCAL ORGANIZATIONS: IMPLICATIONS FOR ECONOMIC EMPOWERMENT IN SOUTH-SOUTH REGION, NIGERIA

G.F. OKWUOKENYE¹ AND E.O. AKINTOYE²

¹Department of Agricultural Economics and Extension, Faculty of Agricultural Sciences, National Open University of Nigeria, Km 4, Kaduna Zaria Expressway, Kaduna, Kaduna State, Nigeria
²Department of Sociology, Faculty of Social Sciences, Benson Idahosa University, Benin – City, Edo State

*Corresponding Author: okwuokenyegoddy@gmail.com
Tel: +2348037568724

ABSTRACT

The study examined the effects of farmers’ level of social participation in local organizations (LOs) and its implications for farmers’ economic empowerment in selected states of the south-south region, Nigeria. Data were gathered from two hundred and eleven (211) respondents spread across the study area. The data gathered were analyzed using descriptive (percentage and means) and inferential statistics (multiple regression and Chow test). Results revealed that the participation in LOs had indeed enhanced farmers’ income, thus alleviating their poverty status; their income range was respectively ₦190,758.29 and ₦338,625.59 before and after belonging to LO groups. Respondents’ level of participation in their group was high and the group’s major source of funding was members’ payment of dues (100%) and special contribution (83.41%). Multiple regression revealed that socio-economic characteristics like sex (1716.662), age (781.276), education (-4598.508), marital status (1666.286), farmers’ income (1853.262) and LO membership experience (157023.476) were significant variables influencing farmers’ level of participation in LO group.

Multiple
regression also showed that age (1572.425), marital status (6887.336), LO membership experience (15398.664) and participation index (1542.718) were significant variables of economic empowerment of farmers’ in their groups. Based on findings, the study recommends that educated farmers should be re-oriented by stakeholders on how to use their level of education to influence their group positively and get more committed so that their farm output, income and standard of living can be improved.

**Keywords:** Participation, Communities, Poverty Alleviation, Agricultural Inputs, Farm Income
INTRODUCTION
Participation is a rich concept that varies with its application and definition. Sidorenko (2006) defined participation as a process of taking part in different spheres of social life: political, economic, social, cultural and others. Participation is conceptualized from different perspective. Some of the perspectives are community, development and social participation. Strange (2003) reiterated that participation of farmers in their farm based organizations may occur in many and varied forms like holding of membership, regular attendance at meetings, contribution of money or payment of levies, holding formal positions or offices in the organization, serving in committees and going out to actually work for the association.

In the view of FAO (2009) people are better influenced to participate in their local organizations when; the group builds on existing potentials and capacities of group members. Tannenbaum (2007) pointed out that the participation of people in high quality local based organization will bring about the following benefits; it makes the people gain access to the range of supports and opportunities that are available within the community, it helps to increase in them sense of self-sufficiency, in handling challenges, problems and needs, it brings in them higher academic achievement and interest in furthering their education, just to mention but a few.

Local organizations (LOs) are formal voluntary social groups that are found in the community, which differs widely in terms of their members (Farinde and Adisa, 2005). NLM (2007) defined local organization as a private non-profit organization that is representative of a community and is engaged in meeting human, educational, environmental or public safety community needs. There are many forms of local organization in Nigeria communities. Some of the existing ones include farmers’ cooperative societies’, thrift and consumer cooperatives,
group farm cooperatives, produce buyer and marketing associations (FAO, 2009).

It is expected that when farmers work with and participate in local organizations, the declining contribution of the agricultural sector will be reversed, more food would be produced in terms of quality and quantity and a gain of some form of empowerment of the people at the community level (Adebayo and Okuneye, 2005). Unfortunately, these expectations have not been met despite the participation of farmers in groups. Perhaps, this shortcoming may be mitigated by challenges faced by the local organization which make it difficult for participants (farmers) to individually break away from the vicious circle of poverty.

To address this anomaly of food shortage, low income, low productivity and poverty, local organizations (LOs) have been advocated by several development agencies as a strategic means of gaining local support and promoting rural as well as agricultural output, income and development (Barrette *et al*, 2004). Farinde and Adisa (2005) adduced that local organizations are formed based on the belief that there is no government however benevolent, paternalistic or well meaning, which can boost of the capacity to provide all the multifarious needs of all its citizens. The local organizations therefore help to bridge this gap; hence a study of local organizations becomes important. In achieving this goal, the study seeks to; describe the socio-economic characteristics of farmers’ local organizations in the South – South region of Nigeria, identify the major sources of funding of local organizations in the study area, examine the perceived economic reasons of farmers’ participation in local organizations activities on farm revenue level, and categorize the farmers’ in their local organization based on level of participation in the study area.

The hypotheses of the study were stated in their null forms: 

\[ H_{01}: \text{Local organizations farmers’ socio-economic characteristics have no} \]
significant influence on their level of participation in local organizations.

H₀2: Farmers’ socio–economic characteristics have no significant effect on the economic empowerment of the farmers.

H₀3: There is no significant difference in income of farmers before and after membership of local organizations.

**MATERIALS AND METHODS**

The study was carried out in two states of the South – South of the Niger Delta region of Nigeria. The states are Delta and Edo States.

**Delta State**

Delta State is one of the six states in the south – south geopolitical zone of Nigeria with its capital at Asaba. The state has 25 LGAs with diverse ethnic nationalities, people and dialects (FISON, 2015). Its population size is 4,170,214 (NAEC, 2008). The State is rich in crude oil and also as an agrarian state and known to enjoy comparative advantage in the production of fisheries, livestock, cassava, yam, maize, plantain and tomatoes (FISON, 2015). Besides farming, the inhabitants also engage in other occupations such as oil prospecting, civil service, trading and commerce (ACW, 2006).

**Edo State**

Edo State is one of the states that make up the south – south region of Nigeria. The state has 18 local government areas with its capital at Benin City (NAEC, 2008). The report noted that the state is oil rich, and endowed with several mineral like quartzite, marble, limestone, and gold. NAEC (2008) also spelt that much of Edo State lies in the tropical rain forest belt of Nigeria and it is typically an agricultural zone with favourable climate and good rain fall. Edo State has various linguistic and cultural affinities. Edo is the major dialect in the area while the official language is English Language. Edo State is rich in culture and can boast of the world best wood carvers, and bronze sculptors.
Sampling Technique and Sample Size

The population of the study comprised of farmer who are members of farmers’ local organizations. A multi – stage random sampling method was employed in selecting the respondents. The first stage involved random selection of two states, namely Delta and Edo States. The second stage involved the random selection of two (2) out of the three (3) senatorial zones in each states. This brought the number of senatorial zones used for the study to four (4). The third stage involved the random selection of three (3) local government areas (LGAs) per senatorial zone and this brought the LGAs used for the study to twelve (12) (see Table 1). It was from the LGAs and agricultural based offices that the lists of registered farmers’ local organizations were obtained. Stage four has to do with the random selection of registered farmers’ local organizations in the LGAs per state. It was at this stage effort was made by the researcher to ensure that the LOs used had been in operation for not less than two years, they are registered and active or functioning. From the obtained lists, two (2) of the LOs were randomly sampled per LGA (this comprise of between 60 – 80% of registered LOs). That made the number of LOs to become twenty – four (24). The last stage (stage five) involved a proportional random selection of 50% of farmers of the sampled LOS. Questionnaires were finally administered on two hundred and eleven (211).
<table>
<thead>
<tr>
<th>State</th>
<th>Senatorial Zone</th>
<th>LGAs</th>
<th>Names of Los</th>
<th>Membership size</th>
<th>Sample size (50%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delta</td>
<td>Delta North</td>
<td>Ika North East</td>
<td>1. Out Oganishi FMPCS, Otokpo 2. Ika North East oil palm FMPCS, Owa-Oyibo</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1. Onyema FMPCS, Afortown</td>
<td>26</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Ndokwa East</td>
<td></td>
<td>2. Onyedi – ndu FMPCS, Iselegu</td>
<td>28</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1. love your neighbor FMPCS, Ugbulu 2. Farm pride FMPCS, Umodafe</td>
<td>28</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Oshimili North</td>
<td></td>
<td>1. Unique FMPCS, Oleh</td>
<td>26</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Isoko South</td>
<td></td>
<td>2. Obokparo women better life FMPCS, Emede</td>
<td>26</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1. Oyede fish FMPCS, Oyede</td>
<td>22</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Delta State FMPCS, Owehlogbo</td>
<td>28</td>
<td>14</td>
</tr>
<tr>
<td>Region</td>
<td>Sub-Region</td>
<td>Local Government Area</td>
<td>FMPCS, Location</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>------------</td>
<td>-----------------------</td>
<td>-----------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bomadi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Joyful FMPCS,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bomadi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Tarakeme FMPCS,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tarakeme</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Edo</td>
<td>Edo South</td>
<td>Orhionmwon</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Isi integrated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>FMPCS, Urhonigbe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Ogba FMPCS,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eseosa Ugboko</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oredo</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Helping hand FMPCS,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Benin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Palm kernel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>processors FMPCS,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ogbelake</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uhunmwode</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Ekhon Nuwaya MPCSk,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Igieduma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Egba I FMPCS,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Echor fadama III</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Edo North</td>
<td>Etsako East</td>
<td>Oshietimegbe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>FMPCS, Agenegbode</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Aiseokhuri FMPCS,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Okpella</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Etsako West</td>
<td></td>
<td>Itsemhe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>FMPCS, Auchi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Esusegbe</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The basic tools employed in gathering data from the respondents are the questionnaire and interview schedule administered to literate and illiterate respondents’ farmers respectively. The instruments were personally (with the assistance of trained enumerators) administered on respondents by the researcher. The Extension agents serving in the Delta State Agricultural Development Programme were used in reaching the farmers and administering the question instruments in the respective LGAs. The consent of the respondents was sought and the researcher got approval from them. There was no conflicting interest in the data obtained from them. The respondents were however informed that the data obtained was strictly for research purpose and they concurred.

