JOURNAL OF AGRICULTURAL EXTENSION

A PUBLICATION OF AESON

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- Extension communication models and strategies;
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Training Needs of Vocational Forestry Staff in Ogun State Nigeria.

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Abstract

Forests contribute in different forms to national and economic growths. Nigeria suffers the second largest net loss in forest reserve with 4.0 million hectares cleared annually. There is also inadequate training based on need assessment, and forestry personnel lack opportunities to update their knowledge. These concerns gave rise to this study with specific objectives to level of knowledge and level of skills of vocational staff in forestry activities. Data were collected using a simple random sampling technique in the selection of 50% of vocational staff totaling 143 respondents. Descriptive statistics and inferential statistics were used to analyze data. Majority of forestry vocational staff were between ages 41-50 years. Majority of vocational staff were school certificate holders and all staff considered themselves to be forest stakeholders. Thirty two percent of vocational staff attended Hammer procedure course. Vocational staff perceived their knowledge level and skill level as medium and that they needed little or no training in most of the area of needs. In conclusion, the study has shown that vocational staff in the study area needs to improve their knowledge, skills in forestry activities to meet up with the contemporary challenges.

Keywords: Vocational staff, Training needs, Forestry Activities, Knowledge level, Skill level

Introduction

Forests contribute in different forms to national and economic growth, thereby, providing employment for the rural populace and serving as good conservers of soil-water. In addition, forests serve as habitation for wildlife biodiversity and provide food, recreational and aesthetic values to the environment. Unlike in the past, when forests were taken for granted, people are becoming increasingly aware of the direct and far-reaching influences of forests on the environment. Trees also help in breaking the forces of wind, thus preventing wind erosion. They therefore, serve as good conservers of soil water by encouraging percolation and discouraging run-off. Forest sub-sector accounts for about 8% of the agricultural gross domestic products (Gbadebo, et al, 2002) and several millions of households, therefore, depend on non-timber forest products (NTFPs) for subsistence purposes and income, (Etukudor, 2003).

Many state forest reserves in the country were originally set up in recognition of the importance of many tree species and the associated flora and fauna. Forestry is a
source of revenue to government and the private sector. This is through the harvesting, processing and sale of forest produce—ranging from wood to non-wood forest produce. For example, between 1990 and 1994, Edo State government generated more than N62 million from Okomu Forest Reserve (Faleyimi and Arowosoge 2011). Furthermore, forestry revenue in Akwa Ibom State accounted for about 30 percent of the state’s total internally generated revenue between 1988 and 1996 (Udo, 2002). However in some cases the public does not control entry into government forest reserves to harvest minor forest products such as tree leaves, barks and roots. Within these forests are many endemic plant species and some that are commercially valuable, like mahogany and other hardwoods. The destruction of forests for timber, cropland, wood, fuel, pasture and urbanization has had an impact on many poor rural families who depend on forest resources for fuel, fodder, food, medicine and housing. Therefore, the deterioration of forests has accelerated soil erosion, sedimentation of rivers, and increased flooding (Kio, et. al. 1992). Lack of knowledge, skilled and well-trained vocational staff in the study area is a major problem, hence developing programmes, teaching farmers on problem solving strategies, facilitating rural community development efforts and forest sustainability may be impossible.

According to Borich, a need is described as a discrepancy or gap between "what is", or the present state of affairs in relation to a group and situation of interest, and "what should be", or desired state of affairs (Witkin and Altschuld, 1995; 2000). Borich (1980) pioneered his methodological model in an effort to design such a survey instrument that would allow one to collect data that can be weighed and ranked in order of priority. By doing so, responses can be linked to a practical decision framework to improve a training program. Borich defined a training need as "a discrepancy between an educational goal and trainee performance in relation to this goal." He further suggested that training programmes could utilize his model by employing the two extreme positions: what is (the measured behaviors, skills, and competencies of trainees) and what should be (the goals of the training program).

The general objective of the study was to assess the perceived training needs of forestry workers in forestry activities in South west of Nigeria. The specific objectives were to: (1) examine the level of knowledge of vocational staff in forestry activities; (2) determine the level of skills of vocational staff in forestry activities; (3) determine the attitudes of vocational staff towards forestry activities; and (4) determine constraints to performance of vocational staff involved in forestry activities in the study area.

**Methodology**

Vocational staff involved in forestry activities in Ogun state, South West Nigeria constituted the target population. Simple random selections of 50% of vocational staff were selected from the state, totaling 143 respondents out of 286. Descriptive statistics were used in analyzing the data. Knowledge Level: This variable was measured by assigning one to each activity mentioned, the maximum mean is 5 and the minimum is 1. The mean were categorised into high knowledge (5-4), moderately knowledge (3.99 – 2.1) and low knowledge (2-1). (Koponiyi, 2003).
Borich formula was used in calculating training needs. Randol and Larry (1988) in a study on identifying staff development needs of cooperative extension Faculty using a modified Borich Needs Assessment Model indicated that scores per training needs could theoretically range from +20 to -4. Interpretation of the calculated scores is suggested as follows:

1. A topic which has a negative score would be considered inappropriate for use in developing in-service programmes since it resulted from a combination of a very low importance score, a very high knowledge score, or a very low opportunity score.
2. A topic with a score which is relatively close to zero also would not be considered appropriate since it would seem that existing knowledge of the topic, or the opportunity to use new knowledge, is equal to the respondents' perceived importance of the topic i.e., the respondents' existing knowledge is equal to the current opportunity to use information related to the topic.
3. Those topics having positive scores should be rank-ordered and programming would be planned around those having the highest values. Therefore, the higher the number, the greater the need for training.

Results and Discussion

Respondents' Socioeconomic characteristics

Table 1 shows that majority of the respondents (87.41%) were male and 12.59% were female while majority (41.26%) were within the age range of 41-50 years in Ogun State. Majority (74.13%) of the respondents were married. Forty-one percent of the respondents had 2 to 3 children, majority (62.94%) of the vocational staff had SSCE/GCE certificate; 32.17% had been on the job for 1-5years. This gives an indication that most of the respondents were employed recently and may be facing challenges on the field if compared to older individuals. Majority (71.33%) of the respondents had no area of specialization because they were not trained in forestry. Majority (32.87%) of the respondents were exposed to short term training on tree identification and 32.17% for hammer procedure.
Table 1: Distribution of respondents Socio Economic Characteristics

<table>
<thead>
<tr>
<th>Socio Economic Characteristics</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>125</td>
<td>87.41</td>
</tr>
<tr>
<td>Female</td>
<td>18</td>
<td>12.59</td>
</tr>
<tr>
<td>Total</td>
<td>143</td>
<td>100</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 – 30</td>
<td>39</td>
<td>27.27</td>
</tr>
<tr>
<td>31 – 40</td>
<td>29</td>
<td>20.28</td>
</tr>
<tr>
<td>41 – 50</td>
<td>59</td>
<td>41.26</td>
</tr>
<tr>
<td>51 – 60</td>
<td>16</td>
<td>11.19</td>
</tr>
<tr>
<td>Total</td>
<td>143</td>
<td>100</td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>34</td>
<td>23.78</td>
</tr>
<tr>
<td>Married</td>
<td>106</td>
<td>74.13</td>
</tr>
<tr>
<td>Divorced</td>
<td>3</td>
<td>2.10</td>
</tr>
<tr>
<td>Total</td>
<td>143</td>
<td>100</td>
</tr>
<tr>
<td><strong>Number of children</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 – 1</td>
<td>42</td>
<td>29.37</td>
</tr>
<tr>
<td>2 – 3</td>
<td>60</td>
<td>41.96</td>
</tr>
<tr>
<td>4 – 5</td>
<td>32</td>
<td>22.38</td>
</tr>
<tr>
<td>6 – 7</td>
<td>8</td>
<td>5.59</td>
</tr>
<tr>
<td>8 – 9</td>
<td>1</td>
<td>0.70</td>
</tr>
<tr>
<td>Total</td>
<td>143</td>
<td>100</td>
</tr>
<tr>
<td><strong>Year in Service</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 – 5 years</td>
<td>46</td>
<td>32.17</td>
</tr>
<tr>
<td>6 – 10 years</td>
<td>30</td>
<td>20.98</td>
</tr>
<tr>
<td>11 – 15 years</td>
<td>27</td>
<td>18.88</td>
</tr>
<tr>
<td>16 – 20 years</td>
<td>19</td>
<td>13.28</td>
</tr>
<tr>
<td>21 – 25 years</td>
<td>15</td>
<td>10.49</td>
</tr>
<tr>
<td>26 – 30 years</td>
<td>6</td>
<td>4.2</td>
</tr>
<tr>
<td>Total</td>
<td>143</td>
<td>100</td>
</tr>
<tr>
<td><strong>Educational Qualification</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GCE/ SSCE</td>
<td>90</td>
<td>62.94</td>
</tr>
<tr>
<td>Certificate</td>
<td>9</td>
<td>6.29</td>
</tr>
<tr>
<td>NCE</td>
<td>1</td>
<td>0.70</td>
</tr>
<tr>
<td>HND</td>
<td>9</td>
<td>6.29</td>
</tr>
<tr>
<td>Total</td>
<td>143</td>
<td>100.00</td>
</tr>
<tr>
<td><strong>In service Training</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beat procedure</td>
<td>4</td>
<td>2.80</td>
</tr>
<tr>
<td>Budding and grafting</td>
<td>1</td>
<td>0.70</td>
</tr>
<tr>
<td>Forest law and policy</td>
<td>3</td>
<td>2.10</td>
</tr>
<tr>
<td>Hammer procedure</td>
<td>46</td>
<td>32.17</td>
</tr>
<tr>
<td>Log checking</td>
<td>1</td>
<td>0.70</td>
</tr>
<tr>
<td>Monitoring patrol</td>
<td>3</td>
<td>2.10</td>
</tr>
<tr>
<td>Nursery establishment</td>
<td>8</td>
<td>5.59</td>
</tr>
<tr>
<td>Plantation establishment</td>
<td>2</td>
<td>1.40</td>
</tr>
<tr>
<td>Plot demarcation</td>
<td>5</td>
<td>3.50</td>
</tr>
<tr>
<td>Seed and Seedling tech</td>
<td>2</td>
<td>1.40</td>
</tr>
<tr>
<td>Silvicultural Operation</td>
<td>5</td>
<td>3.50</td>
</tr>
<tr>
<td>Survey</td>
<td>3</td>
<td>2.10</td>
</tr>
<tr>
<td>Taxonomy</td>
<td>13</td>
<td>9.09</td>
</tr>
<tr>
<td>Refresher course</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tree identification</td>
<td>47</td>
<td>32.87</td>
</tr>
<tr>
<td>Total</td>
<td>143</td>
<td>100.00</td>
</tr>
<tr>
<td><strong>Area of Specialization</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Agriculture</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Fisheries</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Horticulture</td>
<td>1</td>
<td>0.70</td>
</tr>
<tr>
<td>Crop Science</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Soil Science</td>
<td>2</td>
<td>1.40</td>
</tr>
<tr>
<td>Forestry</td>
<td>36</td>
<td>25.17</td>
</tr>
<tr>
<td>Agric Extension</td>
<td>2</td>
<td>1.40</td>
</tr>
<tr>
<td>Agric Economic</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Others</td>
<td>102</td>
<td>71.33</td>
</tr>
<tr>
<td>Total</td>
<td>143</td>
<td>100</td>
</tr>
</tbody>
</table>
Respondents perceived knowledge level

Table 2 shows that Ogun State vocational staff have medium knowledge in forestry activities such as Techniques of plantation establishment and management($\bar{x} = 3.434$), basic measurement techniques($\bar{x} = 3.455$), reporting forest defense and other development activities($\bar{x} = 3.846$) etc. This gives an indication that the vocational staff were familiar with field operations and were performing at medium level while the perceived knowledge level in activities such as wildlife management and monitoring etc. were perceived as low. These areas were relatively new to these Vocational staff although, they may have received instructions on how to handle matters relating to such. They have, however not undergone training to that effect. The implication is that most of the vocational staff need training in the areas as listed in table 2.

<table>
<thead>
<tr>
<th>Knowledge variables</th>
<th>WMA</th>
<th>SD</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reporting forest offences and other development activities</td>
<td>3.846</td>
<td>0.91</td>
<td>M</td>
</tr>
<tr>
<td>Construct, maintain and operate a Forest nursery</td>
<td>3.490</td>
<td>1.21</td>
<td>M</td>
</tr>
<tr>
<td>Basic measurement techniques</td>
<td>3.455</td>
<td>0.23</td>
<td>M</td>
</tr>
<tr>
<td>Techniques of plantation establishment and management</td>
<td>3.434</td>
<td>1.15</td>
<td>M</td>
</tr>
<tr>
<td>Prevention of encroachment</td>
<td>3.238</td>
<td>1.08</td>
<td>M</td>
</tr>
<tr>
<td>Enforcement of environmental law</td>
<td>3.077</td>
<td>1.23</td>
<td>M</td>
</tr>
<tr>
<td>Prevention of accident</td>
<td>2.951</td>
<td>1.05</td>
<td>L</td>
</tr>
<tr>
<td>Public awareness</td>
<td>2.769</td>
<td>1.11</td>
<td>L</td>
</tr>
<tr>
<td>Wildlife management and monitoring</td>
<td>2.490</td>
<td>1.17</td>
<td>L</td>
</tr>
<tr>
<td>Biodiversity monitoring and management</td>
<td>2.357</td>
<td>1.07</td>
<td>L</td>
</tr>
</tbody>
</table>

Weighted Mean Average = WMA SD = Standard deviation
Where H- High, M-Medium, L- Low
Source: Field Survey, 2011

Respondents perceived skills level

Table 3 shows that respondents in Ogun State have a medium level of skills in checking forest offences($\bar{x} = 3.832$); performing basic silvicultural techniques($\bar{x} = 3.497$) etc. while they had low level of skills in few areas. This may be due to the fact that the respondents were not able to put these skills to use because these activities were not their major areas but only useful for their field.
Table 3

Vocational staff perceived skills in Ogun State

<table>
<thead>
<tr>
<th>Skills</th>
<th>WMA</th>
<th>SD</th>
<th>level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree Identification and tagging of tree</td>
<td>3.867</td>
<td>1.152</td>
<td>M</td>
</tr>
<tr>
<td>Checking forest Offence</td>
<td>3.832</td>
<td>1.119</td>
<td>M</td>
</tr>
<tr>
<td>Patrolling and detecting Offenders</td>
<td>3.818</td>
<td>1.161</td>
<td>M</td>
</tr>
<tr>
<td>Perform basic silvicultural techniques</td>
<td>3.497</td>
<td>1.162</td>
<td>M</td>
</tr>
<tr>
<td>On-field procedures and techniques</td>
<td>3.441</td>
<td>0.924</td>
<td>M</td>
</tr>
<tr>
<td>Safety Practices</td>
<td>3.364</td>
<td>0.916</td>
<td>M</td>
</tr>
<tr>
<td>Maintain of boundary lines and marks</td>
<td>3.169</td>
<td>1.113</td>
<td>M</td>
</tr>
<tr>
<td>Prevention of fire outbreak</td>
<td>3.154</td>
<td>1.077</td>
<td>M</td>
</tr>
<tr>
<td>Perform basic survey techniques</td>
<td>3.126</td>
<td>1.119</td>
<td>M</td>
</tr>
<tr>
<td>Monitoring and protecting of Natural resources</td>
<td>3.077</td>
<td>0.986</td>
<td>M</td>
</tr>
<tr>
<td>Perform basic harvesting techniques</td>
<td>2.636</td>
<td>0.727</td>
<td>L</td>
</tr>
<tr>
<td>Ways and means of minimizing fuel wood consuming action</td>
<td>2.538</td>
<td>0.803</td>
<td>L</td>
</tr>
<tr>
<td>Apply basic Principle of first aid</td>
<td>2.042</td>
<td>1.027</td>
<td>L</td>
</tr>
</tbody>
</table>