Two approaches were used for evaluating survey instruments. They are validity and reliability. Content or face validity method was used for validating the instruments, while the instruments reliability was ascertained using the Cronbach Alpha method. The method yielded correlation value of 0.76 which was considered a good indication of the reliability of the instrument (Okwuokenye and Onemolease, 2010).

Respondents’ perception of factors affecting their participation in LOs was obtained through a four – point likert type scale, coded 4, 3, 2 and 1 for Strongly Agree,
Agree, Disagree and Strongly Disagree respectively. The weighted mean score of 2.50 (which was obtained via \[\frac{4 + 3 + 2 + 1}{4}\]) was used to determine which of the perceived factors are important and not. Values of 2.50 and above are considered important, while those with values less than 2.50 are regarded as not important.

**Data Analytical Techniques**

The analytical techniques employed in this study include descriptive (frequency distribution, percentage, and mean) and inferential statistics (multiple regression and Chow-test) were used for testing the hypotheses of the study. Multiple regression was used to determine hypothesis one. The regression equation is specified as:

\[Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + \ldots + b_n X_n + e\]

Where

- \(Y\) = dependent variable
- \(a\) = the coefficient of the constant term
- \(b_i\) = the coefficient of the independent variables
- \(X_i\) = the independent variables
- \(e\) = error term

The variables in the equation are defined below as:

- \(Y\) = Members’ level of participation (percentage rating score)
- \(X_1\) = Gender (male = 1; female = 0)
- \(X_2\) = Age (years)
- \(X_3\) = Marital status: (married = 1; single = 2; divorced/separated = 3; widow/widower = 4)
- \(X_4\) = Household size (number of people living and feeding together)
- \(X_5\) = Educational status
- \(X_6\) = Years of residence (years).
- \(X_7\) = Years of membership in LO (years)
- \(X_8\) = Income (₦) from farm production.

An analysis of farmers’ participation in LOs activities and socio-economic characteristics on their farm income was carried out using multiple regression. The variables in the equation are defined below as:

- \(Y\) = Farm income (₦)
- \(X_1\) = Years of residence in community
\[ X_2 = \text{Gender} \]
\( \text{(male} = 1; \text{female} = 0) \)
\[ X_3 = \text{Age} \]
\( \text{(years)} \)
\[ X_4 = \text{Education status (years)} \]
\[ X_5 = \text{Household size (number of people living and feeding together)} \]
\[ X_6 = \text{Marital status (married} = 1; \text{single} = 2; \text{divorced/separated} = 3; \text{widow/widower} = 4) \]
\[ X_7 = \text{FOs membership experience (measured in years)} \]
\[ X_8 = \text{Participation index score (measured in percentage)} \]

Linear function was adopted as the lead function. This was based on the probability level that shows level of significance of tested variables, number of significant variables, signs of the estimated coefficients of the independent variables and the magnitude of the adjusted $$R^2$$ (Iyoha and Ekanem, 2002)

**Chow test**

Chow test was used to confirm if farmers’ participation in LOs had any significant effect on the economic empowerment on the farmers. In using the Chow test, three linear regressions were fitted; one equation for the restricted model (pooled data) and separate regressions for the unrestricted models, FO participants and non-participants model. The test statistic is formally stated as follows:

\[ F_c = \frac{[S_c - (S_1 + S_2)] / K}{S_c / (N_1 + N_2 - 2K)} \]

\[ F_c = F_{0.05, k, (N_1 + N_2 - 2k)} \]

\[ F^*_{k,N1+N2-2k} = \frac{(S_c - (S_1 + S_2)) / K}{(S_1 + S_2) / (N_1 + N_2 - 2K)} \]

Where;

\[ F_c = \text{the statistical test (calculated)} \]
\[ F^* = \text{the statistical test (tabulated)} \]
\[ S_c = \text{the sum of squared residuals from the combined data} \]
\[ S_1 = \text{the sum of squared residuals from the first group (i.e. FO participants)} \]
\[ S_2 = \text{the sum of squared residuals from the second group (i.e. non-participants)} \]
\[ N_1 \text{ and } N_2 = \text{the observations (sample size) in each group} \]
\[ K = \text{the total number of parameters in the model including the intercept} \]
Decision rule for Chow test
If the test statistics, $F^*$ ($F$–calculated) is greater than the $F$-tabulated, the null hypothesis is rejected while the alternative hypothesis is accepted, vice versa.

RESULTS AND DISCUSSION
Socio-economic characteristics of respondents
Respondents’ socio-economic characteristics are shown in Table 2. Results revealed that most (70.14%) of the farmers were males while few (29.86%) of them were female. From results, males participated more in groups than females. Female low participation in groups could be linked to the refusal of men to allow their women participate in social groups. Low women participation in social organizations was reported by Okwuokenye and Onemolease (2006) thus, confirming the result. Most (37.44%) of the respondents belonged to the age bracket of 40 – 49 years. The average age was 48.56 years. The result implied that most of the farmers were within their active age group. This result is supported by Fakoya and Daramola (2008) whose findings reported similar mean age group. A good proportion of the respondents (69.19%) were married. Participation in LOs could be perceived as a means of empowering themselves economically. Results of Taiye et al (2006) supports this finding. They noted that married people participate more in groups because they see such practice as a means of alleviating their poverty status.

Education level of the respondents revealed that the mean was 19.5 years implying that most of them schooled up to secondary level, with most (54.98%) of them belonging to this category. By implication, they possess the necessary mental capacity to participate effectively in the LOs they belong. Okwuokenye and Akintoye (2015) indicated that most farmers in LOs possess formal education and this characteristic enhances individual capacity to handle agricultural innovations. The average number of years the respondents have spent in their area is about 14 years, with most (28.91%) of them having
spent about 20 years and above, indicating that they have been staying in their communities for a long time and this affords them the knowledge of the good group(s) to belong and those ones to stay away from. Akinola (2000) stressed that a positive relationship exists between the period (years) people/farmers reside in communities and their level of participation in community social groups, thus confirming this assertion. The modal household size of LO farmers (49.29%) was 4 – 6 persons. The average household size of the respondents was about 5 persons. The implication of the result is that the participants have persons who depend on them for their livelihood and who in-turn have to assist the farmers in carrying out their farm operations. This finding is in consonance with the result of Mohammad et al (2011). The authors reported similar household size for members who belong to groups like that of LOs and asserted that it helps to cushion the effect of poverty on them. Majority (42.18%) of the farmers LO members had 4 – 6 years of experience in their groups. The average was about 6 years, so therefore indicates that they are experienced in the groups. Such experience would enable them know the intricacies and use farm technology appropriately. Results of Katungi and Akankwasa (2008) confirmed this assertion as the authors noted that farmers with long years of experience participate more in LO groups and are able to do better economically.
Table 2: Socio – economic characteristics of respondents (n = 211)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Categories</th>
<th>Frequency n = 211</th>
<th>Percentage (%)</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male</td>
<td>148</td>
<td>70.14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>63</td>
<td>29.86</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>&lt; 30</td>
<td>08</td>
<td>3.79</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30 – 39</td>
<td>28</td>
<td>13.27</td>
<td></td>
</tr>
<tr>
<td></td>
<td>40 – 49</td>
<td>79</td>
<td>37.44</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50 – 59</td>
<td>73</td>
<td>34.69</td>
<td></td>
</tr>
<tr>
<td></td>
<td>60 &amp; above</td>
<td>23</td>
<td>10.90</td>
<td>48.56</td>
</tr>
<tr>
<td>Marital Status</td>
<td>Single</td>
<td>22</td>
<td>10.43</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Married</td>
<td>146</td>
<td>69.19</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Divorced</td>
<td>31</td>
<td>14.69</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Widow (er)</td>
<td>12</td>
<td>5.69</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>No formal educ.</td>
<td>2</td>
<td>0.95</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Primary educ.</td>
<td>19</td>
<td>9.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Secondary educ.</td>
<td>116</td>
<td>54.98</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post secondary educ.</td>
<td>74</td>
<td>35.07</td>
<td>19.5</td>
</tr>
<tr>
<td>Years of residence</td>
<td>&lt; 5</td>
<td>25</td>
<td>11.85</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 – 9</td>
<td>27</td>
<td>12.80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 – 14</td>
<td>46</td>
<td>21.80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15 – 19</td>
<td>52</td>
<td>24.65</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 &amp; above</td>
<td>61</td>
<td>28.91</td>
<td>14.42</td>
</tr>
<tr>
<td>Household size</td>
<td>1 – 3</td>
<td>62</td>
<td>29.38</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 – 6</td>
<td>104</td>
<td>49.29</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 – 9</td>
<td>39</td>
<td>18.48</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 – 12</td>
<td>6</td>
<td>2.84</td>
<td>4.48</td>
</tr>
<tr>
<td>Years of experience</td>
<td>1 – 3</td>
<td>42</td>
<td>19.91</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 – 6</td>
<td>89</td>
<td>42.18</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 – 9</td>
<td>51</td>
<td>24.17</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 – 12</td>
<td>29</td>
<td>13.74</td>
<td>5.95</td>
</tr>
</tbody>
</table>

Source: Field survey, 2017
Income range of respondents before and after enrolling in local organizations

Tables 3 and 4 respectively show the income range of the respondents before and after enrolling in LOS and difference in income of farmers before and after membership of LOS. The result showed that most of the farmers (47.87%) before enrolling in LOS earned an income of between₦100,000 – ₦200,000. On the other hand, most (39.81%) of the farmers after enrolling in LOS earned an income range of between₦300,001 – ₦400,000. The average annual earning of farmers before and after enrolling in LO groups was₦190,758.29 and ₦338,625.59 respectively. The difference of ₦147,867.50 in favour of farmers after enrolling in LOS suggest that participation in LOS had indeed enhanced farmers economically. The difference in income was significant since the calculated t-value (27.32) was greater than the tabulated t-value at the 5% level (1.65) (see Table 4). Taiye et al., (2006) thus confirmed this assertion. He reported that participation in groups has a positive impact on farmers’ productivity and consequently their income.

Table 3: Income (₦) range of respondents before and after been members of LOS

<table>
<thead>
<tr>
<th>Categories</th>
<th>Before enrolling with LO</th>
<th>After enrolling with LO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percentage</td>
</tr>
<tr>
<td>&lt; 100,000</td>
<td>24</td>
<td>11.37</td>
</tr>
<tr>
<td>100,000</td>
<td>101</td>
<td>47.87</td>
</tr>
<tr>
<td>200,001</td>
<td>64</td>
<td>30.33</td>
</tr>
<tr>
<td>300,001</td>
<td>20</td>
<td>9.48</td>
</tr>
<tr>
<td>400,001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income (₦) (t-test)</td>
<td>LO membership Status</td>
<td>No.</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------------</td>
<td>-----</td>
</tr>
<tr>
<td>Farmers before membership of 211 LOs</td>
<td></td>
<td>211</td>
</tr>
<tr>
<td>Farmers after membership of 211 LOs</td>
<td></td>
<td>211</td>
</tr>
</tbody>
</table>

*Significant at the 5% level (critical t-value = 1.645)

**Source of funding for local organizations**

The sources of capital for the farmers LOs are shown in Table 5. These included payment of dues (100%), special contribution by members (83.41%) and government assistance (21.33%). Other sources are fines imposed on members (38.39%) and sales of produce (22.75%). Payment of dues and special contribution by members are major sources and compulsory tasks set by these organizations which all members are obliged to, hence the high compliance. Government assistance to the group comes in either cash or the provision of materials that meet their needs. The reports of Abegunde (2009) identified sources of funds to LOs to include payment of dues, contribution from members and grants from the public, this thus supports this findings.
Table 5: Source of funds for local organizations

<table>
<thead>
<tr>
<th>Sources</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payment of dues</td>
<td>211</td>
<td>100.0</td>
</tr>
<tr>
<td>Sales of produces</td>
<td>48</td>
<td>22.75</td>
</tr>
<tr>
<td>Fines imposed on members</td>
<td>81</td>
<td>38.39</td>
</tr>
<tr>
<td>Government assistance</td>
<td>45</td>
<td>21.33</td>
</tr>
<tr>
<td>Special contribution</td>
<td>176</td>
<td>83.41</td>
</tr>
</tbody>
</table>

*Source: Field survey, 2017*

Categorization of respondents based on level of participation in local organizations

On categorization of level of participation of respondents, results on Table 6 show that, most of the farmers (47.6%) were highly involved in the activities of the local organizations they belong to. This proportion was followed by a good number of them (36.97%) who were of average participation and lastly, the low participants who constituted only 15.17%. The implication of high farmers’ participation is that their productivity and income are likely to have been positively impacted. A high level of participation perhaps have yielded a positive effect on economic empowerment on the respondents, hence the acceptance of the alternative hypothesis (that is, hypothesis 3) Okwuokene and Akintoye (2015) findings confirms this result as it concludes that farmers participation in local organizations exposes them to micro finance, produce resources and group motivation which effectively facilitates productivity and revenue.
Table 6: Categorization of respondents based on level of participation

<table>
<thead>
<tr>
<th>Level of participation</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>32</td>
<td>15.17</td>
</tr>
<tr>
<td>Average</td>
<td>78</td>
<td>36.97</td>
</tr>
<tr>
<td>High</td>
<td>101</td>
<td>47.86</td>
</tr>
<tr>
<td>Total</td>
<td>211</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Field survey, 2017

Impart of farmers’ participation in local organization activities on farm revenue

The results (Table 7) showed that the average income of farmers after enrolling in LOs was higher (₦338,625.59) than before enrolling in LOs (₦190,758.29) suggesting that participation in LOs enhances farmers economically. Chow test statistics was used to confirm t-test result on analysis of hypothesis three (see Table 4). The result showed that $F^*$ calculated was 10.51 while $F$-tabulated was 1.75. For this reason, the difference in farm income (₦147,867.50) before and after membership of LO was significant at the 5% level.

LO members earned higher income after enrolling in groups compared to when they were non-members. The difference of ₦147,867.50 (statistically significant at the 5% t-test level) in the revenue of farmers before and after membership suggests that

Based on this, the alternative hypothesis was accepted. It was therefore concluded that there is a significant difference in income of farmers before and after membership of local organizations. This finding is supported by Taiye et al., (2006). Their studies confirmed the positive role of farmers LOs in enhancing farmers’ productivity and income.
Table 7: Farmers participation in local organizations activities on farm revenue (Chow - test)

<table>
<thead>
<tr>
<th>Models</th>
<th>RSS</th>
<th>Mean</th>
<th>N</th>
<th>F cal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pooled</td>
<td>409676676986.698</td>
<td>338,625.59</td>
<td>211</td>
<td>10.51*</td>
</tr>
<tr>
<td>After been LO members</td>
<td>2336254668378.386</td>
<td>338,625.59</td>
<td>211</td>
<td></td>
</tr>
<tr>
<td>Before been LO members</td>
<td>1564362178416.413</td>
<td>190,758.29</td>
<td>211</td>
<td></td>
</tr>
</tbody>
</table>

*Significant at the 5% critical level  *Significant at the 5% level (critical f-value = 1.75)

Influence of farmers’ socio – economic characteristics on level of participation in local organizations activities

Table 8 shows the influence of socio-economic characteristics of respondents on their level of participation in LOs activities (hypothesis one). The result revealed that computed F statistic was 82.17 and was significant at the 5% level (critical F = 2.62). This indicates that the collective influence of the independent variables on respondents’ level of participation was significant. The adjusted coefficient of determination ($R^2 = 0.62$) implies that about 0.62% of the variation in level of farmers’ participation in LO activities was accounted for by the independent variables in the model. Five (5) of the eight (8) independent variables were significant at the 5% level (critical t-value = 1.65). The variables were sex, age, education, marital status, farmers’ income and LO membership experience. Local organization membership experience was positively correlated ($b = 157023.48$) with respondents’ level of participation. It implied that LO membership experience has a direct positive relationship with the level of participation of members in LOs. The experience they had affords them the opportunity to know which LO to belong. Results of Akinola (2000) support this assertion. He stated that the longer one belongs to LO group, the higher would be their level of participation. Farmers income ($b = 1853.26$) was also positively and significantly
related to farmers’ level of participation. By implication, farmers with higher income participate in groups more than the poor ones. The positive relationship between farmers’ income and level of participation was reported by Madukwe (2005). He asserted that high farming experience will result to increased training and indoctrination of the farmers and from which they would learn certain skills that would enable them increase their farm productivity and revenue. Marital status (b = 1666.29) showed a positive and significant relationship with level of farmers’ participation in community based organization. This means that since most (69.19%) of the farmers are married people, it therefore implies that married people are likely to participate more in local organizations. This finding is supported by the results of Akinbile et al., (2008). Who acknowledged that participants in local organizations are mostly married people and they participate in them to improve on their economic livelihood.

Table 8: Influence of farmers’ socio – economic characteristics on level of participation in CBO activities (Multiple regression)

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Coefficient (b)</th>
<th>T</th>
<th>Prob. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>132277.664</td>
<td>0.74</td>
<td>0.65</td>
</tr>
<tr>
<td>Sex</td>
<td>1716.66*</td>
<td>2.60</td>
<td>0.01</td>
</tr>
<tr>
<td>Education</td>
<td>-4598.51*</td>
<td>-1.00</td>
<td>0.02</td>
</tr>
<tr>
<td>Marital status</td>
<td>1666.29*</td>
<td>3.14</td>
<td>0.04</td>
</tr>
<tr>
<td>Farmers income</td>
<td>1853.26*</td>
<td>3.02</td>
<td>0.00</td>
</tr>
<tr>
<td>LO membership experience (years)</td>
<td>157023.48*</td>
<td>17.83</td>
<td>0.00</td>
</tr>
</tbody>
</table>

\[ F = 82.17 \ (p < 0.050) \ (\text{Critical } F = 2.62); \text{ Adjusted } R^2 = 0.621 \]

*Significant at the 5% level (critical t – value = 1.645)

Education of the respondents (b = -4598.51) showed a negative relationship with their level of participation. This result implies that low educated farmers participate more in their groups and vice versa. Okwuokenye and
Onemolease (2010) agreed with this finding. They found education level of farmers to negatively influence the level of farmers’ participation in the activities of the groups they belong. Sex of the respondents showed a beta coefficient of 1716.66. The result revealed a positive relationship between sex and level of participation of the farmers in their groups. A positive relationship implies that since most (70.14%) of the respondents are males; it then goes to say that LOs would experience higher level of participation when it is constituted more of men than women. Similar result regarding low female participation in social organization was reported by Mgbada (2006).