Weighted Mean Average = WMA  
SD = Standard deviation 
Where H- High, M-Medium, L- Low 
Source: Field Survey, 2011

Respondents’ attitude towards forestry activities

Table 4 shows that Ogun State respondents’ attitude towards forestry activities is favourable ($\bar{x} = 3.587$) that is financial management in forestry is part of forestry, senior officers should not be concerned with administration ($\bar{x} = 3.448$), and junior officers are not expected to know anything in marketing of timber ($\bar{x} = 3.225$). This may be due to their level of understanding on administration in which their perception about financial management and administration is small. They also perceived that they were not lacking in technical ability, and site factors should be for specific people not all and because the skills involved in the job are lacking in some cadre of staff ($\bar{x} = 1.860$). Record keeping should not be carried out every day ($\bar{x} = 1.818$); an indication that some were lazy to do the right thing. This current study shows that vocational staff in the study area do not have too strong attitude towards excellent forestry activities although they have a positive attitude which can be improved upon to give right and solid forestry activities in the state.
Table 4
Vocational staff attitude towards forestry in Ogun State

<table>
<thead>
<tr>
<th>Attitudinal statements</th>
<th>WMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack the technical competence in forestry activities</td>
<td>2.392</td>
</tr>
<tr>
<td>Financial Management in forestry is not part of forestry</td>
<td>3.587*</td>
</tr>
<tr>
<td>Site factors should be the job of all stakeholders in forestry</td>
<td>1.860</td>
</tr>
<tr>
<td>Record keeping should be done everyday</td>
<td>1.818</td>
</tr>
<tr>
<td>Forestry workers should be involved in providing seeds and seedlings for farmers</td>
<td>1.713</td>
</tr>
<tr>
<td>Senior officers should not be concerned with administration</td>
<td>3.448*</td>
</tr>
<tr>
<td>Junior officers are not expected to know anything in marketing of timber</td>
<td>3.225*</td>
</tr>
<tr>
<td>Pest and diseases control is more important in forestry than in communication</td>
<td>2.119</td>
</tr>
</tbody>
</table>

Weighted Mean Average = WMA

*Favourable

Source: Field Survey, 2011

Respondents perceived constraints

Table 5 shows that vocational staff in Ogun State perceived all the listed constraints as major constraints due to the fact that most of them were not new on the job, and may have earlier at one time or the other reported same to their supervisors. Some may even have dumped the job for other areas in the State because of these constraints when they were not attended to. These may have demoralized them to put their energy to work.

Table 5
Mean distribution of perceived constraints.

<table>
<thead>
<tr>
<th>CONSTRAINTS</th>
<th>WMA</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor Condition of service</td>
<td>1.097</td>
<td>0.321</td>
</tr>
<tr>
<td>High risk involved in forestry activities</td>
<td>1.245</td>
<td>0.492</td>
</tr>
<tr>
<td>Political Instability</td>
<td>1.648</td>
<td>0.736</td>
</tr>
<tr>
<td>No in-service training</td>
<td>1.147</td>
<td>0.443</td>
</tr>
<tr>
<td>Poor transportation within the forest zone</td>
<td>1.042</td>
<td>0.201</td>
</tr>
<tr>
<td>Insufficient knowledge about management techniques</td>
<td>1.287</td>
<td>0.498</td>
</tr>
<tr>
<td>Human wildlife conflict</td>
<td>1.301</td>
<td>0.531</td>
</tr>
<tr>
<td>Poor funding from the government</td>
<td>1.035</td>
<td>0.184</td>
</tr>
<tr>
<td>Problems of fire outbreak</td>
<td>1.132</td>
<td>0.341</td>
</tr>
<tr>
<td>Diseases and Pest infestation</td>
<td>1.168</td>
<td>0.375</td>
</tr>
<tr>
<td>Lack of Equipment</td>
<td>1.007</td>
<td>0.084</td>
</tr>
</tbody>
</table>

Weighted Mean Average = WMA
In the study area vocational staff training needs are less need because they were having negative scores or scores close to zero as seen in table 6. This indicates that inappropriateness of the topic for training which is as a result of a combination of a very low importance score, a very high knowledge score, or a very low opportunity score or the opportunity to use new knowledge is equal to the respondents' perceived importance of the topic. The respondents' existing knowledge is equal to the current opportunity to use information related to the topic. Therefore, it is important that perceived new areas were explained to workers before embarking on training.

Table 6
Training needs of vocational staff in Ogun State.

<table>
<thead>
<tr>
<th>Training Need</th>
<th>WMDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reporting Forest offences and other development activities</td>
<td>0.38</td>
</tr>
<tr>
<td>Techniques of plantation establishment and management</td>
<td>-0.32</td>
</tr>
<tr>
<td>Construct, maintain and operate a forest Nursery</td>
<td>0.318</td>
</tr>
<tr>
<td>Basic measurement techniques mean</td>
<td>0.9</td>
</tr>
<tr>
<td>Prevention of encroachment</td>
<td>-0.56</td>
</tr>
<tr>
<td>Prevention of accident</td>
<td>-2.02</td>
</tr>
<tr>
<td>Public Awareness</td>
<td>-0.68</td>
</tr>
<tr>
<td>Enforcement of environment Law</td>
<td>-0.106</td>
</tr>
<tr>
<td>Biodiversity monitoring and management.</td>
<td>-0.04</td>
</tr>
</tbody>
</table>

Conclusion

In conclusion, the level of knowledge of vocational staff was low in major forestry activities. The vocational staff were having medium level of skills. Therefore vocational staff in forestry activities must be properly trained in attitude, skill and knowledge to meet needs and ensure satisfactory standards of performance. Training on specific aspect of needs for forest workers will protect the forest reserve in the state.

References

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Analysis of farmers’ adaptation strategies to climate change in cocoa production in Kwara State

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Abstract

Changing climate and weather patterns are predicted to have severe negative impacts on food production, food security and natural resources in the immediate and coming years. Climate change alters the development of cocoa pods, insect pests and pathogens which translate into lower crop yields and impact farm income. This study examined the climate change adaptation strategies of farmers on cocoa production practices. A multi-stage random sampling procedure was used to select 60 cocoa farmers from three out of eight Local Government Areas (LGAs) producing cocoa in Kwara State. Interview schedule was used in data collection and analyzed with descriptive statistics and correlation analysis. The results reveal that 60.7% of the farmers were male. Majority (59.9%) of the farmers were between middle and old age with farming experience of 21-30 years and farm size of mainly between 0.4-2.7 hectares. Most farmers (85%) observed an extension beyond the normal dry months of November to February. This situation could have some implications on cocoa production. The main climate change strategies adopted by farmers include praying for rain (86.7%), use of improved varieties, (81.7%), climate prediction (76.7%), changes in cropping pattern and agro-forestry (75% each), control of soil erosion (73.3%) and fertilizer application (60%). Inadequate irrigation, 41.7% and crop diversification, 36.7%; constituted minor strategies. The cocoa production practices still adopted were weeding, 98.3%; seedling planting, 96.7%; insect pest and diseases control, 95%; bush clearing, 93.3%; fermentation and drying, 91.7%; tree felling, 88.4%; pruning, 85% and burning before planting, 70%. However, Pearson product moment correlation coefficient (PPMCC) showed that a significant relationship existed between age of cocoa farm (0.016) and cocoa production practices at P<0.05. Cocoa farmers’ climate change strategies (0.121) were not statistically related with cocoa production practices at P<0.05. Most of the strategies and practices currently used by farmers should be improved upon to ensure appropriate agronomic practices and adaptation to changes in climate.

Keywords: Climate change, adaptation, cocoa production practices, farmers

Introduction

Cocoa played a significant socio-economic role in Nigeria. It accounts for about 2% of the national export earnings and over 200,000 rural households in 14 Cocoa-producing states depend on cocoa for the majority of their cash income (National Cocoa Development Committee NCDC, 2008). Across the supply chain millions more are involved in trade, transport, processing and export. They are dependent on
cocoa for their livelihoods. Cocoa beans are used in the production of cocoa powder, chocolate products, beverages, wine and butter. Also, cocoa is used to produce cocoa bread, biscuits, soap, cream, livestock feeds among others (Arueya1989, Olubamiwa et al, 2000 and Hamzat et al, 2003).

Nigeria used to be the second leading producer in the world, but due to a combination of factors its production has dwindled over time. Nigeria is currently the fourth largest producer of cocoa after Cote d’Ivoire, Ghana and Indonesia, (ICCO, 2009/2010). According to Ayanlaja (2000) cocoa production vied from 310,000 tonnes despite increase in land area, insecticide application and introduction of high yielding F3 Amazon varieties. The causes of decline in production have been attributed to the oil boom, which led to the neglect of cocoa due to a shift in labour from cocoa farms to the industrial sectors (Ayoola, et-al 2000). Also, there are issues of aged cocoa trees, old age of farmers, poor agricultural practices and climate change.

Climate is very important in agriculture. Climate sets the limit for the agricultural activity in any area or ecological zone of the world. The major components of climate which interact to produce the local weather are temperature, rainfall, humidity, photo-period and altitude (Opeke, 2005). Cocoa production is highly sensitive to change from length and intensity of sunshine, to rainfall and water application, soil condition and temperature due to evapo-transpiration effects. It has been reported widely that climate change also plays a major role in altering the development of cocoa pests and pathogens and shifting their interactions (Oyekale et al, 2009). This translates into lower crop yields, which in turn impact income and livelihood. Also, it was reported by Mpako et-al, (2008) that some years came with adequate rainfall but most people fail to maximize the opportunity because of the confusion in rainfall patterns.

Unfortunately, recent rainfall patterns have been either excessive, resulting in a high incidence of black pod disease and yield losses, or insufficient leading to high seedling mortality and poor yields in terms of annual rainfall. Enete and Amusa, (2010) reported that climate change is one of the most serious environmental threats facing mankind worldwide. It affects agriculture in several ways; including its direct impact on food production which is attributable to the natural climate cycle and human activities has adversely affected agricultural production in Africa (Ziervogel et-al, 2006). Available evidence shows that climate change is global, likewise its impacts, but the most adverse effect will be felt mainly by developing countries, especially those in Africa due to their low level of coping mechanisms in such countries (Odjugo, 2010). As the planet warms, rainfall patterns shifts and extreme events such as droughts, floods and forest fires become more frequent (Zoellick, 2009), which results in poor and unpredictable yields, thereby making farmers more vulnerable, particularly in Africa (UNFCCC, 2007).

Adaptation to climate change involves taking action to reduce either the negative effects or to capitalize on the positive effects of climate change (Anim-kwapong, et-al 2003). The Inter-governmental Panel on Climate Change (IPCC) (2007) describes climate change adaptation as an adjustment to or interventions, which take place in order to mange the losses or take advantage of the opportunities presented by a changing climate. Adaptation to climate change in cocoa production and other
agricultural management practices in response to changes in climate conditions involves a combination of various individual responses at the farm-level and assumes that farmers have access to alternative practices and technologies available in their areas of production. Some of these important adaptation options as documented in literature include crop diversification, mixed cropping, livestock farming system, using different crop varieties, changing planting and harvesting dates, mixing less productive drought resistant varieties and high yield water sensitive crops (Jagtap, 1995).

Agricultural adaptation involves two types of modification in production systems. The first is increased diversification that involves engaging in production activities that are drought tolerant and or resistant to temperature stress as well as activities that make efficient use and take full advantages of prevailing water and temperature conditions, among other factors. Crop diversification in cocoa and non-cocoa sub-sectors can serve as insurance against rainfall variability as different crops are affected differently by climate events.

The second strategy focuses on crop management practices geared towards ensuring that critical crop growth stages do not coincide with very harsh climate condition such as mid-season droughts, crop management practices that can be used include modifying the length of growing period and changing planting and harvesting dates.

In Nigeria, the discovery and exploitation of petroleum, led to the decline in the importance attached to cocoa production and other crops. The cocoa sub-sector is not receiving much attention for it to maintain its leading role as non-oil export crop. This situation is further implicated by the behaviour and changes of global climatic variables which tend to reduce cocoa production due to its negative impact. Adaptations to these changes by cocoa farmers have become necessary in view of its implications for production and sustainability of cocoa.

This paper provides insight into those strategies cocoa farmers use in adapting to the global problem caused by climate change in Kwara State. This is important because adaptation to climate change is expected to present a heightened risk, new combinations of risks and potentially grave consequences, particularly in Kwara state Nigeria due to its direct dependence on rain fed agriculture.

**Objectives of the study**

The main objective of the study is to examine the climate change adaptation strategies of farmers on cocoa production practices in Kwara State Nigeria. The specific objectives were to:
1. determine the climate change adaptation measures of cocoa farmers,
2. identify the periods of dry months of the year that are becoming longer or shorter for cocoa production and
3. examine the cocoa production practices of farmers in the study area.
Hypotheses

H$_{0i}$: There is no significant relationship between farmers’ personal characteristics and cocoa production practices in the study area.

H$_{0ii}$: There is no significant relationship between climate change adaptation strategies of farmers and cocoa production practices.

Methodology

The study was conducted in Kwara state of Nigeria. Kwara state lies within the North central geopolitical zone of Nigeria. It is located between latitudes 7° 45’N and 9° 30’N and longitudes 2° 03’E and 6° 25’E. The annual rainfall ranges between 1000mm and 1500mm. Average temperature ranged between 30°C and 35°C (Kwara State ADP, 1996). The major occupation of people in the area is cultivation of cash crops with cocoa being the main crop, but often intercropped with cashew, oil palm, plantain, banana and kola. Also, food crop like maize, beans yam, sorghum and vegetable are cultivated (Yusuf, 2000).

The study made use of multi-stage sampling procedure. Cocoa is produced in eight local Government Areas of Kwara State. These include: Asa, Isin, Ifelodun, Irepodun, Oke-Ero, Ekiti, Offa and Oyun (Kwara State Ministry of Agriculture, 2011). Three out of the eight LGAs (Irepodun, Isin and Oke-Ero) well noted for cocoa production were chosen. In the next stage, 24 farmers were selected from two villages in Irepodun, 20 farmers from two villages in Isin and 16 farmers from two villages in Oke-Ero LGAs due to their level of production. A total of sixty cocoa farmers were randomly selected across the three LGAs based on their predominance in cocoa production. Interview schedule was used in data collection.

The study provided information on the socio-economic characteristics of the cocoa farmers, farm size, climate change adaptation strategies adopted by farmers with respect to cocoa production practices. Descriptive statistics and Pearson product moment correlation co-efficient (PPMC) were used in the analysis. Cocoa production practices were measured using three categories by scoring: Not practiced 0, practicing but stopped 1, still practicing 2. The scores were pulled together and correlated against climate change adaptation strategies of farmers.

Results and Discussion

Personal characteristics of cocoa farmers

The results in Table 1 show that 66.7% of the farmers were males while 33.3% were females. It means that more males were more involved in cocoa production in the study area. Adetunji et al, (2007) reported that men actively participate in cocoa production than the female cocoa farmers. Majority (59.9%) of the cocoa farmers were between 55-64 years old with a mean age of 49 years which implies that semi aged and aged persons are engaged in cocoa production. Uwagboe et al, (2010), Iremiren, (2011) and CTA Agritrade (2012) reported that those into cocoa production in Nigeria are mainly old farmers over 60 years. This is seen as a factor that will hold back government efforts to promote a tripling of cocoa production especially during
this period of climate change. On the years of farming experience, 35% of the farmers had 21-30 in cocoa production. Most of the farmers had some form of education: primary 30%, secondary 15% and tertiary 28.3%. Long years of farming and education will facilitate adaptation and better production practices. The farm sizes of farmers (65%) were between 0.4-2.7 hectares with a mean of 2.59 hectares. This is a reflection of small holdings common among Nigerian and West African cocoa farmers. Anim-kwapong and Frimpong, (2003) and Oluyole and Sanusi, (2009) confirm it that most cocoa farmers own small farm sizes. Most (61.0%) of cocoa farms of farmers were more than 28 years of age. It is an indication of aging cocoa trees that needs rehabilitation. This will further be implicated by the possible impacts of climate change on cocoa trees because old age could reduce production and yield. Studies carried out by Gro-Cocoa, (2008), Adeogun, *et al* (2010) and Iremiren, (2011) corroborate this result that most cocoa farms in Nigeria are old with low productivity.

Table 1
Distribution of personal characteristics of cocoa farmers

<table>
<thead>
<tr>
<th>Variables</th>
<th>Percentage(n=60)</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>66.7</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>33.3</td>
<td></td>
</tr>
<tr>
<td><strong>Age of cocoa farmers (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-28</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td>29-37</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>38-46</td>
<td>6.7</td>
<td></td>
</tr>
<tr>
<td>47-55</td>
<td>31.6</td>
<td>49.1</td>
</tr>
<tr>
<td>56-64</td>
<td>28.3</td>
<td></td>
</tr>
<tr>
<td>65-73</td>
<td>11.7</td>
<td></td>
</tr>
<tr>
<td><strong>Farming experience (Years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-10</td>
<td>23.3</td>
<td></td>
</tr>
<tr>
<td>11-20</td>
<td>28.3</td>
<td></td>
</tr>
<tr>
<td>21-30</td>
<td>35.0</td>
<td>20.40</td>
</tr>
<tr>
<td>31-40</td>
<td>10.0</td>
<td></td>
</tr>
<tr>
<td>41-50</td>
<td>3.3</td>
<td></td>
</tr>
<tr>
<td><strong>Educational status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>26.7</td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>30.0</td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>15.0</td>
<td></td>
</tr>
<tr>
<td>Tertiary</td>
<td>28.3</td>
<td></td>
</tr>
<tr>
<td><strong>Farm size (Hectares)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.4-1.5</td>
<td>41.7</td>
<td>2.59</td>
</tr>
<tr>
<td>1.6-2.7</td>
<td>23.3</td>
<td></td>
</tr>
<tr>
<td>2.8-4.0</td>
<td>21.7</td>
<td></td>
</tr>
<tr>
<td>4.1-5.0</td>
<td>3.3</td>
<td></td>
</tr>
<tr>
<td>5.1 and above</td>
<td>10.0</td>
<td></td>
</tr>
<tr>
<td><strong>Age of cocoa farms (Years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-15</td>
<td>27.0</td>
<td></td>
</tr>
<tr>
<td>16-28</td>
<td>33.0</td>
<td>25.9</td>
</tr>
<tr>
<td>29-41</td>
<td>28.0</td>
<td></td>
</tr>
<tr>
<td>42-54</td>
<td>7.0</td>
<td></td>
</tr>
<tr>
<td>55 and above</td>
<td>5.0</td>
<td></td>
</tr>
</tbody>
</table>

Field survey, 2011
Climate change adaptation strategies of farmers in cocoa production

Figure 2 reveals that the major climate change strategies adopted by cocoa farmers include praying for rain (86.7%), use of improved varieties (81.7%), climate predicting (76.7%), changes in cropping pattern 75% and use of agro-forestry 75%. Others were control of soil erosion 73.3% and fertilizer application 60%. The use of irrigation facilities (41.7%) and crop diversification (36.7%) were however minor strategies of farmers. From this finding it is clear that the farmers are already involved in proactive measures for coping with possible challenges of climate change which is affecting all crops including cocoa. The high adaptation could be attributed to farmers’ educational level and the importance farmers placed on cocoa production. It is not surprising that cocoa farmers relied on prayers to God for rainfall and predicting climate change because most people call on God for solutions to problems at difficult times in Nigeria and West Africa. This is an indigenous measure which is not scientific but Lumala, (2008) attested to this in a study where farmers used different means to know the beginning and end of rain and future events. Bradshaw et al (2004) and Ngigi (2009) reported most of these adaptation options as part of measures used in climate change. However, the low adoption of irrigation calls for serious attention since shortage of rainfall could make cocoa to be vulnerable to the impacts of climate change. Nigerian agriculture is almost entirely rain-fed and hence inherently susceptible to the vagaries of weather. Most farmers do not have access to irrigation inputs. In line with this result, Madu, et al (2010) and Ozor and Nnaji (2010) reported that Nigeria has not developed adequate irrigation facilities for farming. The consequences are that the increasing frequency and severity of droughts especially in cocoa farms are likely to cause crop failure, low income and poverty among producers of cocoa.
Cocoa production practices of farmers

In Table 2, the main cocoa production practices still adopted by farmers were weeding 98.3%, seedling planting 96.7%, pests and diseases control 95%, bush clearing 93.3%, fermentation and drying 91.7%. Others include tree felling 88.4%,
pruning 85%, and burning before planting 70%. It means that almost all farmers carry out these practices which, is an indication of Good Agricultural Practices but this may not necessarily translate to how the practices are applied. It was observed that most farmers engage in firing the debris in their farms before planting. This is a traditional practice which contributes to climate change in the environment. There may be need to sensitize farmers to reduce burning operation so as to reduce the gas emissions going into the atmosphere trapping heat and causing global warming. Also, burning exposes the land to soil erosion and reduces organic matter. Medugu, (2009) opined that the activities of bush burning could increase the concentrations of green house gases that could lead to climate change.

Table 2

<table>
<thead>
<tr>
<th>Cocoa production practices</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weeding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not practiced</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Stop practicing</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>Still practicing</td>
<td>59</td>
<td>98.3</td>
</tr>
<tr>
<td>Seedling planting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not practiced</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>Stop practicing</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>Still practicing</td>
<td>58</td>
<td>96.7</td>
</tr>
<tr>
<td>Pests and diseases control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not practiced</td>
<td>3</td>
<td>5.0</td>
</tr>
<tr>
<td>Stop practicing</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Still practicing</td>
<td>57</td>
<td>95.0</td>
</tr>
<tr>
<td>Bush clearing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not practiced</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>Stop practicing</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>Still practicing</td>
<td>56</td>
<td>93.3</td>
</tr>
<tr>
<td>Fermentation and drying</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not practiced</td>
<td>3</td>
<td>5.0</td>
</tr>
<tr>
<td>Stop practicing</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>Still practicing</td>
<td>55</td>
<td>91.7</td>
</tr>
<tr>
<td>Tree felling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not practiced</td>
<td>5</td>
<td>8.3</td>
</tr>
<tr>
<td>Stop practicing</td>
<td>2</td>
<td>3.3</td>
</tr>
<tr>
<td>Still practicing</td>
<td>53</td>
<td>88.3</td>
</tr>
<tr>
<td>Pruning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not practiced</td>
<td>5</td>
<td>8.3</td>
</tr>
<tr>
<td>Stop practicing</td>
<td>4</td>
<td>6.7</td>
</tr>
<tr>
<td>Still practicing</td>
<td>51</td>
<td>85.0</td>
</tr>
<tr>
<td>Burning before planting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not practiced</td>
<td>13</td>
<td>21.7</td>
</tr>
<tr>
<td>Stop practicing</td>
<td>5</td>
<td>8.3</td>
</tr>
<tr>
<td>Still practicing</td>
<td>42</td>
<td>70.0</td>
</tr>
</tbody>
</table>

Field survey, 2011
Months of dry periods in cocoa production

The findings in the study showed that 85 percent of the farmers observed an extension beyond the normal dry months of November to February while 15% indicated that there was no extension beyond dry months. The months of dry periods were longer than short periods. This is an indication of drought which is usually experienced during dry season. It affects the young and old cocoa trees. Most cocoa trees suffer serious water stress during this period when they are not irrigated. It therefore means that in order to boost cocoa production during dry periods there is need for irrigation water to be supplied to cocoa farms to reduce drought associated with climate change.

Correlation of some farmers’ personal characteristics and cocoa production practices

Pearson product moment correlation coefficient (PPMC) in table 3 revealed that a significant relationship existed between age of cocoa farm (0.016) and cocoa production practices at p< 0.05. As the cocoa farm is aging, the production practices will be more carried out by farmers so as to get good yield and income. It is a statement of fact as documented by Adeogun, et al (2010) and Iremiren, (2011) that most cocoa farms in Nigeria are old. Aging cocoa trees coupled with problems of bad weather could result in poor yield.

Table 3

Correlation analysis of farmers’ personal characteristics (Age of farmer, experience, farm size and age of cocoa farm) and cocoa production practices

<table>
<thead>
<tr>
<th>Variables</th>
<th>r</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of farmer</td>
<td>-0.194</td>
<td>0.164</td>
</tr>
<tr>
<td>Experience</td>
<td>-0.204</td>
<td>0.128</td>
</tr>
<tr>
<td>Age of cocoa farm</td>
<td>0.309</td>
<td>0.016**</td>
</tr>
<tr>
<td>Farm size</td>
<td>0.115</td>
<td>0.382</td>
</tr>
</tbody>
</table>

Field survey, 2011

Correlation of cocoa farmers’ climate change adaptation strategies and cocoa production practices

In table 4, there was positive relationship between farmers’ climate change strategies and cocoa production practices. However, the result was not statistically significant when cocoa farmers’ climate change strategies were correlated with cocoa production practices. This may be due to the same practices carried out by almost all the farmers in the study area.

Table 4
Correlation analysis of cocoa farmers’ climate change adaptation strategies and cocoa production practices (n=60)

<table>
<thead>
<tr>
<th>Variables</th>
<th>R</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cocoa farmers’ climate change adaptation strategies vs cocoa production practices</td>
<td>0.203</td>
<td>0.121*</td>
</tr>
</tbody>
</table>

*Not significant
Field survey, 2011

Conclusion

The main strategies engaged by farmers in mitigating the impacts of climate change on cocoa production in the study area were praying for rain, use of improved varieties, climate forecasting, changes in cropping pattern, agro-forestry use, control of soil erosion and fertilizer application. Inadequate irrigation and crop diversification constituted farmers’ minor strategies. Low application of irrigation will limit production because the dependence on rain fed agriculture is implicated when juxtaposed with longer periods of dry months been observed in farmers’ plots. The production practices hitherto well adopted with respect to climate change include weeding, seedling planting, pests and diseases control, bush clearing, fermentation and drying, tree felling, pruning, and burning before planting. The old age of cocoa farmers and trees predicts low productivity if the farms are not rejuvenated. There is need for sustainable cocoa rehabilitation programme as a measure of adapting to possible challenges of climate change. Most of the strategies and practices currently used by farmers should be improved upon to ensure appropriate agronomic practices and adaptation to changes in climate. Private and public sectors’ intervention in assisting cocoa farmers with small-scale irrigation facilities should be provided to enhance water availability especially during drought. These will boost production and inherent threats posed by climate change in the study area.

Acknowledgement

The Executive Director/Chief Executive officer of Cocoa Research Institute of Nigeria is also acknowledged for his permission granted to publish this work.

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Approaches to Economic Empowerment of Rural Women for Climate Change Mitigation and Adaptation: Implications for Policy

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Abstract

There are several ways of promoting women’s economic participation while also counteracting climate change. One approach in the field of climate mitigation is the promotion of renewable energies that help avoid greenhouse gas emissions. The potential of rural women as agents of change for climate mitigation and adaptation remains untapped: Their extensive theoretical and practical knowledge of the environment and resource conservation is not given due consideration. In terms of economic participation, they are not paid for the environmental services that they already provide (example, reforestation). The potential contribution of rural women to climate mitigation by being part of the economic cycle is not sufficiently exploited. The economic empowerment of women through climate mitigation and adaptation fosters economic growth and socioeconomic development, reduces poverty, keeps environmental problems in check, and increases the potential for adaptation, which is to the benefit of both women and men. Enhancing the economic empowerment of women is a catalyst for development, which helps boost a country’s economic growth, promotes the socioeconomic development not only of women, but of the entire population, and helps reduce poverty. It is observed that less attention is paid to the potential that lies in the combination of climate mitigation/adaptation and the economic empowerment of rural women. Yet mitigation or adaptation activities offer opportunities to advance the economic empowerment of women. In particular, this applies to work that is already being undertaken by women or activities in which women could assume a leading role. In developing countries, for instance, women frequently play a major role in the reforestation and afforestation of cleared land and in forest conservation, yet they have hardly ever benefited from these environmental services. The paper addresses the economic empowerment of rural women through climate change mitigation and adaptation. The study recommends that measures to promote the economic participation of women can be integrated into climate mitigation and adaptation initiatives. In order for rural women to play an economic role, an institutional, legal and political framework is required that enables and/or makes it easier for rural women to hold their own in the market. Concrete, promising project measures at the local level should therefore be combined with advisory services at the political level related to climate change and the economic empowerment of women, with a view to initiating structural reform.

Key words: Empowerment, rural women, climate, mitigation and adaptation.
Introduction

Climate change effects vary among regions, generations, age, classes, income groups, occupations and gender. There are, however, several ways of promoting women’s economic participation while also counteracting climate change. One approach in the field of climate mitigation is the promotion of renewable energies that help avoid greenhouse gas emissions (Denton, 2002). It is increasingly recognised that empowering women, children and other marginalised groups is beneficial not only as a policy in itself, but also as a means of strengthening the effectiveness of climate change measures (United Nations Development Programme (UNDP), 2009; Deutsche Gesellschaft für Technische Zusammenarbeit GmbH (GTZ), 2010). Women in rural areas in developing countries, for example, are the principle producers of basic foods and have thus taken action to conserve soil and water. Various examples in different countries are provided where women’s knowledge and activism have helped to control erosion, prevent flood damage, and improve access to water. Women should be included in decision-making in order to allow their knowledge to benefit entire communities. Knowledge of how women are affected by climate change is essential for their effective involvement in the climate change response and for harnessing their capacity for appropriate mitigative action.