**Relationship of socio-economic characteristics of farmers’ and Participation level in local organizations on economic empowerment of the farmers**

Multiple regression results on hypothesis two shows that the computed F statistic (9.37) was significant at the 5% level (critical F = 3.94), denoting that the collective influence of the variables on respondents’ farm income was significant at the 5% level hence the acceptance of the alternative hypothesis. The variables in the model jointly account for about 68% variation in farm income of the respondents (adjusted $R^2 = 68.4\%$). Four (4) of the eight (8) explanatory variables were significant at the 5% level. The variables were age, marital status, LO membership experience, and participation level of the farmers in the group’s activities (see Table 9).

Age of the respondents ($b = 1572.43$) was positively related to farm income. The result implies that older farmers are likely to engage more in farming activities and this translates to earning higher income. Results of Fakoya and Daramola (2008) are in line with these findings. They acknowledged that higher age enables farmers’ participants have more experience and knowledge to function adequately in LOs and this enables them earn more farm income. Marital status was positively correlated ($b = 6887.34$) with respondents’...
farm income. This result suggests that since most (69.19%) of the respondents are married farmers (see Table 2), it then means that as much as the group is made of more married people, the higher their income is likely to be. Participation in LOs may be perceived by them as a means of supporting their families. This finding is supported by the results of Akinbile et al. (2008). The authors noted that participants in local organizations are mostly married people and they participate in them to improve on their economic livelihood. Local organization (LO) membership experience (b = 15398.66) showed a positive and significant relationship with farm income. The implication of this is that farmers who have stayed or spent more number of years in their groups are more likely to make higher income from their farming activities. The reports of Katungi and Akankwasa (2008) confirms this finding that farmers who participate more in years in LOs are likely to learn and adopt modern farm technology and this helps to improve their productivity and economic empowerment. Participation index score (b = 1542.72) of the respondents as well revealed a positive and significant relationship with the farmers’ farm income. The implication of the result is that the more farmers participate in their groups, the greater knowledge they grasp from farm activities which they input into their farming and thus helps improve farm productivity and income. Similar results have been reported by Abegunde (2009) who noted that higher participation of farmers in their groups would go a long way in speeding socio-economic empowerment of the farmers.
Table 9: Influence of farmers’ socio-economic characteristics and Participation level in local organizations activities on economic empowerment of farmers

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Coefficient (b)</th>
<th>T</th>
<th>Prob. Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>7364.56</td>
<td>1.60</td>
<td>0.14</td>
</tr>
<tr>
<td>Age (years)</td>
<td>1572.43*</td>
<td>2.59</td>
<td>0.00</td>
</tr>
<tr>
<td>Marital status</td>
<td>6887.34*</td>
<td>2.64</td>
<td>0.02</td>
</tr>
<tr>
<td>LO membership experience</td>
<td>15398.66*</td>
<td>3.13</td>
<td>0.00</td>
</tr>
<tr>
<td>Participation Index score</td>
<td>1542.72*</td>
<td>2.11</td>
<td>0.00</td>
</tr>
</tbody>
</table>

\[ F = 9.366 \ (p < 0.050) \text{ Adjusted } R^2 = 0.68 \]

\(*\text{Significant at the 5\% level (critical } t-\text{value} = 1.645)\

**CONCLUSION AND RECOMMENDATIONS**

The study revealed that participation level of farmers was high and this has influenced the economic empowerment of the LO members. The income level of the farmers before and after becoming members of their groups was respectively \(₦190,758.29\) and \(₦338,625.59\). The difference of \(₦147,867.50\) was significant at the 5\% using t-test statistics. This indicates that participation in the LO groups has positively influenced their farm income and as such has alleviated their poverty status.

Based on findings, the study advanced the following recommendations:

i. The education level of the respondents showed a negative relationship with their level of participation in local organizations and income generated from their farms. Efforts should be made by stakeholders (like agricultural extension agents and other relevant government functionaries) to re-orientate the farmers generally and most importantly the
educated ones to use their level of education to influence their group positively and again get more committed in the group they belong. Doing this will go a long way to improving on their farm output, income and standard of living.

ii. The result also noted that government assistance to the group was very poor and since most of the participants of these groups are peasant farmers, they need to be supported. On this note, government needs to increase their commitment and assistance to them. It is hoped that doing such will encourage them in their group and farming activities, and in the long run translate to higher farm output and income.

Declaration of conflicting interest
The authors of this manuscript declare that there is no conflict of interest.
REFERENCES


Okwuokenye, G. F. and Onemolease, E. A. (2010). Evaluation of agricultural and inputs supply programme on


A REVIEW OF POTENTIALS OF AGRICULTURAL BIO-TECHNOLOGY IN FOOD SECURITY, POVERTY ERADICATION AND MITIGATION AGAINST VICES OF CLIMATE CHANGE

Abiona Michael Petu-Ibikunle

Faculty of Agricultural Sciences, Department of Soil and crop Sciences. National Open University of Nigeria. kunlepetu@gmail.com +2347032693482.

ABSTRACT
The poor management of the natural ecosystem was critically reviewed from the viewpoint of its consequences on the prevailing global natural disaster. The Relationship between the drops in the contribution of agriculture to Nigeria Gross Domestic Productivity (GDP) from 62% in 1960 to 23% in 2015 was established to be a consequence of the global warming and the resultant effect of the reduction in surface area of Lake Chad with a surface area of 25,000 sq km in 1960 and 2,700 sq km in 2005. Various national developmental programs and schemes initiated by past government regimes in Nigeria over a period of 30 years were critically examined with the objective of investigating why the realization of their objectives could not solve the problems of rural poverty. The uncontrolled exploration and exploitation leading to a near exhaustion of natural vegetation, soil fertility, destruction of biodiversity, and burning of the fossil carbon to provide energy were identified as the major contribution of agriculture to greenhouse gases and climate change. The efficiencies of Agricultural biotechnology, agronomic/cultural interventions (like composting, sericulture, fungiculture, bio pesticides, phyto-remediation etc.) were presented as nature friendly/organic practices that are sequesters of carbon. Agricultural-biotechnology was suggested to be a single and simple way to simultaneously reverse the fast degrading ecosystem, alleviate poverty and as well provide a natural insurance for food insecurity.
Keywords: Biotechnology, Climate Change, Economic Recession, Poverty alleviation

INTRODUCTION
The consequences of climate change and the consequent global warming has recorded a significant effect on most aspect of life if not all. Man in his physical and social environment has experienced changes that have resulted to an alteration in his production pattern, health status of man, and economic activities (IPCC, 2007). Agricultural insect pests and disease causing pathogens are known to be sensitive in their responses to relative humidity, carbon dioxide ($CO_2$), moisture regime, temperature and a host of other climatic factors. A shift in the natural ecological balance of the conditions that were previously optimum for the survival of the organisms has led to extinction of some, and as well a succession of other new species. Hibernation and aestivation periods of some species might have been reduced or prolonged, and above all, the feeding and growth cycle of the organisms are all parts of the biological processes that might have been altered as a result of the climate change. The adaptation of existing crops to temperature regime, moisture regime, photo-period and prevailing pest and diseases is consequently and subsequently becoming unpredictable. Specific planting dates for crops as well as the calendar for farming activities according to Gladis (2005) are no longer accurate neither are they reliable. Agricultural producers are now coping with related issues to flood, drought, pests, diseases, wind and water erosion, depleting soil fertility, as reported by Godfrey & Martin (1999).
Agricultural biotechnology approach was used to breed a maize plant variety TRSR 1(v) from International Institute for Tropical Agriculture (IITA) to develop early fast growing fibrous roots to enhance the foreseen unpredictable stability of rains commonly experienced at the onset of the rainy season (which is a consequence of climate change) in the Nigeria northern guinea savannah.

The conventional agriculture in Ijebu Ode Ogun State Nigeria (Figure 2), a typical case of a rain forest zone gradually transforming into a derived savannah due to slash and burn agriculture. In this practice, the values of organic agriculture, conservation of natural resources and sustainability of the eco system according to Haggblade, & Tembo (2003) is grossly disregarded.