Worldwide, women have less access than men to resources that would enhance their capacity to adapt to climate change, including land, credit, agricultural inputs, decision making bodies, technology and training services (Women’s Environment & Development Organization (WEDO), 2007). For the vast majority of women working in the informal sector and in small enterprises, lacking capital and access to credit and information, recovering from the devastating effects of environmental disasters is nearly impossible (Organization for Economic Cooperation and Development (OECD), 2008).

In many countries, droughts, floods and deforestation increases work burdens for many women leaving them less time to earn income, get an education, or provide care to their families. Girls regularly drop out of school to help their mothers gather fuel wood and water. Extreme weather conditions and natural disasters also increase their exposure to infectious diseases, such as cholera and HIV/AIDS (Klasen and Lamanna, 2008). Continued global warming will extend the areas affected by malaria. Conflicts driven by climate change and disasters can increase women’s vulnerability to violence (UNDP, 2007).

Women also function as change agents in community natural resource management, innovation, farming and care giving and hold the key to adaptation to climate change. Responsibilities in households, communities and as stewards of natural resources position them well to developing strategies for adapting to changing environmental realities.

Experience has shown that communities fare better during natural disaster when women play a leadership role in early warning systems and reconstruction. Women tend to share information related to community well being, choose less polluting energy sources, and adapt more easily to environmental changes when their family’s survival is at stake (WEDO, 2007).
According to the Food and Agricultural Organization (FAO) (2007), women and men are adapting their agricultural practices to naturally-varying climate conditions based on their specific needs, knowledge and access to resources. An FAO study found that when gender differentiated knowledge is properly understood and addressed, interventions to strengthen livelihoods and food security are more effective and efficient (FAO, 2007).

In rural areas of many developing countries there is a lack of energy services. This mainly affects women in their daily work in the home, since they are usually responsible for providing energy for the household, such as heating and cooking. Without access to convenient, affordable fuels, women may spend up to three hours a day gathering firewood and other energy sources. Energy on the other hand may also be a starting point for income-generating activities (Mitchell, Tanner and Lussier, 2007). Probably the best-known example that combines renewable energy, jobs and skills training is the Grameen Shakti (GS) microloans initiative in Bangladesh. GS has helped to install more than 100,000 solar home systems in rural communities, creating employment opportunities while also empowering women and local youth (Intergovernmental Panel on Climate Change, IPCC, 2007).

Climate change produces new and different weather patterns and extreme weather events; and research findings support the view that women’s economic insecurity increases more than men’s in the aftermath of natural disasters (Enarson, 2000). Women also recover more slowly than men from economic losses due to damage to property and the loss of livelihood (Athen, 2009).

Food, water, health and energy are particularly affected by climate change. These areas happen to be the bases of women’s livelihoods and fall within the purview of women’s socio-economic responsibilities (International Union for Conservation of Nature (IUCN), 2007). For instance, women are often in charge of growing and preparing food, gathering firewood for fuel, collecting water and caring for the ill in their families and communities, all of which tasks become more gruelling and time consuming with the increased occurrence of floods and droughts associated with climate change.

Moreover, women’s lack of property rights and control over natural resources aggravated by their limited access to information, education, credit and technologies -translate to fewer means to deal with climate change. Adaptation measures, related to anti-desertification, are often labour-intensive and women often face increasing expectations to contribute unpaid household and community labour to soil and water conservation efforts. Women often rely on a range of crop varieties (agrobiodiversity) to accommodate climatic variability, but permanent temperature change will reduce agro-biodiversity and traditional medicine options (Aguilar, 2004).

Additionally, women are consistently underrepresented in policy and decision-making processes around climate change at the local, national and global levels (Brody, Demetriades and Espen, 2008; IUCN, 2007). This is a matter of concern not only because women comprise one of the most vulnerable groups of people, but also because women play a pivotal role in mitigating and adapting to climate change. As heads of households, active community leaders and members, and stewards of natural resources, women can and have offered different perspectives and resources
in responding to climate change challenges. Case studies suggest that women have a better understanding of the causes and consequences of climate change and have the knowledge and skills to mitigate and adapt to changing weather conditions (O’Connor, Bord and Fisher, 1998; Röhr, 2007). For all of these reasons, financing policies for climate change mitigation and adaptation must explicitly consider as well as respond to the different experiences and needs of women, especially those women who are on the socio-economic margins of society.

The protection of livelihoods and sources of sustenance among rural women are paramount, entailing adaptation measures that build in climate resilience in agriculture and fishery, ensure people’s access to potable water and other necessities, and provide social insurance and protection, among others. Adapting to and mitigating climate change will entail a transition to new patterns of production, consumption and employment. Huge opportunities exist to create jobs through energy and industrialization policies that reduce the environmental footprint. These jobs can provide decent work and incomes that will contribute to sustainable economic growth and help lift people out of poverty. Women, with their unique knowledge and capabilities of natural resource management and use of energy sources are strong change agents and key contributors to climate change mitigation and adaptation programmes at local, regional and international levels (International Labour Organization (ILO), 2008).

The economic empowerment of women through climate mitigation and adaptation fosters economic growth and socioeconomic development, reduces poverty, keeps environmental problems in check, and increases the potential for adaptation, which is to the benefit of both women and men (Bäthge, 2010).

The paper is designed to review approaches to economic empowerment of rural women through climate change adaptation and mitigation measures. The paper relied mostly on current literature and observations about climate change.

Adaptation measures of climate change among rural women

Areas in which women are traditionally engaged and which are closely tied to the availability of natural resources (e.g., food security, domestic energy and water) will be hit particularly by the consequences of climate change (WEDO, 2008) and require greater adaptation. With regard to climate adaptation, it should be noted that women often do not have much of a say in decisions taken by the family or the community and are therefore unable to diversify cultivation, for example (Rodenberg, 2009). Furthermore, it is usually women who are responsible for collecting water and fuel (e.g., firewood) for the household. The scarcity of these resources induced by climate change increases a woman’s workload and time poverty, burdened as she already is by the many roles she has to play. She is consequently left with no time for income-generating activities, education, training or participation in community decision making processes. In overall terms, climate change intensifies the existing economic and social gender disparities (Rodenberg, 2009).

Apart from the differential vulnerability, the sexes also play different roles in dealing with climate change. It is generally recognised that women are major actors in mitigation and adaptation measures (IUCN, 2007; Rodenberg, 2009; UNDP, 2009;
United Nations Population Fund (UNFPA)/WEDO, 2009) and their role in adaptation measures in developing countries is often highlighted. Women play a particularly significant role in ensuring a family’s food security. They shoulder the responsibility for this activity, have extensive knowledge about their natural surroundings, and are at the forefront in the conservation and selection of seeds of different crops (IUCN/UNDP/Global Gender and Climate Change Alliance (GGCA), 2009). In many areas women are already adapting to the fallout of climate change and are fully aware of where their own needs and those of their families lie (BRIDGE, 2008).

According to WEDO (2007) greater decision-making powers for women at the family and community level with regard to agricultural cultivation and the farming of new and more resistant crops could increase agricultural production, leading to greater food security, the production and marketing of surpluses, and ultimately to a source of income.

In order to effect comprehensive adaptation to changing climatic conditions, a number of measures in vastly different sectors and at different levels are needed (Athen, 2009). In concrete terms, the adaptation measures required with reference to climate change, gender, and the advancement of women’s economic empowerment should specifically enable women to secure or expand their livelihood options. In the context of agricultural production, in which most of the women work to ensure food security for the family (IUCN/UNDP/GGCA, 2009), this refers primarily to the use of cultivation and irrigation methods that allow for crop security even in the case of natural resource depletion or unforeseen weather events. In irrigation, it is important to adapt type, time, and use (IUCN/UNDP/GGCA, 2009). Ideally, one can switch from traditional irrigation methods to efficient and modern irrigation systems. As regards cultivation methods, it is advisable to select crops that can flourish despite floods or heat waves or those with a short growth cycle which can, for example, be harvested before the flooding season or can be planted during the (short) rainy season. Moreover, it would be possible to grow different crops on one and the same field in order to optimise the use of soil and irrigation and perhaps to counter the onset of erosion. Locally produced organic fertiliser could also be used that would not only fertilise the soil, but would also prevent disease or ensure crop survival in times of drought. These adaptation measures could actually increase production and with the existing resources, the highest possible yields could be attained.

However, complementary training and agricultural extension services are required to teach women about the economical use of scarce resources, processing and marketing methods for agricultural products. The latter includes converting raw materials into derivates (value addition) that usually fetch higher prices and reduce dependence on raw material prices (Bathge, 2010).

Mitigation measures of climate change among rural women

The role of women in mitigation measures should not be under-estimated. Developing countries have the potential to reduce or store greenhouse gases, particularly in areas in which women are already active. Thus providing energy for the household is usually a woman’s job and she often resorts to the energy-inefficient open burning of biomass, e.g., firewood. The use of efficient energy systems at the household level (e.g., special cooking stoves and ovens) could
reduce emissions and harness the potential of women as actors for mitigation measures (IUCN/UNDP/GGCA, 2009). Women worldwide are also involved in natural resource and forest conservation. The forests supply women with vital products and are used not just to gather firewood, but also to obtain other raw materials, food or medicinal plants to provide for their families and to boost their income (IUCN/UNDP/GGCA, 2009).

The conservation and care of forests coupled with reforestation and afforestation for which women are responsible helps avoid the emissions caused by deforestation and leads to greater sequestration of greenhouse gases from the atmosphere. Women therefore contribute directly to climate mitigation. Given their significant role in mitigation and adaptation efforts, it is imperative that women be involved in the relevant measures of climate change mitigation (Aguilar, 2004).

**Ways of strengthening economic empowerment of rural women for climate change adaptation and mitigation.**

**Access to education, training and upgrading:** In the context of climate, measures designed for training and continuing education could be particularly significant in the following areas:
- Awareness of the causes and consequences of climate change in order to sensitise rural women on the dangers of climate change and to the possible requirements/mechanisms of adaptation
- Awareness of existing mitigation and adaptation programmes in which rural women can be involved and from which they can benefit.
- Training programmes on adaptation measures with a special focus on the needs of rural women (example, alternative cultivation methods and more resistant crops in agriculture, more efficient domestic and agricultural use of available water resources, alternative sources of domestic energy).
- Training programmes on the use of (new) technologies (example, means of agricultural production, energy-efficient cooking stoves and ovens, renewable energy systems, information and communication technologies).
- Awareness of existing rights and laying claim to these rights in different spheres of life (example, land ownership or land use rights, ownership rights for means of production).

**Access to and control over productive resources (access to land and ownership rights)** This is important because it will help them to:
- own land and be able to use it according to one’s own needs and wishes in order to be active in climate mitigation and adaptation.
- procure, own and be able to use the means of production, particularly new technologies, and the related technical know-how.
- obtain, own, and be able to deploy financial capital for one’s own undertakings in order to have investments available for the adoption or development of climate-related work.

**Access to services**
- to have access to (medical) care and child-care services in order to ease the burden on women, reduce time poverty, and gain more time for income-generating activities.
- to have access to the (agricultural) extension services required, for example, to expand agricultural production or nature and resource conservation work.
- to be able to formalise one’s own enterprise, which involves neither a great deal of time nor money.

**Access to markets (land, labour, financial and product markets)** - In this context implies:
- to be able to acquire (additional) land or sell it.
- to be able to use one’s own labour in the formal and informal labour markets, to have access to loans and funds and, in the context of climate, access to international climate finance mechanisms (e.g., climate funds or CDM).
- to be able to access product markets to sell one’s own products and so have access to the information required about market prices and trading options (WEDO, 2008).

**Economic activities of rural women that reduces climate change effects**

- **Greenhouse gas reduction: natural resource conservation**
  
  Climate change and its consequences may pose challenges, there are also opportunities to be found in adaptation and mitigation. In several developing countries, the people (women) are already engaged in traditional work that does not cause greenhouse gas emissions or captures emissions that have been released. Several commitments to enhance the economic empowerment of women have also been made by donors and partners at international, transnational and national levels (Ramani, 2002).

  An example of natural conservation resource project is Green Belt Movement. The Green Belt Movement (GBM) is a Kenyan women’s NGO that began to plant trees at the grassroots level in 1977 to tackle the problems of deforestation, soil erosion and water scarcity. The programme has since evolved into an instrument that facilitates the empowerment of women. It pursues a holistic approach, as trees (including fruit and other commercial trees) are planted by voluntary networks of women and their families. The participants are also trained in sustainable agriculture with the aim of diversifying their livelihoods and earning an income. They undergo comprehensive capacity building in food production, processing and marketing, apiculture, and the planting and care of trees, activities that aim to empower women to generate an income of their own (Kabeer, 2001).

  The programme makes an overall contribution to climate mitigation, as emissions are hindered and absorbed because existing trees are cared for and new ones planted. A contribution is also made to climate adaptation, as the communities learn about the sustainable use of scarce resources and about sustainable agricultural techniques. And finally, the Green Belt initiative also empowers women economically, as they now have alternative sources of income created by the planting and caring of trees (GBM, 2009, World Bank, 2006).

  The Kinawataka Women’s Development Initiatives in Uganda is an example of green recycling where the non-profit organization located in the suburbs found a way of turning used plastic straws, bags and other non-biodegradable waste items that were clogging drainage systems and contaminating the soil into a profitable enterprise. The women turn the waste items into useful products such as handbags, earrings, bags, belts and mats. Recent training in record keeping, organizing exhibitions and advertising provided by the ILO’s Women’s Entrepreneurship Development and
Gender Equality Programme (WEDGE) helped improve the business' bottom line and provide worldwide recognition of their fashionable products (OECD, 2008).