**Figure 1:** Drought tolerant maize variety

*Maize plant at Kwara state University Nigeria, showing tolerance to a dry spell of 3 weeks after sowing (Figure 1). which is which?*
Figure 1: Drought tollerant maize variety

The eventual consequence is that organic matter, macro/micro floral and fauna are destroyed and removed from their role as sequesters of carbon leading to higher release of green house gases (especially CO$_2$) to the atmosphere which further contribute to global warming via the destruction of the ozone layer. The “slash and burn agricultural” is a major contributor to the declining soil productivity via organic nitrogen depletion. Conscious efforts is thus required to put in place measures that would replenish the soil fertility since it is practically difficult at the present time to make the susistence farmers change in slash and burn farming system. The conventional alleviation efforts directed at coping with these the aforementioned vices of climate change continued to focus on increasing usage of chemical fertilizer, inorganic herbicides, inorganic pesticides, genetically modified organisms (GMO) and extensive irrigation projects as reported by Sue & Haliu (2011). The conventional efforts have however not efficiently addressed the mitigation objectives. Rather, more problems were actually created especially in the area of environmental degradation,
poor carbon sequestration, and disregarded sustainability
Human population continues to increase at an increasing rate while food production and other basic needs of man like cloth, and shelter are becoming relatively scarce. Further efforts by man geared towards increasing land productivity consequently resulted to excessive extraction of natural resources like water (Brown 2009), declining soil fertility according to Petu-Ibikunle and Tenebe, (2012) and general environmental degradation/climate change as reported by IPCC, (2007a). Petu-Ibikunle et al., (2010) reported that there is a correlation between the declining agricultural productivity, global warming and the economic recession is experienced in Nigeria. A progressive yearly increase in percentage rural poverty and proportion of population in poverty between 1980 and year 2000 was observed (Table 1). The surface area of the Lake Chad (the largest endorheic basin in Africa, with basin countries including Chad, Cameroon, Niger and Nigeria on the coordinate 13.1079ºN, 14.4490ºE) was also observed to have progressively reduced from 25,000sqkm in 1960 to 2,700 in 2005, while the share of agriculture in Nigeria Gross Domestic productivity (GDP) simultaneously decreases from 62.5 in 1960 to 23.11 in 2011 (Table 2). Food importation likewise increased over the years and food exportation consequently decreased (Table 2). The contributions of agriculture to Nigeria GDP (Table 3) relative to other sectors (Industries and Services) was rated lowest and observed to be somehow static in the range of 20.90 – 23.91 %. The Annual Growth Rate of agriculture was also observed to be erratic, slow and declined from 6.70- 3.72 between 2012 -2015.

The current trend of the condition of Lake Chad established (Table 1) the fact that there exists a relationship or correlation between the climate/environment, agricultural productivity and human standard of living which include food security and level of economic activities. Poverty incidence has increased from 27.2 in 1980 to 69.0% in 2010. The
relationship between the climate and man can be so managed to achieve food security, alleviate poverty, empower the youth and simultaneously militate against vices of climate Change. This study thus has the objective of introducing agricultural biotechnology as a means of: (i) Stimulating further studies and projects on production of useful product with conservation of wastes to valuable products (ii) creation of skilled jobs and (iii) consequent poverty alleviation, (iv) stressing the relevance of environmental conservation and sustainability.

**Conceptual framework**

Taking a clue from the introduction, it was obvious that (i) drought and water scarcity is now prevailing in most ecosystems in Nigeria. It was also unveiled that agricultural productivity is declining subsequent to a poor production technology and consequent unfavorable climatic conditions resulting from global warming. (ii) Environmental pollution due to exploration of natural resources is fast resulting in environmental degradation. (iii) Natural resources (especially, soil texture, structure and fertility) are also experiencing degradation at an alarming rate.

**Concept of Rural Development: A Review of Past Government Agenda on Rural Development in Nigeria:**

Various past government regimes since Nigeria as a nation got her independence in 1960 had made series of conscious efforts to achieve enhanced productivity, industrial revolution and economic advancement. The review of the rural development programmes in Nigeria is considered relevant for the purpose of linking the past efforts made via developmental policies. The effort will simultaneously serve as a pathfinder and a bridge linking the past with the present with an overall objective of proffering solutions to the issue of food security, poverty alleviation and conservation/sustainability of the natural ecosystem in Nigeria (Ihimodu *et al.*, (2004).
National Accelerated Food Production Project (NAFPP): This programme was launched in 1973 to facilitate the distribution of tractor and machinery services to farmers to support the promotion of improved packages of technology developed by various research institutes.

Operation Feed the Nation (OFN): Initiated and implemented between 1976 and 1979. The objective was to popularise agriculture especially amongst elites and to ensure abundant food production through a mass-oriented approach.

Green Revolution Programme: The project commenced in 1980, with an objective many scholars considered unsuitable approach to agriculture.

Structural Adjustment Programme: The structural adjustment programme was introduced in 1986 with the main objective of correcting some negative economic policies and their consequences such as low productivity in agriculture, environmental degradation leading to unfavourable climatic conditions (weak internal market, low and unstable world market prices for export), inflation and lack of viable innovations for capital investment.

River Basin Development Authority: A project launched in 1986 with main objective to facilitate land development and ensure efficient water resource management.

Agricultural Development Authorities: A project that began in the mid-1970s. The programme used the training and visit strategy of extension services coupled with integrated rural development programmes to boost agricultural productivity.

Peoples’ Bank and Community Banks: This approach to poverty alleviation was implemented in 1989. An attempt was made to make credit facilities available to the rural poor that lived in resource poor risk prone areas.

Poverty Alleviation Programme/National
Programme on Poverty Alleviation: The government was of the opinion the people needed was employment generation and poverty alleviation.

National Directorate for Employment (NDE): The NDE was established in 1987 to tackle the problem of mass unemployment involving both skilled and unskilled labour. It was designed to check the wave of rubbery and threat to life and property that arose from mass unemployment amongst school leavers.

Directorate of Food, Road and Rural Infrastructure: The project was established by environmental impact assessment decree No.4 (1986) of Military government of Nigeria. The focus was on the development of the entire rural areas of Nigeria. The directorate was to improve the quality of life of rural dwellers, with mandates including the identification, involvement and supporting viable local community organisation.

Table 1: Relative poverty head count 1980-2010

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Poverty incidence</th>
<th>Estimated Population (Million)</th>
<th>Population in Poverty (Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>27.2</td>
<td>65</td>
<td>17.1</td>
</tr>
<tr>
<td>1985</td>
<td>46.3</td>
<td>75</td>
<td>34.7</td>
</tr>
<tr>
<td>1992</td>
<td>42.7</td>
<td>91.5</td>
<td>39.2</td>
</tr>
<tr>
<td>1996</td>
<td>65.6</td>
<td>102.3</td>
<td>67.1</td>
</tr>
<tr>
<td>2004</td>
<td>54.4</td>
<td>126.3</td>
<td>68.7</td>
</tr>
<tr>
<td>2010</td>
<td>69.0</td>
<td>163</td>
<td>112.47</td>
</tr>
</tbody>
</table>


The Identification of areas of high production potential for the country’s production for food and fibre was one of the main focuses of the project mandate. The project encompasses a support of natural rural water supply facilities that would enhance greater production economic activities in the rural area.

Family Economic Advancement Programme: This programme was enacted in 1997. It was an economic project specifically for the
poor and needy. It was aimed at improving stimulating appropriate economic activities in various wards and local government areas.

**Better Life Programme:** The programme was initiated in 1987 and transformed to Family Support Programme in 1994. The objective was to alleviate poverty and encouraging rural especially women to improve their standard of living via promotion and formulation of self-help rural development organisations.

Table 2: Nigeria GDP in response to climate change.

<table>
<thead>
<tr>
<th>S/N</th>
<th>Period</th>
<th>Surface area of Lake Chad (sq.km)</th>
<th>Share of Agric. in Nigeria GDP (%)</th>
<th>Food Importation % Total Importation</th>
<th>Agric. Exportation as % of total export</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1960-1964</td>
<td>25,000</td>
<td>62.5</td>
<td>9.9</td>
<td>86.1</td>
</tr>
<tr>
<td>2</td>
<td>1965-1969</td>
<td>24,450</td>
<td>58.4</td>
<td>9.2</td>
<td>79.5</td>
</tr>
<tr>
<td>3</td>
<td>1970-1974</td>
<td>19,000</td>
<td>54.3</td>
<td>7.8</td>
<td>56.8</td>
</tr>
<tr>
<td>4</td>
<td>1975-1979</td>
<td>17,450</td>
<td>39.1</td>
<td>9.4</td>
<td>25.7</td>
</tr>
<tr>
<td>5</td>
<td>1980-1984</td>
<td>14,900</td>
<td>23.1</td>
<td>11.1</td>
<td>5.7</td>
</tr>
<tr>
<td>6</td>
<td>1985-1989</td>
<td>14,900</td>
<td>23.3</td>
<td>11.2</td>
<td>2.7</td>
</tr>
<tr>
<td>7</td>
<td>1990-1994</td>
<td>13,350</td>
<td>41.6</td>
<td>16.8</td>
<td>5.6</td>
</tr>
<tr>
<td>8</td>
<td>1995-1999</td>
<td>9,800</td>
<td>39.9</td>
<td>12.5</td>
<td>1.9</td>
</tr>
<tr>
<td>9</td>
<td>2000-2004</td>
<td>7,250</td>
<td>40.8</td>
<td>24.2</td>
<td>1.6</td>
</tr>
</tbody>
</table>
The objectives of the individual projects are well stated in the names from which it is obvious that projects are targeted at increasing productivity of the export cash crop and paying attention to the problems of rural economy in food production. It also deals with the problem of decreasing carrying capacity of land.

**Factors Responsible for the Prevailing Ecological Problems in Nigeria?**

It is obvious that the objectives of most of the rural development projects were actually targeted at eradicating poverty via exploration and exploitation of human and natural resources, but disregarded sustainability and conservation. 

Kolawole. (2004). This was justified by the establishment of the structural adjustment programme in 1987 when it was observed that most of the earlier economic policies had long run negative environmental and socio economic impact. Increasing the productivity of the land was also proposed to be enhanced by some of the policies, these however disregarded their contributions to general environmental degradation (via liquid, solid and gaseous wastes) and their eventual contributions of the programmes to climate change.

Man is now left with the option of reversing some of the consequences of the adverse effect of
the policies. The first option was to consider the option of biotechnology approach. It is however obvious that biotechnology in Nigeria was disregarded in all the policies until National Agency for Biotechnology Development was inaugurated in year 2005 and the bio safety law enacted in 2015.