As part of the reforestation and afforestation efforts, women can also plant trees that not only sequester emissions, but also produce a crop (agroforestry), which may provide them with a source of income (USAID, 2005). Besides adapting production methods, it is also important to conserve soil and water sources as the basis of agricultural production. Here, too, women across the world are involved as central players and therefore could make a significant contribution towards meeting adaptation requirements (IUCN/UNDP/GGCCA, 2009). Soil degradation and the unused water runoff could, for instance, be reduced by planting the area or by constructing infiltration ditches (WEDO/ABANTU for Development/ ActionAid/ENDA, 2008). According to a case study from Senegal, women are keen to address the problem of erosion mainly because erosion reduces their agricultural productivity and makes it more difficult for them to access water (WEDO/ABANTU for Development/ActionAid/ENDA 2008). Both are fundamental requirements if production is to be increased and is to generate income. In addition to soil and water sources, ecological systems in the wider sense must be rehabilitated to conserve soil, water sources and habitat and therefore also to maintain the basis for life and livelihoods. Women are already engaged in work that addresses the rehabilitation of eco-systems encompassing not just traditional forests but, for instance, mangrove forests as well. They thus help combat desertification and the loss of biodiversity in coastal regions (WEDO/ABANTU for Development/ ActionAid/ENDA, 2008).

b. Energy

As is the case with the cultivation of agricultural products for the market, the energy sector is also largely viewed as a male sector in which women are assigned a minor role (Carlsson, 2007). However, in most developing countries, domestic energy, e.g., for cooking, heating or lighting is still obtained from the energy-inefficient and toxic burning of biomass, such as wood, charcoal or agricultural waste, which is traditionally women’s work (Carlsson, 2007). Even when households are connected to an electricity network, the power available is usually used only for smaller electrical gadgets and for lighting; it is not used as a substitute for biomass, particularly not in rural areas (Carlsson, 2007). Women therefore continue to spend enormous amounts of time on procuring the biomass they require and they need larger amounts of fuel as they burn it inefficiently. Not only does this give them even less of an opportunity to pursue alternative, income-generating activities, but, as it is virtually impossible for them to meet this need sustainably, the practice exacerbates deforestation, land degradation and desertification (GTZ HERA, 2007). The use of energy-efficient stoves and ovens could help reduce unhealthy emissions and improve the situation described, not least because these stoves and ovens reduce the quantity of biomass required while cutting down on cooking time (GTZ HERA, 2009).

Besides energy-efficient ovens, it is particularly important for the rural population to be connected to the electrical grid, with electricity ideally generated by renewable energy. The production factor that is most readily available to women is the use of their own labour (UN, 2009). Hence the bulk of a woman’s income-generating activities is labour-based, hence greater attention should be paid to the issue of
energy supply as it is directly responsible for reducing the human workload involved in production (Ramani, 2002). In other words, power is required to run electricity-based means of production that would increase a woman’s productivity while reducing her workload as well as mitigate climate change.

However, in climate mitigation and adaptation measures women must therefore be perceived as actors with specific needs. For women to play an economic role, an institutional, legal and political framework is required that enables and/or makes it easier for women to adapt to climate change and maintain economic empowerment. Additionally, pilot experiences in climate adaptation have shown that women, given their vast knowledge, are able to develop and disseminate innovative cultivation methods that are adapted to climate change (Carlsson, 2007).

For mitigating climate change, women propose more comprehensive approaches and tend to focus more on lifestyle and behavioral changes to reduce greenhouse gas emissions and are more skeptical about technology will solve the problem of global warming (OECD, 2008).

**Actions to promote climate change adaptation and mitigation among rural women**

- Tapping into the vast knowledge and natural resource management abilities of women when devising adaptation and mitigation policies and initiatives for climate change.
- Mainstreaming gender perspectives into international and national policies.
- Ensuring that women and men participate in decision- and policy-making processes.
- Promoting participatory approaches in local and community planning activities.
- Creating opportunities at the national and local level to educate and train women on climate change, stimulate capacity building and technology transfer and assign specific resources to secure women’s equal participation in the benefits and opportunities of mitigation and adaptation measures.
- Gathering new sex-disaggregated data and gender analysis in key sectors such as agriculture, forestry, energy and water usage to further understand how climate change impacts on women’s lives (ILO, 1998).

**Conclusion and Recommendations**

The combination of climate change and the economic empowerment of women creates an opportunity for both fields to create mutual synergy on the path to poverty reduction and development. Any response to climate change should be mainstreamed into national, sectoral and local development strategies. Both adaptation and mitigation policies will need to include strategies for enhanced social protection, enterprise development and employment generation among rural women.

Identification and implementation of programmes to support education and training initiatives that will facilitate the development of the skills necessary for creation of employment among rural women who are vulnerable to climate change remains paramount. If women are to be empowered to take strategic decisions, it is advisable to supplement the measures at the target group level with long-term structural approaches. However, an integrated approach involving institutional and political measures are required to create the basic structural conditions necessary for
sustainable economic empowerment of rural women for climate change adaptation and mitigation.

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Risk management strategies utilized by small scale poultry farmers in Oyo State, Nigeria: Implications for agricultural transformation

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Abstract

Birds can only tolerate narrow temperature changes; therefore, poultry flocks are vulnerable to climate induced risk. This study investigated risk management strategies utilized by small scale poultry farmers in Oyo state. A total of 118 respondents were sampled using multi stage sampling procedure. Interview schedule was used to elicit perception of climate change related on risks, utilization of available climate change information and management strategies employed for risk reduction. Data were described using frequency counts and percentages. PPMC, Chi-square analysis, Independent t-test and multiple linear regression analysis were used to test hypotheses. Majority (58.5%) of the respondents were aged between 31 to 50 years ( = 40.38 ± 10.96 years), were males (77.1% ), had high level of education (74.3%), with mean farming experience and estimated monthly income of 10 years and ₦330,000 respectively. Utilization of climate information was high (53.4%) among the small scale poultry farmers who had access to information. Most (55.1%) of the respondents had a high risk perception of climate change. Production risks were the most experienced in relation to climate change. Management practices were high among the respondents (61.9%) and mostly employed in cases of production risks. A negative correlation existed between climate risk perception of farmers and the management strategies employed (r= -0.413), while utilization of climate change information directly correlated with the management strategies employed (r=0.281). Significant difference existed between climate risk management strategies employed by members and non-members of PAN in Oyo State (t=2.49). Major predictors of risk management strategies employed by farmers were: production risks, utilization of climate information and financial risks, respectively (R² = 0.344). The study concluded that the level of risk perception was high among small scale poultry farmers in Oyo State, thus, the high level of management strategy used.

Introduction

Climate change is undoubtedly the most current and topical global environmental issue. This is because apart from being environmental, it also has developmental dimension. Climate is the synthesis of weather of a given area or location over a period of at least thirty years. Its elements include the atmosphere, lithosphere, hydrosphere, cryosphere and the biosphere, all interacting together and powered by solar radiation. Disturbances to the steady state of the climate system bring about movement over time to a new state of equilibrium i.e. a new climate state and this
has a permanent effect on the ecosystem and the environment until another change occurs (Ayoade, 2010). African nations and indeed developing countries including Nigeria suffer most from climate change consequences because of high dependence on agriculture carried out on large expanse of arid or semi-arid cultivable lands which is climate sensitive. According to Akinbile (2010), estimate of the effects of climate change on crop yields are predominantly negative for the tropics. The possible effects of climate change on food production is not only limited to crops in agriculture, but also has far reaching consequence on poultry, livestock and fisheries sub sector. As observed by Adene and Oguntade, 2006, the poultry sub-sector is the most common of all the sub-sectors of Nigeria’s agriculture. The types of poultry that are commonly reared in Nigeria are chickens, ducks, guinea fowls, turkeys and pigeons. Those that are of commercial or economic importance given the trade in poultry, however, are chickens, guinea fowls and turkeys, amongst which chickens predominate.

Local communities and indigenous peoples have an in-depth understanding of their environment and a vast experience in managing climate variability. This knowledge is key to the development of effective adaptation strategies (Calviosa et.al, 2009). It is of importance to note that climate risks are location specific, differing across geographic zones. The likely impacts of climate change on agriculture are regionally and highly distinct (Rowlinson, 2008). Therefore responses to variations (adaptive capacity) are expected to differ across locations and are expected to be influenced by individual risk perceptions and several intervening variables such as socio-economic status, environmental conditions and resources available to farmers. Sustainability and performance of poultry farm infrastructure is highly compromised as a result of extreme weather such as flood, high temperatures and susceptibility to heat stress. This manifests as reduced feed intake, reduced laying performance, reduced fertility level, decreased activity, in the worst cases increased mortality. These factors are some of the factors that contribute to under-performance of investment in the poultry enterprise.

In this regard, climate risks pose enormous challenges to the possible contributions of poultry towards the attainment of the Millennium Development Goals of addressing the problem of extreme poverty in its many dimensions. It also poses a threat to the realization of the nation’s Agricultural Transformation Agenda (ATA). In their work, Thornton et al. (2008) observe that there are considerable gaps in knowledge of how climate change and increasing climate variability will affect livestock systems and the livelihoods of the people who depend on them. They also highlight the need for detailed assessment of localized impacts, and the importance of identifying appropriate options that can help livestock keepers adapt to climate change. Limited availability of reliable and useful information on climate risks and management is usually an obstacle in this regard. While affecting all economic sectors, climate risks to individual industries will differ in dimension and extent. In view of this, small scale poultry farmers need to consider management options to help avoid, reduce, control or transfer risks, cost and concern in the future. It is therefore important that the nature and extent of their adaptation to climate-related risks is examined.

Objectives
1.) determine the risk perceptions of the poultry farmers about climate change and variability;
2.) ascertain utilization of available climate information by the small scale poultry farmers;
3.) determine management strategies employed by the small scale poultry farmers for risk reduction in the study area.

Hypotheses

1.) There is no significant relationship between risk perception and management strategies employed among the poultry farmers.
2.) There is no significant relationship between utilization of climate information and climate risk management strategies employed by the poultry farmers.
3.) There is no significant difference in climate risk management strategies employed by members and non-members of Poultry Association of Nigeria (PAN), Oyo State branch.
4.) There is no significant contribution of type of risk to which they are exposed, knowledge of climate risk, availability, access and use of climate information to risk management strategies employed by the poultry farmers.

Methodology

The study was carried out in Oyo state of Nigeria. The population of the study consisted of all small scale poultry farmers, including those who were registered with and those not registered with the Poultry Association of Nigeria (PAN) in Oyo State. A multi-stage sampling procedure was employed. Small scale poultry farmers were stratified into; registered members of PAN in Oyo State and non-members of PAN. Thirty percent of the 195 currently registered with PAN were randomly selected. This gave 59 respondents. A list of equivalent number of non-members of PAN (i.e. 195) was also generated by snowball technique and 30% (i.e. 59) of these were again randomly selected. Therefore, a total number of 118 respondents were interviewed. Data was collected from primary sources, using a valid and reliable interview schedule. A scale of risk perception was adapted from the Domain-Specific Risk Taking Scale (DOSPERT) (Weber, 2003) to measure farmers’ risk perception to climate change. Respondents were asked to respond appropriately to a list of perception statements to indicate how risky they perceive a variety of climate situations; They were scored on a five point risk scale of not at all risky (1), moderately risky (2), risky (3), very risky (4), and extremely risky (5). Aggregated scores on the indicators of risk perception provided a basis for classification of farmers’ risk perception into high or low categories. Respondents were required to state their level of utilization of climate information on different risk categories. This was measured on a four point scale of never utilized= 0, sometimes utilized =1, mostly utilized =2 and always utilized=3. Identified and listed risk categories are production, marketing, financial, human and legal/institutional risks.

Respondents were asked to indicate management strategies they employ to tackle risky situations from a list of sixteen (16) strategies with respect to the types of climate risks. The listed strategies were broadly categorized as: avoidance measures, control measures, reduction measures, transfer measures and disaster...
risk management. A score of 1 was assigned to each management strategy used. Hence an index of risk management strategies was obtained and the mean score was used to categorise the respondents into high (above mean) and low (below mean). Data were described using frequency counts and percentages. PPMC, Chi-square analysis, Independent t-test and multiple linear regression analysis were used to test hypotheses.

Result and discussion

Distribution of respondents according to their socio-economic characteristics

Majority (58.5%) of the respondents fell within the age range of 31-50 years with a mean age of 40.3 years. This is an indication that majority of the poultry farmers are still actively involved in farming activities. Hence, they are economically productive. According to Zhang and Flick (2001), age determines the level of involvement of farmers in farming activities. Majority of the poultry farmers were male (77.1%). This suggests that women were less involved in farming activities, and so involved in off-farm activities than their male counterparts. This is in consonance with the report from FAO (2001) that women were more involved in off-farm activities than men, especially transportation of farm produce, processing of farm produce, feeding of family members and reproductive functions. The educational level of majority of the respondents is high, with 74.3% of the respondents having attained one form of tertiary education or the other and 6.8% of the respondents having had post graduate education. The high level of literacy among the respondents is expected to have a positive influence on their perception of climax risks and management. They are also able to source information from a variety of channels. The findings of the study also revealed that majority (72.9%) of the respondents had stock size of between 10 and 400 birds (X=280.59). While 14.4% have about 2000 birds.

Due to the high level of risk, involved 74.6% of the respondents owned the property on which the poultry farms were sited, while 25.4% rented, leased or the borrowed property. Measures such as relocation of farm in cases of flooding for example may be a difficult decision for farmers who own the property on which they rear poultry.

A high disparity existed between the observed minimum estimated monthly income of N1,000 and the maximum N20,000. This can be attributed to the farm/stock size which is also highly dispersed. According to Sarap and Vashist (1994), farm income is negatively correlated with farmers’ level of risk aversion. Hence, smaller farm managers are expected to be more risk seeking than managers of large farms and this should have a positive influence on risk management. The study further reveals that only 39% of the respondents were involved in some other occupation (secondary or primary) besides poultry farming while majority (61%) have poultry farming as their sole source of livelihood. According to Ayinde (2008), the presence of other sources of income enhances the risk bearing ability of farmers and thus reduces their level of risk management.
Table 1