The pool of water at the base of the picture (figure 3) in the building was captured at a residential place in Lagos (Nigeria). The pool of water is a mixture of domestic and sewage effluent. Features like this are common in major cities in Nigeria where disposal of liquid and solid waste is a major problem.

**Fig.3: Surface effluent at residential areas.**
Poorly managed environment ordinarily constitute a large percentage of pollution to the human environment.

The biological activities of microorganisms on organic material release many bi-products including putrefying gases which mostly contain greenhouse gasses. Other environmental hazard experienced from this agent of environmental degradation which also includes the pool of effluent providing a suitable breeding media for mosquitoes.

The materials used for land filling in figure 4 contained solid wastes most of which are made of hazardous and non-hazardous biodegradables, heavy metals, plastics, polyethylene and asbestos etc. These materials are being identified to be major sources of underground and surface water contaminations.

A biotechnology approach achieved by decomposing all available biodegradables solid wastes (from kitchen, farm and vegetable markets) under special conditions is a giant stride with multiple successes recorded in affording bio-fertilizer, bio-pesticides thus achieving environmental conservation and protection AIDAB (2012). Biotechnology could be simply defined as all business activity that uses biological manipulations to obtain a final new product.
Biotechnology means doing business with the use of living organisms. It is a business with the living nature and indeed a biological business) with the main objective of addressing food security and poverty eradication.

Agricultural bio-technology can then be identified as a collection of scientific techniques used to improve plants, animals and microorganisms. Based on an understanding of DNA, scientists developed solutions to increase agricultural productivity. It is important to mention that most of the efforts in the practice of agricultural biotechnology have the main objective of enhancing the natural biotechnology which is the autotrophic nutrition/manufacturing of food by green plants, and as well alter the morphological characteristics of the plants and other living organisms for an enhanced improvement in the functions of the morphological trait Figures 5, 6 and 7.)

A critical view on the development of most of the engineering technologies and sciences will unveil that the main objectives is improving or affording more efficient ways of exploring and exploiting/depleting natural resources. These technologies thus considered problematic since they disregard conservation and sustainability. KAST (2004a): KAST (2007b)

Natural resources are either being exhausted or depleted (because conservation and sustainability are disregarded). “People need nature; nature does not need people”. Therefore, to ensure sustainable living, people have to conserve nature.

Environmental impact assessment of agricultural biotechnology: A safe and sufficient food supply, grown in an environmentally responsible fashion, is essential for humanity. Like any technology, agricultural biotechnology has economic and social impacts. Since their introduction, crops improved by biotechnologies have been
used safely, with benefits such as the reduction of pesticide use

Specific causes of Food Insecurity in Nigeria and Concept of Agricultural - biotechnology Approach. These includes: (i) poor seed and production (input) technology. (ii) tedious/laborious production techniques. (iii) High competitive use of factors of production (land, labour and capital). The solutions to issues raised form the pivot of this study. This is because they are the major issues that could be tackled with appropriate biotechnology approaches. From time immemorial, farmers have been improving wild plants and animals through the selection and breeding of desirable characteristics. This breeding has resulted in the domesticated plants and animals that are commonly used in crop and livestock production. In the recent time, breeding has become more sophisticated, as the traits that breeders’ select include drought resistance (Fig 1) disease and pest resistance, and enhanced yield/produce quality (Fig 7b).

Benefits of Agricultural Biotechnology
Biotechnology is being used to address problems in all areas of agricultural production and processing. This includes plant breeding to raise and stabilize yields; to improve resistance to pests, diseases and abiotic stresses such as drought (Plate 3) and cold, and to enhance the nutritional content of foods.

Development of low-cost disease-free plant material for crops such as cassava (Manihot esculenta), banana (Musa acuminata) and potato (Ipomea batatas); creating new tools for the diagnosis and treatment of plant and animal diseases; measurement and conservation of genetic resources. Prohens (2011)

Speeding up breeding programmes for plants, livestock and fish and to extend the range of traits that can be addressed. Animal feeds and feeding practices are being changed by biotechnology to improve animal nutrition and to reduce environmental waste. Prohens (2011)
Biotechnology in crop improvement

Biotechnology can be applied to all classes of organism - from viruses and bacteria to plants and animals. It is becoming a major feature of modern agriculture, medicine and industry. Modern agricultural biotechnology includes a range of tools that scientists employ to understand and manipulate the genetic make-up of organisms for use in the production and processing of agricultural products. Prohens J. (2011)

Field performance (Fig.5a) and harvested produce of local maize varieties (Fig.5b) showing poor field productivity and poor quality harvest as a result of poor seed technology and open pollination. There was a display of poor uniformity in the crop growth, maturity, poor crop establishment and series of cob grades, seed sizes and colours. The quality of harvested produce as seen from the figures (5a and 5b) is ordinarily expected to attract a low market economic value. It is obvious from the physical observation of the produce that a poor seed technology had been deployed in the production.
A comparison of figures 6a and 6b with figure 5a and 5b will convince a learner that the open pollinated maize production, has a substandard field performance. The hybrid maize unveiled a good field establishment, growth uniformity, high cob yield and seed size and colour uniformity of the harvested cobs. An evidence of successful seed breeding technology had been demonstrated in figure 6a and 6b. An application of genetics and breeding, using the skills of controlled crossing or cross pollination is a biotechnology approach that have successfully led to the production of hybrid maize. 

FAO (2001a)

Biotechnology is being used to speed up breeding programme for plants, livestock and fish and to extend the range of traits that can be addressed. Animal feeds and feeding practices are being changed by biotechnology to improve animal nutrition and to reduce environmental waste. Biotechnology is used in disease diagnostics and for the production of vaccines against animal diseases.

Biotechnology in food processing, nutrition and dietetics.

Applications of biotechnology in Agricultural post harvest technology, such as fermentation and brewing, have been popular since the ancient time. Other applications are newer but also well established. For example,
micro-organisms have been used for decades as living factories for the production of modern detergents rely on enzymes produced via biotechnology, pasteurization (milk and yogurt production) Boor, (2005): Fox, (2004), and Godbey (2014) hard cheese production largely relies on outcome bio-technology.

Agricultural-biotechnology, genetic engineering and molecular biology
Biotechnology is more than genetic engineering. Indeed, some of the least controversial aspects of agricultural biotechnology are, potentially, the most beneficial for the poor. Genomics, for example, is revolutionizing our understanding of the ways genes, cells, organisms and ecosystems function and opening new horizons for marker-assisted breeding and genetic resource management. At the same time, genetic engineering is a very strong tool which is not included in the scope of the present study. Modern agricultural biotechnology includes a range of tools that scientists employ to understand and manipulate the genetic make-up of organisms for use in the production or processing of agricultural products.

Agricultural - biotechnology in the development of crop resistance to insect attack
In the last few years, several crops have been genetically engineered/manipulated to produce their own Bacillus thuringiensis (Bt) proteins, making them resistant to specific groups of insects. Bacillus thuringiensis, a soil bacterium that contains a protein that is toxic to a narrow range of insects, but not harmful to animals or humans. Applications of Bacillus thuringiensis have been used to control insect pests for many years, before the advent of the current Bt crops were made using biotechnology. Varieties of Bt insect-resistant cereals and cotton are now in commercial production. FAO, (2001a),

Agricultural- biotechnology in herbicide selectivity
Chemical herbicides are frequently used to control weeds as reported by Richard
Weeds growing in the same field with crop plants can significantly reduce crop yields because the weeds compete for soil nutrients, water, and sunlight. Many farmers now control weeds by spraying herbicides directly onto the crop plants. Because these herbicides generally kill only a narrow spectrum of plants (if not, the crop plants will also be killed), farmers apply mixtures of multiple herbicides to control weeds after the crop has started to grow. The selectivity of herbicides can be achieved via biotechnology. According to Haggblade, & Tembo, (2003) researchers have realized that if a crop plant is genetically engineered to be resistant to a broad-spectrum herbicide, weed management could be simplified and safer chemicals could be used. It is often argued that such GE varieties reduce soil erosion, because they make adoption of soil-conserving practices such as “no-till” easier. Research is on-going on many other crops. One application of this technology is that herbicide could be coated on seed from an herbicide resistant variety (maize) and while the maize would germinate and thrive, weeds including Striga (a parasitic weed) would be killed.

Biotechnology and the Management of the Environment

In the area of environmental management, the application of biotechnology in agricultural production processes simultaneously affords conversion of waste to wealth, environmental

One of the major inputs in agricultural production is fertilizer for soil fertility improvement and pesticides for weed and pest control. These inputs are usually very expensive ($16.56 per 50kg bag fertilizer) and not usually within the reach of the native farmers. The use of the synthetic/mineral fertilizer and pesticides sometimes significantly reduce the farmer’s profit margin. Waste are collected and withdrawn from littering the environment sorted into biodegradable and non-biodegradable components.

The amazing fact about the conversion of waste to wealth is that the poor, in most cases, ignores wastes and deposits the waste materials in places where they constitute nuisance to the community. While a Nigerian farmer wallows in poverty, farmers in most of the Asian nations participates in a lot of biotechnology activities to boost the economy of their nations (development of the local industries).

Figure 8 to 11 unveils most of the biotechnology activities like apiculture, sericulture, fungi-culture, production of bio-gas from waste, to mention but few, are being handled by the common/native rural dwellers. Nigerians will have to take these biotechnology activities beyond research level, depend less on government for intervention and embrace necessity as a mother of invention.

**Biotechnology and Bio-degradation of Organic Matter for Militating Against Production of Greenhouse Gases**

- A large volume of methane gas ($\text{CH}_4$) is produced during anaerobic decomposition of ruminant’s faeces. This is a greenhouse gas that contributes to the global warming.
- Nitrous oxide from de-nitrification of
inorganic fertilisers produces greenhouse gases as well.

- Decomposition of carbon containing substances found in the oxygen-free environments, such as wastes in landfills, release methane.

- Other pollutants, including nitrous oxide from fertilizers and the pesticide methyl-bromide, also attack atmospheric ozone.

Nitrogen-containing fertilizers break down in the soil to emit nitrous oxide into the air. Ploughing fields also releases nitrous oxide. This also have a devastating effect on the ozone layer. Umar & Ibrahim (2011): Niggli (2008) Bio-fertiliser.

Processing of wastes specifically organic residues otherwise called composting to obtain compost manure (Figure 8) is upcoming agricultural intervention in Nigeria. The technology is expected to cope with the prevailing infertility status of the agricultural soils, create wealth via conversion of ‘waste to wealth or trash to treasure’ and as well minimise environmental degradation and pollution created by uncontrolled disposal of wastes and use of mineral fertilisers. Compost manure contains amongst other useful organisms, _Trichoderma_ spp. which can also be presented for commercial uses as bio-fertilizer and pesticide produced from compost manure. It is good to mention that the fungi spp. serves two purposes. It is an organic fertiliser and at the same time, an organic pesticide. This is one of the special attribute of biotechnology/organic interventions in crop production. There are many more organic products that are feeds to animals and fertiliser to crops. Compost has been widely reported to contain microorganisms that have the ability to improve crop immunity to diseases via antibiotics reaction (Banitez et al., 2012, Ait-Lahsen 2002): Isabel et al., 2006

**Uses of*Trichoderma*, a fungi species produced from compost.**

**Disease control:** *Trichoderma* is a potent bio control agent

**Plant Growth Promoter:** *Trichoderma* strains solubilized phosphate and micronutrients, therefore *Trichoderma* strains with plants increases the number of deep roots, thereby increasing the plants ability to resist drought. Hexon et al., (2016).

**Biochemical elicitors of diseases:** *Trichoderma* strains are known to induce resistance in plant. *Trichoderma* produces three classes of compounds-induced ethylene production, hypersensitive responses and other defence-related reactions in plant cultivars.Cristina (2017)

**Bioremediation:** *Trichoderma* strain plays an important role in the bioremediation of soil that are contaminated with pesticides and herbicides. They have the ability to degrade a wide range of insecticides: organochloride, organophosphate and carbonate.Kredics et al., (2001).

**Transgenic plants:** Introduction of endochitinase gene from *Trichoderma* into plants such as tobacco and potato plants leads to their resistance to fungal growth. Selected transgenic line are highly tolerant to foliar pathogen such as *Alternaria alternata*, *A solani* and *Botrytis cirerea* as well as to the soil-borne pathogen, Suchita (2016).

**Biological nitrogen fixation:** Nitrogen fixation has also been achieved via biotechnology. Suitable species of both free living and parasitic fungi and bacteria had been used to inoculate either the seed or the soil to achieve this. With the biological N-fixation, the root of crops (legumes) can automatically fix nitrogen and as well enjoy other benefits like enhanced nutrient and water uptake. The soils productivity and crop yield thus enhanced. Such inoculated crops have been successfully grown on very
poor soils where other crops have failed (Sanders, 2001; Wagner, 2011; Frans, 2015).

**Biological pest control:**
The invasion/outbreak of cassava mealy bug in Nigeria (mid to late 70’s defiled the use of pesticides.) The insect pest protects its colony with a waxy material that cannot be penetrated by any pesticide. The success story came when the natural enemy of the pest was imported and released to the field by International Institute for Tropical Agriculture (IITA) scientists. This biotechnology approach is environmentally friendly, affordable, and sustainable. Some bio pesticides are also formulated using suspensions of natural enemies, parasites and pathogens that are capable of causing disease that could control the pests of some specific crop. (ICIPE, 2010).

The application of biotechnology in the control of insect pests redefined insects to sometimes be seen as been beneficial and not to entirely recognise insects as a pest/destroyer. The organism (insect) is converted to a more resourceful use as we have it in the production of silk cotton, edible honey producers, producer of clay (termite) and edible and industrial dye producers (Figure 11).

![Figure 11: Bio Pesticides](image)

**Other Bio-pesticides** *(botanical)*: Cloyd, R. 2005, Cloyd, R. 2006, Casey, C. 2005 Thomas, C. (2005) Nicotine is extracted from tobacco or related *Nicotiana* species and is one of the oldest botanical insecticides in use today. It breaks down quickly however,
so it is legally acceptable to use it on organically grown crops.

**Sabadilla:** another botanical insecticide, derived from the seeds of the sabadilla lily. The active ingredient is an alkaloid known as veratrine. Sabadilla is considered among the least toxic of botanical insecticides. No residue is left after application of sabadilla because it breaks down rapidly in the sunlight. Cloyd, (2005).

**Rotenone:** is a resinous compound produced by the roots of two members of the Leguminoceae family. Its common use is to control various leaf-feeding caterpillars, beetles, aphids and thrips on a wide variety of vegetables. Cloyd, (2006).

**Neem:** is a botanical pesticide derived from the neem. This tree supplies at least two compounds, azadirachtin and salannin, that have insecticidal activity and other unknown compounds with fungicidal activity. Casey, (2005) Thomas, (2005).

**Pyrethrum/pyrethrins:** are extracted from a chrysanthemum plant, grown primarily in Kenya, Rwanda, Tanzania and Ecuador. Most insects are highly susceptible to pyrethrin at very low concentrations. Pyrethrum is non-toxic to most mammals, making it among the safest insecticides in use. The Environmental Protection Agency (EPA 2012) has approved it for more uses than any other insecticide (Leonard, 2009).

**Current technologies to decrease dietary toxicity of heavy metals:**
Different technologies have been employed for soil decontamination. Two strategies depending on the amount of heavy metal contents in soil can be adopted. First is the application of different agronomical practices in order to minimize the availability of heavy metals in soils. These include pH modification, organic matter management, fertilizer management, and choice of the most suitable vegetables for a particular soil.
This strategy can be employed in areas where heavy metal pollution is not extensive. Another way is the use of phytoremediation techniques in which metal accumulating plants are used to transport and concentrate metals from soil into the aboveground shoots, which are then harvested. This technique is ideal in soils where heavy metal pollution is very high.

**Agricultural biotechnology in the Control of Root Knot Nematode:**

Numerous works on Crotalaria has paid attention to nematode suppression in crop production systems. The basic principle behind the use of trap crop hinged on the ability of some species (crotalaria) to produce root metabolites that are capable of attracting the invasion of the root of susceptible crops, subsequent to the invasion, Crotalaria become a poor host (thus posing a good trap) to many crop-parasitic nematodes including *Meloidogyne* spp., *Rotylenchulus reniformis*, *Radopholus similis*, *Belenolaimus longicaudatus*, and *Heterodera glycines* as reported by Nurul et al. (2016); Koon-Hui Wang et al. (2008); Karajeh (2008). The aim of this review is to collate the knowledge of the efficacy of *Crotalaria* spp. in plant-parasitic nematode management, *Crotalaria* species are used as pre-plant cover crops, intercrops, or soil amendments (Mauchline et al., 2004). Integrating other pest management strategies with Crotalaria could offer promising nematode management approaches (Sahebani, 2008; Al-Hazmi, 2016).

Tomato is highly susceptible to root knot nematode infection, report from Goswami et al., (2008): Goswami, and Mittal, (2004): Goswami, et al.,(2008) have shown that the application of a fungal apecies *Acremonium strictum* and *Tricoderma harzianum* showed that the fungi posed an antagonist to the infection of tomatoes by the root knot nematode (*Meloidogyne incognita*). The bio-control of *Meloidogyne* inconita damaging queen palm (*Livistona rotundifolia*) was reported by Feyisa et al., (2016) who also outlined the efficacy of some botanicals and trichoderma harzianum the
for the management of tomato root-knot nematode \textit{(Meloidogyne incognita} (Kofoid and White) Chitwood) in tomato.

**Phytoremediation**

Use of higher plants to absorb heavy metals from polluted lands, has gained much interest recently. Phytoremediation may include phytoextraction, phytoviolatilization, rhizofiltration or phytostabilization. A number of plant species from Angiospermic groups have been employed to carry out phytoremediation. Certain plants such as \textit{Thlaspi caerulenscens}, \textit{Haumaniastrum robertii}, \textit{Ipomoea alpina}, \textit{Macadamia neurophylla}, \textit{Psychotria douarret}, \textit{Thlaspi rotundifolium}, etc. which can selectively accumulate heavy metals are employed to remove heavy metals from soils. Such plants can accumulate 10~500 times higher levels than crops. Azita and Seid (2008); Yan-de Jing (2007): Abou-Shanab

![Figure 12: Jathropha, a shrub popularly grown as hedges but now grown as economic crop, seed processed to bio-diesel for use as fuel in automobiles](image)

**Bio-Diesel Production**

Fuel production from Jathropha is a biotechnology approach to produce and afford an alternative to fossil oil. Fossil oil exploration in Nigeria had been a source of environmental degradation in the oil producing areas. Oil spilage into the soil had rendered most of the agricultural soils unproductive. Cases of oil spilage had severally been experienced on the sea and some major rivers leading to the death of many aquatic species most of which are of valuable economic importance.
The fossil oil had been a major source of foreign exchange to the nation Nigeria. It is however unfortunate that the international trade and market of fossil oil had been very uncencouraging in the past few decades. The poor international oil price had been linked to the reduced preference for fossil of because of the shift in technology to a more sustainable and environmentally friendly sources of fuel and energy like bio-diesel, solar energy and wind and hydro driven sources of energy.