Personal characteristics of respondents

<table>
<thead>
<tr>
<th>Variables Description</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤30</td>
<td>30</td>
<td>25.4</td>
</tr>
<tr>
<td>31-40</td>
<td>36</td>
<td>30.5</td>
</tr>
<tr>
<td>41-50</td>
<td>33</td>
<td>28.0</td>
</tr>
<tr>
<td>51-60</td>
<td>14</td>
<td>11.9</td>
</tr>
<tr>
<td>61-70</td>
<td>4</td>
<td>3.4</td>
</tr>
<tr>
<td>&gt;70</td>
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<td>0.8</td>
</tr>
<tr>
<td>Level of Education</td>
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<td></td>
</tr>
<tr>
<td>No formal education</td>
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<td>7.6</td>
</tr>
<tr>
<td>Primary education</td>
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<tr>
<td>Secondary education</td>
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<td>17.8</td>
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<tr>
<td>OND/NCE</td>
<td>30</td>
<td>25.4</td>
</tr>
<tr>
<td>HND/BSc</td>
<td>47</td>
<td>39.8</td>
</tr>
<tr>
<td>Post Graduate</td>
<td>8</td>
<td>6.8</td>
</tr>
<tr>
<td>Sex</td>
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<td></td>
</tr>
<tr>
<td>Male</td>
<td>91</td>
<td>77.1</td>
</tr>
<tr>
<td>Female</td>
<td>27</td>
<td>22.9</td>
</tr>
<tr>
<td>Marital Status</td>
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<td></td>
</tr>
<tr>
<td>Single</td>
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<td>24.6</td>
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<tr>
<td>Married</td>
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<td>66.1</td>
</tr>
<tr>
<td>Divorced</td>
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<td>7.6</td>
</tr>
<tr>
<td>Widowed</td>
<td>2</td>
<td>1.7</td>
</tr>
<tr>
<td>Membership of Associations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAN(Poultry Association of Nigeria) only</td>
<td>53</td>
<td>44.9</td>
</tr>
<tr>
<td>PAN &amp; LFA(Lagelu Farmers Association)</td>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td>PAN&amp;PFA(Poultry Farmers Association)</td>
<td>2</td>
<td>1.7</td>
</tr>
<tr>
<td>PAN &amp; AAHT (Assoc. of Animal Health Tech.)</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td>PFA</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td>Non-members of any association</td>
<td>58</td>
<td>49.2</td>
</tr>
<tr>
<td>Stock size/farm size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-400</td>
<td>86</td>
<td>72.9</td>
</tr>
<tr>
<td>410-800</td>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td>810-1200</td>
<td>6</td>
<td>5.1</td>
</tr>
<tr>
<td>1210-1600</td>
<td>2</td>
<td>1.7</td>
</tr>
<tr>
<td>1600-2000</td>
<td>4</td>
<td>3.4</td>
</tr>
<tr>
<td>&gt;200000</td>
<td>17</td>
<td>14.4</td>
</tr>
<tr>
<td>Land Ownership</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self</td>
<td>88</td>
<td>74.6</td>
</tr>
<tr>
<td>Rented/Leased</td>
<td>30</td>
<td>25.4</td>
</tr>
<tr>
<td>Monthly income(in Naira)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000-4000</td>
<td>43</td>
<td>36.4</td>
</tr>
<tr>
<td>4100-8000</td>
<td>25</td>
<td>21.2</td>
</tr>
<tr>
<td>8100-12000</td>
<td>15</td>
<td>12.7</td>
</tr>
<tr>
<td>12100-16000</td>
<td>11</td>
<td>9.3</td>
</tr>
<tr>
<td>16000-20000</td>
<td>4</td>
<td>3.4</td>
</tr>
<tr>
<td>&gt;2000000</td>
<td>20</td>
<td>16.9</td>
</tr>
<tr>
<td>Other income generating activities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arable crops production</td>
<td>7</td>
<td>5.8</td>
</tr>
<tr>
<td>Agro-input dealership</td>
<td>17</td>
<td>13.9</td>
</tr>
<tr>
<td>Trades &amp; Crafts</td>
<td>11</td>
<td>9.0</td>
</tr>
<tr>
<td>Civil Service</td>
<td>9</td>
<td>7.4</td>
</tr>
<tr>
<td>Banking</td>
<td>1</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Respondents’ risk perception of climate change

Vaccination failure ($\bar{X} = 3.76$), scarcity of water ($\bar{X}=3.69$) and scarcity of feed ($\bar{X}=3.63$) were mostly perceived as extremely risky by the respondents, while
climate change resulting in relocation of farm ($\bar{X}=2.50$) and laying off staff ($\bar{X}=2.63$) were perceived as the least threat of climate change to poultry production. (Table 2) This may explain why the risk perception of climate change is low among the farmers as people tend not to admit a risky situation until live(s) or sources of livelihood are threatened.

**Table 2**

*Distribution of respondents based on their risk perceptions of climate change effects*

<table>
<thead>
<tr>
<th>Perception statements</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flooding caused by extremes of rainfall</td>
<td>3.42</td>
</tr>
<tr>
<td>Erratic rainfall patterns</td>
<td>2.90</td>
</tr>
<tr>
<td>Intermittent high temperatures/dry spells</td>
<td>3.11</td>
</tr>
<tr>
<td>Reduced feed intake by poultry birds</td>
<td>3.11</td>
</tr>
<tr>
<td>Loss of weight of poultry birds</td>
<td>3.27</td>
</tr>
<tr>
<td>Vaccination failure</td>
<td>3.76***</td>
</tr>
<tr>
<td>Resistance to antibiotics</td>
<td>3.19</td>
</tr>
<tr>
<td>Reduced laying performance of poultry</td>
<td>3.19</td>
</tr>
<tr>
<td>Increased prevalence of poultry diseases</td>
<td>3.50</td>
</tr>
<tr>
<td>Smaller egg sizes</td>
<td>2.75</td>
</tr>
<tr>
<td>Increased zoonosis</td>
<td>3.17</td>
</tr>
<tr>
<td>Destruction of poultry farm infrastructure</td>
<td>3.28</td>
</tr>
<tr>
<td>Scarcity of feed</td>
<td>3.63***</td>
</tr>
<tr>
<td>Higher levels of feed contamination</td>
<td>3.58</td>
</tr>
<tr>
<td>Poor quality of available feed</td>
<td>3.52</td>
</tr>
<tr>
<td>Scarcity of water for farm use</td>
<td>3.69***</td>
</tr>
<tr>
<td>Intolerance of poultry birds to heat</td>
<td>3.22</td>
</tr>
<tr>
<td>Non-availability of hardy poultry breeds</td>
<td>2.88</td>
</tr>
<tr>
<td>Climate induced stress to farm staff</td>
<td>2.65</td>
</tr>
<tr>
<td>Relocation of farm</td>
<td>2.51</td>
</tr>
<tr>
<td>Reduced income</td>
<td>3.03</td>
</tr>
<tr>
<td>Laying-off staff</td>
<td>2.64</td>
</tr>
<tr>
<td>False onset of rains</td>
<td>3.01</td>
</tr>
<tr>
<td>Windstorms</td>
<td>3.61</td>
</tr>
<tr>
<td>Very low temperatures</td>
<td>2.72</td>
</tr>
<tr>
<td>Poor quality of available water</td>
<td>3.38</td>
</tr>
<tr>
<td>Power failure due to damages by extreme climate conditions</td>
<td>3.04</td>
</tr>
<tr>
<td>Water stagnation</td>
<td>3.32</td>
</tr>
<tr>
<td>Extended wet spell</td>
<td>2.97</td>
</tr>
<tr>
<td>Early withdrawal of rainfall</td>
<td>2.00</td>
</tr>
</tbody>
</table>

*** Mostly perceived as extremely risky.

**Distribution of respondents according to their level of risk perception of climate change effects**

Majority (55.1%) of the respondents had high risk perception of climate change impacts, while 44.9% of them have low risk perception of impacts of climate change.
Table 3. The percentage of respondents who still do not perceive climate change as risky is worrisome, considering their risk exposure and vulnerability to it. Therefore there is an urgent need to intensify actions to improve how farmers perceive the effects of climate change.

Table 3
Distribution of respondents according to their level of risk perception of climate change effects

<table>
<thead>
<tr>
<th>Scores</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (38-95.2)</td>
<td>53</td>
<td>44.9</td>
<td>38.00</td>
<td>150.00</td>
<td>95.0678</td>
</tr>
<tr>
<td>High (95.3-150)</td>
<td>65</td>
<td>55.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>118</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Respondents’ utilization of climate change information with respect to climate risks

Table 4 reveal that information about climate risks with respect to production ($\bar{X}=1.71$) and marketing ($\bar{X}=1.70$) were mostly utilized by the respondents. This implies that level of production and effective marketing channel are likely to improve standard of living than others.

Table 4
Distribution of respondents based on utilization of climate change information

<table>
<thead>
<tr>
<th>S/N</th>
<th>Climate risk information</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Information on climate risks as it affects production.</td>
<td>1.71***</td>
</tr>
<tr>
<td>2</td>
<td>Information on climate risks to marketing.</td>
<td>1.70***</td>
</tr>
<tr>
<td>3</td>
<td>Information on financial aids in managing climate risks (insurance packages, available credit sources).</td>
<td>1.51</td>
</tr>
<tr>
<td>4</td>
<td>Information on climate risks to humans</td>
<td>1.58***</td>
</tr>
<tr>
<td>5</td>
<td>Information on legal/institutional risk as a result of climate variation/variation.</td>
<td>1.44</td>
</tr>
</tbody>
</table>

*** Mostly utilized information

Distribution of respondents based on level of utilization of climate information for management strategies.

The results reveal that 53.4% of the respondents have a high level of utilization of climate change information while 46.6% of them utilized climate change information at low levels. This is an indication that the high level of education attained by most of
the respondents aid them in accessing and consequently utilization of available information on climate change, it is also expected that it will help them to better manage climate-related risks. Information about climate change is a crucial component of knowledge, perception and adaptation. It is therefore important to motivate farmers to actively seek and use information on climate risks.

<table>
<thead>
<tr>
<th>Scores</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (0 – 7.8)</td>
<td>55</td>
<td>46.6</td>
<td>.00</td>
<td>1 5.00</td>
<td>7.9492</td>
</tr>
<tr>
<td>High(7.9–15)</td>
<td>63</td>
<td>53.4</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Total</td>
<td>118</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Management Strategies of respondents

Respondents’ management strategies were measured against the different climate risk types. The listed management strategies are categorized as avoidance measures, preventive measures, control measures, transfer measures and disaster risk management. Results reveal that disasters risk ( X= .21), upgrading sanitary measures (control measure) ( X=.20) and increased water use efficiency (sanitary measures) ( X=.19) were the most employed management strategies by the respondents. This result suggests the prominence of climate risks associated with sudden disaster and poor hygiene among small scale poultry farmers. This is consistent with the argument of Thornton and Herrero (2008) who expressed that poor hygiene practices ranked as one of the most important climate associated risks confronting poultry farmers in Nigeria.
Table 6
Distribution of respondents based on management strategies employed for the risk types

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Avoidance Measures</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hardy/tolerant breeds</td>
<td>55.9(66)</td>
<td>11.9(14)</td>
<td>11.9(14)</td>
<td>10.2(12)</td>
<td>3.4(4)</td>
<td>.10</td>
</tr>
<tr>
<td>Diversification</td>
<td>22.9(27)</td>
<td>39.0(46)</td>
<td>30.5(36)</td>
<td>4.2(5)</td>
<td>4.2(5)</td>
<td>.04</td>
</tr>
<tr>
<td>Farm relocation</td>
<td>27.1(32)</td>
<td>19.5(23)</td>
<td>36.4(43)</td>
<td>11.0(13)</td>
<td>2.5(3)</td>
<td>.11</td>
</tr>
<tr>
<td><strong>Preventive Measures</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reinforcing infrastructure</td>
<td>35.6(42)</td>
<td>19.5(23)</td>
<td>33.9(40)</td>
<td>9.3(11)</td>
<td>8.5(10)</td>
<td>.09</td>
</tr>
<tr>
<td>Improved vaccination scheme</td>
<td>43.2(51)</td>
<td>15.3(18)</td>
<td>27.1(32)</td>
<td>6.8(8)</td>
<td>5.9(7)</td>
<td>.07</td>
</tr>
<tr>
<td>Mixed farming practices</td>
<td>39.8(47)</td>
<td>17.8(21)</td>
<td>21.2(25)</td>
<td>15.3(18)</td>
<td>1.7(2)</td>
<td>.15</td>
</tr>
<tr>
<td>Water harvesting</td>
<td>38.1(45)</td>
<td>17.8(21)</td>
<td>15.3(18)</td>
<td>13.6(16)</td>
<td>4.2(5)</td>
<td>.14</td>
</tr>
<tr>
<td>Replacing stock with more hardy breeds</td>
<td>37.3(44)</td>
<td>16.1(19)</td>
<td>28.8(34)</td>
<td>4.2(5)</td>
<td>2.5(3)</td>
<td>.04</td>
</tr>
<tr>
<td>Upgrading sanitary measures</td>
<td>27.1(32)</td>
<td>15.3(18)</td>
<td>18.6(22)</td>
<td>20.3(24)</td>
<td>4.2(5)</td>
<td>.20***</td>
</tr>
<tr>
<td><strong>Control Measures</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusting prices</td>
<td>16.9(20)</td>
<td>31.4(37)</td>
<td>12.7(15)</td>
<td>5.9(7)</td>
<td>1.7(2)</td>
<td>.05</td>
</tr>
<tr>
<td>Increased water use efficiency</td>
<td>35.6(42)</td>
<td>18.6(22)</td>
<td>15.3(18)</td>
<td>18.6(22)</td>
<td>0.8(1)</td>
<td>.18***</td>
</tr>
<tr>
<td>Cooperative activities</td>
<td>25.4(30)</td>
<td>20.3(24)</td>
<td>30.5(36)</td>
<td>14.4(17)</td>
<td>7.6(9)</td>
<td>.14</td>
</tr>
<tr>
<td>Market coordination</td>
<td>12.7(15)</td>
<td>47.5(56)</td>
<td>15.3(18)</td>
<td>9.3(11)</td>
<td>3.4(4)</td>
<td>.09</td>
</tr>
<tr>
<td><strong>Transfer Measures</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insurance schemes</td>
<td>16.9(20)</td>
<td>16.9(20)</td>
<td>34.7(41)</td>
<td>5.9(7)</td>
<td>16.1(19)</td>
<td>.06</td>
</tr>
<tr>
<td>Outsourcing/contracting</td>
<td>18.6(22)</td>
<td>16.9(20)</td>
<td>33.9(40)</td>
<td>19.5(23)</td>
<td>15.3(18)</td>
<td>.19</td>
</tr>
<tr>
<td><strong>Disaster risk management</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>22.0(26)</td>
<td>19.5(23)</td>
<td>23.7(28)</td>
<td>21.2(25)</td>
<td>19.5(23)</td>
<td>.21***</td>
</tr>
</tbody>
</table>

*** Mostly employed management strategies

Distribution of respondents based on utilization levels of management strategies for risk types.

From Table 7 It can be observed from the mean values that management strategies were most employed for production risks (4.75). Mean utilization of management strategies to resolve financial and market risk issues by the respondents are 3.89 and 3.43 respectively. Management strategies were least used to deal with human risks (1.89) legal/institutional risks (1.02). Thus, efforts to assist the farmers should focus on their production risks as they engage the attention of the farmers more than other risks.
Table 7
Distribution of respondents based on utilization levels of management strategies

<table>
<thead>
<tr>
<th>Management strategies</th>
<th>F</th>
<th>%</th>
<th>Range of Scores</th>
<th>Mean</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production Risks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>62</td>
<td>52.5</td>
<td>0 - 4.7</td>
<td>4.7542</td>
<td>0.00</td>
<td>14.00</td>
</tr>
<tr>
<td>Low</td>
<td>56</td>
<td>47.5</td>
<td>4.8 – 14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market Risks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>70</td>
<td>59.3</td>
<td>0 - 3.3</td>
<td>3.4322</td>
<td>0.00</td>
<td>12.00</td>
</tr>
<tr>
<td>Low</td>
<td>48</td>
<td>40.7</td>
<td>3.4 – 12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial risks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>51</td>
<td>43.2</td>
<td>0 – 3.8</td>
<td>3.8983</td>
<td>0.00</td>
<td>11.00</td>
</tr>
<tr>
<td>Low</td>
<td>67</td>
<td>56.8</td>
<td>3.9 – 11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legal Risks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>65</td>
<td>55.1</td>
<td>0 - 0.9</td>
<td>1.0169</td>
<td>0.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Low</td>
<td>53</td>
<td>44.9</td>
<td>1 – 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human Risks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>70</td>
<td>59.3</td>
<td>0 – 1.8</td>
<td>1.8983</td>
<td>0.00</td>
<td>16.00</td>
</tr>
<tr>
<td>Low</td>
<td>48</td>
<td>40.7</td>
<td>1.9 – 16</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Summary of respondents’ management strategies

Summarily, Mean value of 15.00 was recorded for all management strategies. 61.9% of respondents’ had scores above the mean while 38.1% scored below the mean. Utilization of management strategies for climate risk issues is therefore high among the small scale poultry farmers. This finding can be attributed to respondents’ educational status and utilization of useful climate information for management decisions. However, much still needs to be done to increase levels of climate risk management especially among poultry farmers.