The advent of bio-diesel (a product of biotechnology) if well developed has a great potential of minimising the increasing cases of environmental pollution/degradation and as well contribute to the share of agriculture in Nigeria GDP as discussed (Table 1)

**Sericulture**

Some species of insects (especially the lac scale insects) have been identified to be producers of dyes of good quality for both industrial and nutritional purposes. The dye from the insects used in the food (chewing gum and sweet, cosmetics and cake colour) because of their nontoxic nature in the human diet. The textile industries likewise use the dye produced from biotechnology in preference to the dye and synthetic alternatives which are sometimes more expensive and has a lot of bye products that are not environmentally friendly.

The silk rearing is an alternative to the conventional cotton and fibre crops production. The establishment of arable commercial farm of crops especially cotton could be very laborious and resource intensive. The comparative advantage sericulture (a biotechnology) and arable farming of cotton is that silk produced from insect rearing (figure 15??) is an alternative biotechnological approach to the field production of fibre materials for industrial purposes. The technology involved feeding some species of high fibre plants to silk warms, an insect species that would ordinarily spine silk. A comparatively smaller space energy and input afforded via biotechnology had been
involved to produce silk/fibre, against the laborious, capital intensive arable field establishment of cotton. Odiabo (2009)

**Apiculture**

Bees (*Anthophila mellifera*) had since ages been identified as one of the most valuable social insects. The values place on bees is based on its biological roles in nature as a pollinator, producer of wax, and edible honey. Honey in the past was collected from the wild using a destructive harvesting method. The honey beehive is usually attacked with burning flames to kill the bees in an attempt to prevent the honey collector from been attacked/stung. With the application of biotechnology, honey rearing has been domesticated. The bees are reared in colonies. The beekeeper collects the honey without destroying the bees and the environment. The approach of honey production has thus recorded a success of industrialisation of honey production and ecological protection as well. Suresh(2009).

**Fugiculture**

A species of fungi specifically called mushroom in Nigeria usually grow in the wild/forest in Nigeria during September which is the peak of the raining season in the rain forest. The highly edible nutritious species is usually collected in the wild in the early morning on daily bases. The method of wild collection is somehow regarded as been primitive because of the labour intensity; a major limitation of the wild collection method of the mushroom is the seasonal availability.

*Figure 13: Fungi-culture: very useful domestic and industrial food and raw material.*
CONCLUSION
Agricultural technology enhances the conservation of the biodiversity: Rear and endangered species are conserved, preserved and protected. The rigorous, laborious and capital intensive food production can be minimized. (This will make farming very attractive as a result of which more people will be willing to practice agriculture). The practice of Biotechnology is economically viable: manufacturers can produce enough for self-sufficiency and sufficient cash/profit to pay for labor and other costs of production. (A pointer to food security and rapid industrialization). Efforts to take biotechnology beyond the present experimental and theoretical stage will need the intervention of an on farm adaptive research and training.

REFERENCES


FAO, (2001a), what are GE Crops? PBS and ABSP II Bt Corn field at the University of the Philippines, Los Baños. An occasional Publication of Food an Agricultural Organisation.


Hexon Angel Contreras-Cornejo Lourdes Macías-RodríguezEk del-Val John Larsen (2016). Ecological functions of Trichoderma spp. and their secondary metabolites in the rhizosphere: interactions with plants


Petu-Ibikunle, A.M and Tenebe. V.A. (2012) The role of bio intensive technology in minimizing the vices and contribution of traditional Agricultural practices to climate change. NISEB Journal 12(1) 41-45


Publications Distribution Center, The Pennsylvania State University, 112 Agricultural


Sustainable development (ISD) Addis Ababa. Pp 70


Aims and Scope of NOUN Journal of Physical and Life Sciences

*NOUN Journal of Physical and Life Sciences* (NJPLS) is a joint publication of the Faculties of Agricultural Sciences, Health Sciences, and Sciences of the National Open University of Nigeria (NOUN). It accepts and publishes (in English language) high-quality articles, original research papers, review articles and short communications in all disciplines of Agricultural Science, Health and Behavioral Sciences, Physical, Computational, Biological and Environmental Sciences. It also accepts and publishes articles in cross-disciplinary fields, interfacing with science-based disciplines.

Handling/page charges

The handling and page charges are ₦5,000.00 and ₦15,000.00 respectively. International authors on the other hand should pay a total of $150 for both handling and page charges (handling charge: $30, page charges $120). The handling charge will be paid at the point of paper submission for review while the page charge will be paid on final submission of the paper after its acceptance.

All payments should be made on remita at www.remita.net to:
Name of MDA: National Open University of Nigeria. Specify name of service / purpose as “Miscellaneous income”. Forward a copy of receipt of payment to the Editor-in-Chief at njpls@noun.edu.ng

Process

All manuscripts are reviewed by two expert reviewers. The reviewers’ comment determines whether a paper will be accepted or rejected. Decisions will be made as rapidly as possible, as the journal strives to return reviewers’ comments to authors within the shortest possible time. It is the goal of the NJPLS to publish manuscripts in the very next edition of the Journal after final submission.

Copyright: Submission of a manuscript implies: It is the responsibility of the corresponding author to ensure that the work described has not been published before (except in the form of an abstract or thesis) or submitted for publication elsewhere. If and when the manuscript is accepted for publication, the authors agree to automatic transfer of the copyright to the publisher.
Instructions for Contributors

Manuscript format and preparation

Manuscripts should be typed in A4 paper, 12 font sizes, Time New Roman, double line spacing, and all pages numbered starting from the title page. The order of appearance of materials in the articles should be: Name and address, Title, Abstract (not more than 300 words), Keywords, Introduction, Materials and Methods, Result, Discussion and References (APA format).

The Title should be a brief phrase describing the contents of the paper. Where possible the title should not be longer than 18 words. The Title Page should include the following: authors’ full names and affiliations; the name of the corresponding author along with phone number, e-mail information and current address.

The Abstract should concisely indicate the purpose and method of research, the results and the conclusion. The abstract should be written in the past tense. Standard nomenclature should be used and abbreviations should be avoided. No literature should be cited. 3 to 5 keywords should be provided.

The Introduction should provide a clear statement of the problem, the relevant literature on the subject, and the proposed approach or solution. It should be understandable to colleagues from a broad range of disciplines.

Materials and methods should be complete enough to allow experiments to be reproduced. However, only truly new procedures should be described in detail; previously published procedures should be cited, and important modifications of published procedures should be mentioned briefly. Sub-headings should be used. Methods in general use need not be described in detail.

Results should be presented with clarity and precision. The results should be written in the past tense when describing findings in the authors’ experiments. Results should be explained, but largely without referring to the literature. Discussion, speculation and detailed interpretation of data should not be included in the results but should be put into the Discussion section.

The Discussion should interpret the findings in view of the results obtained in this and in past studies on this topic. State the conclusions in a few sentences at the end of the paper. The Results and Discussion sections can include subheadings, and when
appropriate, both sections can be combined.

Tables should be kept to a minimum and be designed to be as simple as possible. Tables are to be typed single-spaced throughout, including headings. Each table should be fixed in appropriate section within the text.

Figure legends should be typed in numerical order on a separate sheet. Graphics should be prepared using applications capable of generating high resolution GIF, TIFF, JPEG or PowerPoint before posting in the Microsoft Word manuscript file. Tables should be prepared in Microsoft Word. Use Arabic numerals to designate figures and upper case letters for their parts (Figure 1). Begin each legend with a title and include sufficient description so that the figure is understandable without reading the text of the manuscript. Information given in legends should not be repeated in the text.

References: In the text, a reference identified by means of an author’s name should be followed by the date of the reference in parentheses. When there are more than two authors, only the first author’s name should be mentioned, followed by ‘et al’ in subsequent citation. In the event that an author cited has had two or more works published during the same year, the reference, both in the text and in the reference list, should be identified by a lower case letter like ‘a’ and ‘b’ after the date to distinguish the works.

Submission of manuscripts should be by electronic means only, as e-mail attachment, to the Editor-in-Chief at njpls@noun.edu.ng. Tables and figures should be embedded in the appropriate section in the text. Ensure also that the file is compatible and thus could be opened across systems.

Three types of manuscripts may be submitted: Research papers: These should describe new and carefully confirmed findings, and experimental procedures should be given in sufficient detail for others to verify the work. The length of a full paper should contain about 10 pages; the minimum required to describe and interpret the work clearly (this excludes wording related to an abstract, a full set of references, tables and diagrams). Papers can either be theoretical or empirical based.

Review articles: Submission of reviews and perspectives covering topics of current interest are welcome and encouraged.
Reviews should be concise and about 7-8 printed pages. Reviews/opinion manuscripts are also peer-reviewed.

**Short Communications:** A Short Communication is suitable for recording the results of complete small investigations or giving details of new models or hypotheses, innovative methods, techniques or apparatus. The style of main sections need not conform to that of full-length papers. Short communications are 4 to 6 printed pages in length.