Table 8
Distribution of respondents’ level of utilization of management strategies.

<table>
<thead>
<tr>
<th>Scores</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>45</td>
<td>38.1</td>
<td>.00</td>
<td>34.00</td>
<td>15.0000</td>
</tr>
<tr>
<td>High</td>
<td>73</td>
<td>61.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>118</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Relationship between respondents’ risk perception and management strategies employed.

Correlation analysis results reveal negative correlation ($r = -0.413$) in the relationship between respondents risk perception of climate change and management strategies employed, hence The stated null hypothesis is accepted. This result corroborates the findings of Anton (2008), that farmers’ level of risk management is influenced by their attitude towards risks. It however deviates from the findings of Sangotegbe (2011) and Hassan & Nhemachena (2008) that perception is an important factor influencing adaptation. It also negates the assertion of Mileti (1993), that farmers’ responses to risks are often in ways consistent with their perception of risks and it is these perceptions that influence behaviours or actions. In their work, O’Connor et.al(1995) also theorized that risk perceptions of climate change and knowledge of its causes will predict individuals’ preferences regarding what (if anything) should be done to address climate change.

This finding therefore can be attributed to the fact that risk perception of climate change and its consequences is low among the respondents (Table 4.3). It can therefore be inferred that low risk perception therefore resulted in low level of management strategies.

Relationship between respondents utilization of climate information and management strategies employed

The results of correlation analysis show a significant relationship between utilization of climate information and management strategies employed. Therefore, the null hypothesis is rejected, and the alternative hypothesis accepted. This result is in agreement with Jones and Henessy (2000) that the availability of better climate and agricultural information helps farmers make comparative decisions among alternative management practices and hence choose those that enable them cope better with changes in climate.

<table>
<thead>
<tr>
<th>Variable</th>
<th>r- value</th>
<th>p- value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilization of climate risk information</td>
<td>0.281</td>
<td>0.002</td>
</tr>
<tr>
<td>Risk perception</td>
<td>-0.143</td>
<td>0.124</td>
</tr>
</tbody>
</table>
Difference in climate risk management strategies employed by members and non-members of Poultry Association of Nigeria (PAN), Oyo State branch.

Independent t-test result reveals that there exists significant difference (p<0.05) in climate risk management strategies employed members and non-members of Poultry Association of Nigeria (PAN), Oyo State branch. The null hypothesis is therefore rejected in favour of the alternative hypothesis. Farmers’ inclination towards social networks is therefore a positive influence on their level of risk management as they are able to share information with one another. This is similar to the observations of Aye and Oji (2005) while studying crop farmers that membership of a solidarity group enhances farmers’ access to credit and other production inputs—such as fertilizer, chemicals and improved seeds.

Table 10
Summary table of test of difference between members and non-members

<table>
<thead>
<tr>
<th>Category</th>
<th>N</th>
<th>Mean</th>
<th>S.D</th>
<th>S.E</th>
<th>T</th>
<th>df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Members</td>
<td>59</td>
<td>16.25</td>
<td>3.452</td>
<td>0.450</td>
<td>2.49</td>
<td>116</td>
<td>0.014</td>
</tr>
<tr>
<td>Non-members</td>
<td>59</td>
<td>13.75</td>
<td>6.905</td>
<td>0.899</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There is no significant contribution of type of risk to which they are exposed, availability and use of climate information to risk management strategies employed by the poultry farmers.

Contributions of the independent variables to risk management strategies of the respondents.

Regression analysis was conducted on the variables first, to determine the contributions (joint) of each of selected independent variables and risk perception to management strategies employed by the small scale poultry farmers (Table 11). The results yielded a $R^2$ value of 0.344 revealing that the variables in the regression model put together explain 34.4% of the variance in farmers’ utilization of management strategies for climate risks.

Individual contributions of the independent variables to management strategies employed by the respondents are shown in (Table 11). The independent variables of interest were: utilization of climate information and type of risk (production, financial, market, human and institutional).

The table further shows that four (4) of the variables significantly predicted the farmers choice of risk management strategy, these are production risk ($\beta= 0.296$), utilization of climate information ($\beta= 0.251$), and financial risks ($\beta= 0.194$) respectively. All these predictors had direct relationships to the management strategy employed by the small scale poultry farmers. The most important predictor was therefore found to be production risks. Production risks include variations in crop yields/livestock production due to weather conditions (such as excessive rainfall and drought), diseases and pests, inefficient production techniques among others. All these pose a threat to farmers’ livelihood and food security and therefore may
require positively drastic measures to manage such. Salimonu and Falusi (2009) also asserted that risk management therefore, becomes an essential aspect of the farming business.

Table 11
Individual Contributions of variables in regression equation to Risk Management Strategies

<table>
<thead>
<tr>
<th>Variables</th>
<th>Beta</th>
<th>T</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilisation of climate Variation information</td>
<td>0.251</td>
<td>2.934</td>
<td>.004***</td>
</tr>
<tr>
<td>Production risks</td>
<td>0.296</td>
<td>2.999</td>
<td>0.003****</td>
</tr>
<tr>
<td>Market risks</td>
<td>-0.064</td>
<td>-0.671</td>
<td>0.504</td>
</tr>
<tr>
<td>Financial risk</td>
<td>0.194</td>
<td>2.005</td>
<td>0.047*</td>
</tr>
<tr>
<td>Human Risk</td>
<td>-0.138</td>
<td>-1.277</td>
<td>0.204</td>
</tr>
<tr>
<td>Institutional Risk</td>
<td>0.115</td>
<td>1.320</td>
<td>0.190</td>
</tr>
</tbody>
</table>

*S Significant
R = 0.587; R² = 0.344; Adjusted R= 0.296; S.E = 4.70.

Conclusion
The small scale poultry farmers in Oyo state were mostly male, young, married, had high level of education and low stock size. Utilization of climate information was high among the poultry farmers and management strategy practices were high among the respondents with the strategies being mostly employed in cases of production risk. Correlations were found between respondents’ climate risk perception and management strategies (negative) and utilization of climate change information and management strategies (positive). Differences exist in climate risk management employed by members and non-members of PAN in Oyo State. It was further established in the study that utilization of useful climate information by farmers and experiences with production and financial risks contributed to adoption of climate risk management strategies.

References


Agricultural extension needs of farmers in *Telfairia* production and marketing in Enugu State, Nigeria

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Abstract

The study assessed agricultural extension needs of farmers in *Telfairia* production and marketing in Enugu State, Nigeria. Multistage sampling technique was used to select 160 *Telfairia* farmers for the study. Structured interview schedule was used to collect data. Data was analysed by use of descriptive statistics and factor analysis. Results show that farmers sold their products directly to consumers through village or local markets (56.9%), village squares (27.6%), at roadside stands (16.2%), while 11.2% sold them at farm gate. Only 3.6% sold their products through cooperative societies. The quantity and price of sale of produce varied depending on the season of the year (26.6%) in which the crop was produced, number of buyers (20.0%) and quality of produce (16.2%). About 63% of the respondents did not have extension contact in the last one year. Extension needs of farmers were indicated in the following areas: sourcing of farm input (M= 3.62), sourcing appropriate marketing channel (M= 3.18), sourcing of improved farm tools (M= 3.11), expansion of scale of production (M= 3.07), receiving information on appropriate cultural practices (M= 3.06), and sourcing farm credit (M= 3.00). Infrastructural, technical, logistic and financial challenges hindered effective production and marketing of *Telfairia* among farmers. There is need for extension to assist farmers to source farm inputs and establish or explore viable markets where farmers will sell their products at a favourable price.

Introduction

Vegetables are among the major dietary intake in our everyday life. Vegetables usually augment nutritive value of most of our staple food which are deficient in vitamin, protein and minerals (Nwalieji, 2006). To provide adequate quantities of protein rich food, a family has to be fairly well to do. Therefore, our dietary needs could, to some appreciable extent, be met from the consumption of meals centred on vegetables, fresh grains and fruits (Muanya, 2003).

Apart from their nutritive value, vegetables are also good source of income to farmers who produce them. It is possible to earn much money annually on vegetable farming with a little start-up capital as against most arable crops (Eleke 2004). An annual income of about 3 million naira can be realized from vegetable farming with a start-up capital of between ₦95, 000 and ₦250,000 (Eleke 2004). According to Ugwu (2001) it is an important cash crop known for steady supply of income. This could be through the sales of either the vegetative parts or the pods.
Telfairia (fluted pumpkin) has become one of the popularly consumed vegetables as well as a lucrative farming business in Nigeria especially in Southeastern states. However, Telfairia production and consumption has gained popularity in many other parts of Nigeria because of its medicinal, economic and nutritive value (Ugwu, 2001). The crop forms one of the major components of human diet in many parts of Nigeria and may rank next to soya bean if properly processed (Achinewhu, 1990). It also has the ability to ratoon easily which shows that it can yield some amount of money to the farmers at off seasons when the newly planted ones are not well established. Medicinally, the leaves and juice are recommendable for pregnant women, lactating mothers and for the prevention of anaemia (Umeha, 2002). It also helps to solve gynecological, problems in both men and women.

Food and Agricultural Organization FAO (2002) notes that non-wood crops are essentially part of the local subsistence economies but has not received the required attention in the development plan and nutrition programmes of the population groups that depend on them. As a result of this, potential contribution of such crops to human welfare remains unrealized. Over the years, Telfairia is usually produced at a subsistence level and marketed locally, considering the perishable nature of the crop. This is attributable to some poor production and marketing strategies. The result is bulk production during on season and selling in local markets without any standardized measure or price and sometimes selling on credit. This also results to unemployment during off farm period. Marketing plays a critical role in meeting the overall goals of food security, poverty alleviation and sustainable agriculture, particularly among smallholder farmers in developing countries like Nigeria (Altshul, 1998; Lyster, 1990).

Provision of technical advice on important issues involving efficient production and marketing of Telfairia, will reposition farmers to address the challenges of production and efficient marketing of the crop. Agricultural extension plays vital roles in providing relevant technical services to the farmers. Provision of such relevant services requires proper assessment of the needs of the farmers. This study was therefore conducted to identify personal characteristics of the Telfairia farmers in the state; assess extension needs of the producers, ascertain marketing channels used by farmers and to identify constraints of Telfairia production and marketing in the state.

Methodology

The study was conducted in Enugu State, Nigeria. The state is made up of six (6) agricultural zones. All Telfairia farmers in the state constituted the population for the study. Multi-stage sampling technique was used to select respondents for the study. In the first stage, two (2) agricultural zones namely: Nsukka and Enugu Ezike were purposefully selected based on the dominance of Telfairia production. In the second stage, two (2) blocks out of 8 blocks from each of the zones were randomly selected using simple random sampling technique giving a total of four (4) blocks. In the third stage two (2) cells were randomly selected giving a total of 8 cells. Twenty farmers were randomly selected from a list of Telfairia farmers in the zone, giving a total sample size of one hundred and sixty (160) respondents used for the study. Data were collected using structured interview schedule.
To assess the extension needs of farmers, a list of 11 possible needs was presented to the respondents. Their responses were evaluated on a 4 – point Likert-type scale of highly needed =4, Needed = 3, somehow needed = 2, and not needed = 1 was used. The values were added (4+3+2+1) to get 10 which was divided by 4 to get a mean score of 2.5. Variables with mean score of 2.5 and above were regarded as areas of extension needs of farmers while variables which scored less than 2.5 were areas they had no extension needs. Data was analysis by use of descriptive statistics and factor analysis.

Results and Discussions

Majority (58.1%) of the respondents were female (Table 1) showing that women were more involved in Telfairia production than men in the area. Sixty three percent of the respondents were part-time farmers while 55.6% of the farmers were small-scale producers (cultivated less than 2 plots) which agrees with the finding of Ugwu (2001) who opined that few people within Enugu North Agricultural Zone produce Telfairia at a subsistence level not minding the value of the crop. Production at subsistence level may minimized profit of the farmers.
Table 1
Distribution of respondents according to socio-economic characteristics

<table>
<thead>
<tr>
<th>Socio-economic characteristics</th>
<th>Frequency</th>
<th>Percentage (%)</th>
<th>Mean (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>67</td>
<td>58.1</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>93</td>
<td>41.9</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 – 19</td>
<td>14</td>
<td>8.8</td>
<td></td>
</tr>
<tr>
<td>20 – 29</td>
<td>61</td>
<td>38.1</td>
<td></td>
</tr>
<tr>
<td>30 – 39</td>
<td>34</td>
<td>21.2</td>
<td>33.4</td>
</tr>
<tr>
<td>40 – 49</td>
<td>30</td>
<td>18.8</td>
<td></td>
</tr>
<tr>
<td>50 – 59</td>
<td>21</td>
<td>13.1</td>
<td></td>
</tr>
<tr>
<td>60 and above</td>
<td>00</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td>Level of education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non formal education</td>
<td>9</td>
<td>5.6</td>
<td></td>
</tr>
<tr>
<td>FSLC</td>
<td>56</td>
<td>35.0</td>
<td></td>
</tr>
<tr>
<td>WASC/GCE</td>
<td>62</td>
<td>38.8</td>
<td></td>
</tr>
<tr>
<td>OND/NCE/HND/B.ED/Others higher</td>
<td>33</td>
<td>20.6</td>
<td></td>
</tr>
<tr>
<td>Household size</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 – 9</td>
<td>118</td>
<td>73.8</td>
<td>8</td>
</tr>
<tr>
<td>10 – 19</td>
<td>33</td>
<td>20.6</td>
<td></td>
</tr>
<tr>
<td>20 – 29</td>
<td>9</td>
<td>5.6</td>
<td></td>
</tr>
<tr>
<td>Telfairia farming as major occupation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>101</td>
<td>63.1</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>59</td>
<td>36.9</td>
<td></td>
</tr>
<tr>
<td>Others occupations apart from Telfairia farming</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artisan</td>
<td>54</td>
<td>33.6</td>
<td></td>
</tr>
<tr>
<td>Civil service</td>
<td>76</td>
<td>47.6</td>
<td></td>
</tr>
<tr>
<td>Farming</td>
<td>160</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Petty trading</td>
<td>32</td>
<td>20.0</td>
<td></td>
</tr>
<tr>
<td>Apprentice Applicant</td>
<td>6</td>
<td>3.8</td>
<td></td>
</tr>
<tr>
<td>Student</td>
<td>34</td>
<td>21.2</td>
<td></td>
</tr>
<tr>
<td>Scale of farming</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large scale (used above 2 plots)</td>
<td>71</td>
<td>44.4</td>
<td></td>
</tr>
<tr>
<td>Small scale (used less than two plots)</td>
<td>89</td>
<td>55.6</td>
<td></td>
</tr>
</tbody>
</table>

Extension contacts with Telfairia farmers

About 63% of the respondents did not have extension contact in the last one year (Table 2). Poor extension contact will often result in poor access to relevant information on how to improve Telfairia production and marketing and this could be a discouraging factor for the farmers. All (100%) the farmers that had extension contact indicated that the information they obtained from extension agents was useful. This agrees with Obibuaku (1983) who reported that extension has the function of disseminating useful information relating to agriculture. Therefore, regular extension visit is required for improve production and income of Telfairia farmers in the area. Majority (57.7%) of the farmers who had extension contact received information from extension agent’s every 5 – 9 months while 22.1%, 18.6%, 1.7%
received information every 10 – 14 months; 1 – 4 months and 15 months and above respectively. This indicates that farmers do not receive extension information regularly. The frequency of contact determines the level and rate of adoption in any extension programmes. Therefore, the impact extension is making in the \textit{Telfairia} production in the study area is low.

About 82\% of the respondents received information on how to get farm inputs while 71.0\%, 54.2\%, 47.4\%, 27.1\%, 15.3\%, 3.4\% received information on how to source farm credit, family health, appropriate marketing channel, home management, record keeping and post planting operations, respectively. This implies that extension still has a lot of work to do in the area of production and marketing of \textit{Telfairia}.

<table>
<thead>
<tr>
<th>Table 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution of respondents according to extension contact</td>
</tr>
<tr>
<td>Variables</td>
</tr>
<tr>
<td><strong>Extension contact (n = 160)</strong></td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td><strong>Reception of useful information (n = 59)</strong></td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td><strong>Frequency of reception (n = 59)</strong></td>
</tr>
<tr>
<td>Once in every 1 – 4 months</td>
</tr>
<tr>
<td>Once in every 5 – 9 months</td>
</tr>
<tr>
<td>Once in every 10 – 14 months</td>
</tr>
<tr>
<td>Once in every 15 months and above</td>
</tr>
<tr>
<td><strong>Specific areas farmers received extension services (n = 59)</strong></td>
</tr>
<tr>
<td>Home management practices</td>
</tr>
<tr>
<td>Family health</td>
</tr>
<tr>
<td>Planting and post planting techniques</td>
</tr>
<tr>
<td>Assistance to source farm credit</td>
</tr>
<tr>
<td>Sourcing farm input</td>
</tr>
<tr>
<td>Sourcing appropriate marketing channel</td>
</tr>
</tbody>
</table>

Marketing channels and marketing information

Farmers sold their products to consumers via several channels including (Table 3) village or local markets (56.9\%), village squares (27.6\%), roadside stands or street selling (16.2\%), and farm gate (11.2\%). Only 3.6\% sold their products through cooperative societies. The findings show that majority of the farmers sold directly to consumers. Ugwu (2001) reported that most of the farmers market their products in sub-standard markets where they are sold at a give-away price. This reduces their incentive to participate in economic transactions and result in subsistence rather than market-oriented production systems. However, Hall (2002) opined that justification for establishing a direct farmer-to-consumer marketing outlet is based primarily on the producer’s desire to increase the financial returns from farm production. This opportunity for increased returns stems from opportunities to reduce marketing costs attributed to intermediaries (middle-men) in the supply chain, an consumer desire to buy (and willingness to perhaps pay a premium for) riper,
fresher, higher-quality fruits and vegetables. These two factors combined have often generated substantially higher net returns for producers.

Roadside stands are located next to a public road so that they can be exposure to drive-by traffic. Farmers can charge less to consumers at the roadside while enhancing their own income because they often eliminate or reduce conventional marketing costs of intermediary firms. With knowledge of the advantages and disadvantages of these marketing channel alternatives, producers can evaluate their marketing needs and assess the likelihood that direct marketing will satisfy those needs. Farmers should therefore be educated on the opportunities of these market channels so that they can take advantage over them and increase production of maximize profit.

Table 3
Percentage distribution of respondents according to marketing channel (n = 160)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm gate</td>
<td>18</td>
<td>11.2</td>
</tr>
<tr>
<td>Cooperatives</td>
<td>6</td>
<td>3.6</td>
</tr>
<tr>
<td>Roadside stands</td>
<td>26</td>
<td>16.2</td>
</tr>
<tr>
<td>Village/local markets</td>
<td>91</td>
<td>56.9</td>
</tr>
<tr>
<td>Village square</td>
<td>44</td>
<td>27.6</td>
</tr>
<tr>
<td>Nearby town</td>
<td>16</td>
<td>10.0</td>
</tr>
<tr>
<td>Distant market</td>
<td>7</td>
<td>4.4</td>
</tr>
</tbody>
</table>

Marketing factors that determine sales

The level and price of sale of individual producers varied depending on the season of the year (26.6%) in which they produce the crop, number (volume of sales) of buyers (20.0%) and quality of produce (16.2%) as shown in Table 4. Fresh, high quality produce is important to customers. Harvest timing and post-harvest handling are two important factors affecting the quality of the produce (Hall, 2002). The volume that can be sold through a given channel has a large impact on profitability. The more perishable the crop, the more important it is to have a channel that can absorb the volume harvested as quickly as possible. LeRoux et al. (2009) noted that choosing the appropriate marketing channel requires consideration of many factors, including sales volume, risk, lifestyle preference and stress aversion, labor requirements, and channel-specific costs. The weights (or importance) assigned to each of these factors is unique to the individual or firm. Additionally, the nature of highly perishable crops, along with the risks and potential sales volumes of particular channels, requires combining different channels to maximize firm performance.

Season of the years is also an important factor that affects sales. At on seasons produce are in much qualities, whereby supply is higher than demand and this may affect the price. Farmers should be educated on how to process excess Telfairia to meet demand during the rest of the year. Irrigation schemes should be developed for farmers to enable produce all year round in other to maximize profit.
Table 4

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Season of the year</td>
<td>41</td>
<td>25.6</td>
</tr>
<tr>
<td>Quality of produce</td>
<td>26</td>
<td>16.2</td>
</tr>
<tr>
<td>No of buyers</td>
<td>32</td>
<td>20</td>
</tr>
<tr>
<td>Distance to the market</td>
<td>14</td>
<td>8.8</td>
</tr>
<tr>
<td>Quality of produce</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>Selling on credit or cash</td>
<td>21</td>
<td>13.1</td>
</tr>
<tr>
<td>No standardized price</td>
<td>6</td>
<td>3.8</td>
</tr>
<tr>
<td>Place of sale</td>
<td>4</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Areas of extension need

Extension needs of farmers was indicated in the following areas as shown in Table 5: sourcing of farm input (M= 3.62); sourcing appropriate marketing channel (M= 3.18); sourcing of improved farm tools (M= 3.11); expansion of scale of production (M= 3.07); receiving information on appropriate cultural practices (M= 3.06); and sourcing farm credit (M= 3.00). The farmers further identified other areas of extension need as home management practices (M= 2.9); information on seed processing (M= 2.89); record keeping and evaluation (M= 2.84); family care and health care services (M= 2.76).

In the absence of well-developed markets, farmers will tend to self-insure by engaging in off-farm employment. Although the extra income could be used as investment in Telfairia farming it could play an important role in enterprises choices and investments decisions which may not favour Telfairia production. However, farmers will grow large quantities of Telfairia only when they are assured that they can market them easily.

Availability of credit and the associated cost of credit are crucial in the success of the agricultural industry. Credit could be used to purchase inputs (planting material, fertilizer and expand scale of production), pay wages, among others. The availability of credit is expected to lead to increased Telfairia production and commercialization. There is need for extension to intervene in these areas of need identified by farmers as any growth in Telfairia production is likely to affect poverty in different ways in rural areas. According to Osie (nd), traditional agronomic practices, disease and pest and inadequate extension advice, among others play a major role in reduced agricultural yields. However agricultural extension programmes provide the much-needed help to farmers in the form of practical field advice and improved technologies from research institutions and the universities. Khalil, (2007) opined that agricultural extension activities are considered to be one of the most important activities in achieving the comprehensive rural development by transferring technologies from research stations to the farmers.
Table 5
Mean distribution of respondents based on areas of extension need

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean score (M)</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sourcing of farm input</td>
<td>3.62*</td>
<td>0.758</td>
</tr>
<tr>
<td>Sourcing appropriate marketing channel</td>
<td>3.18*</td>
<td>0.910</td>
</tr>
<tr>
<td>Sourcing improved farm tools</td>
<td>3.11*</td>
<td>1.072</td>
</tr>
<tr>
<td>Expansion of scale of production</td>
<td>3.07*</td>
<td>1.061</td>
</tr>
<tr>
<td>Need information on planting and post</td>
<td>3.06*</td>
<td>1.070</td>
</tr>
<tr>
<td>plant techniques</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sourcing farm credit</td>
<td>3.00*</td>
<td>1.075</td>
</tr>
<tr>
<td>Home management practices</td>
<td>2.90*</td>
<td>1.122</td>
</tr>
<tr>
<td>Seed processing techniques</td>
<td>2.89*</td>
<td>1.163</td>
</tr>
<tr>
<td>Record keeping and evaluation</td>
<td>2.84*</td>
<td>1.195</td>
</tr>
<tr>
<td>Family and health care services</td>
<td>2.76*</td>
<td>1.151</td>
</tr>
</tbody>
</table>

* = Extension needs of farmers

Factors constraining the production and marketing of *Telfairia*

Constraint factors were extracted and variables with 0.4 and above were used in naming the factors (Table 4). Based on the clustering of items, factors 1, 2, 3, and 4 were named infrastructural, technical, logistic and financial constraints respectively. The major constraints under infrastructural limitations (factor 1) as identified by the farmers include poor technical know-how on the production (0.62); unsuitable time of transaction (0.50); poor infrastructural facilities (0.44); and poor access to irrigation facilities (0.41). Inadequate irrigation facilities and perishability of *Telfairia* limit producers to off-season production and sales at a low price owing to lack of storage facilities.

In factor 2, (technical problems) specific constraint variables were inadequate credit facilities (0.57); inadequate storage facilities (0.56); and lack of extension contact (0.44). Items that loaded high under logistic problems (factor 3) include unsuitable marketing channel (0.55); poor access to improved seeds (0.51); and unavailability of other farm input like fertilizer, agro chemicals (0.48) while items that load under financial problems (factor 4) include: inadequate fund (0.55) and family problems (e.g. sickness, children’s’ education (0.41).

Poor technical know-how on production is a significant constraint to vegetable production and the capacity of small producers in particular. According to (USAID, 2005), ineffective and inaccessible extension and education networks have resulted in inadequate human technical capacity and expertise throughout the horticultural (vegetable) market chain in developing countries. Extension should have effective mechanisms to ensure that farmers are trained in currently required methodologies and practices in the production of *Telferia*.

Compared to cereal crops, most vegetables demand high levels of inputs. Small holder farmers often lack access to appropriate inputs and the necessary technical production skills due to inadequate input and credit markets as well as weak extension systems (USAID, 2005). Improving access to appropriate inputs and
information resources can help farmers raise productivity and contribute to sound natural resource management.

Unsuitable market channels may result in vegetables being wasted as postharvest losses. This often cause a reduction in the price of the vegetables and consequently the inability of the farmers to sustain their livelihood. Makhura (2001) found that marketing by smallholder farmers in Switzerland was constrained by poor infrastructure, distance from the market, lack of assets (such as lack of own vehicles) and inadequate market information. Lack of bargaining power along with various credit bound relationships with the buyers have led to farmers being exploited during the transaction where most of the farmers become price takers and this may affect commercialization of this venture. Jaleta (2007) showed that inadequate market channels and poor information regarding price were among factors affecting commercialisation of agriculture. Furthermore, Emana and Gebremedhin (2007) in their study on market chain analysis argued that the marketing of horticultural crops is affected by inadequate local markets, poor pricing system, lack of local markets to absorb supply, low produce prices, excess of intermediaries, and poor marketing institutions and coordination of farmers. Emana and Gebremedhin (2007) further argued that poor handling and packaging of products, poor pricing systems, and information asymmetry affect marketing of vegetables.

Given the high local demand for vegetables, it is important to address these challenges for producers to benefit from market opportunities and to increase their incomes. Dealing with these challenges will require a whole value chain approach.
Table 4
Varimax rotated factors constraining production and marketing of Telfairia

<table>
<thead>
<tr>
<th>Variables</th>
<th>Factor 1 (Infrastructural problems)</th>
<th>Factor 2 (technical problems)</th>
<th>Factor 3 (Logistics problems)</th>
<th>Factor 4 (Financial problems)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequate fund</td>
<td>-0.17</td>
<td>0.11</td>
<td>0.23</td>
<td>-0.55</td>
</tr>
<tr>
<td>Inadequate credit facilities</td>
<td>0.06</td>
<td>0.57</td>
<td>-0.22</td>
<td>-0.22</td>
</tr>
<tr>
<td>Lack of extension contact</td>
<td>0.01</td>
<td>0.44</td>
<td>0.05</td>
<td>0.18</td>
</tr>
<tr>
<td>Lack of frequent extension contact</td>
<td>-0.04</td>
<td>-0.30</td>
<td>0.32</td>
<td>0.14</td>
</tr>
<tr>
<td>Family problem (sickness)</td>
<td>0.16</td>
<td>0.01</td>
<td>0.06</td>
<td>0.41</td>
</tr>
<tr>
<td>High cost of labour</td>
<td>0.20</td>
<td>0.37</td>
<td>0.04</td>
<td>-0.05</td>
</tr>
<tr>
<td>Small sized farm land</td>
<td>-0.04</td>
<td>0.02</td>
<td>-0.02</td>
<td>0.18</td>
</tr>
<tr>
<td>Poor access to improved seeds</td>
<td>0.18</td>
<td>-0.04</td>
<td>0.51</td>
<td>-0.10</td>
</tr>
<tr>
<td>Unavailability of other input (fertilizer, agro chemicals etc.)</td>
<td>-0.00</td>
<td>-0.03</td>
<td>0.48</td>
<td>0.04</td>
</tr>
<tr>
<td>High cost of input</td>
<td>0.17</td>
<td>0.32</td>
<td>-0.02</td>
<td>0.38</td>
</tr>
<tr>
<td>Weed problem</td>
<td>0.29</td>
<td>0.12</td>
<td>0.05</td>
<td>0.06</td>
</tr>
<tr>
<td>Pest and disease problem</td>
<td>-0.39</td>
<td>-0.55</td>
<td>-0.05</td>
<td>-0.01</td>
</tr>
<tr>
<td>Poor access to irrigation facilities</td>
<td>0.41</td>
<td>-0.01</td>
<td>0.25</td>
<td>0.02</td>
</tr>
<tr>
<td>Lack of irrigation facilities</td>
<td>-0.02</td>
<td>0.32</td>
<td>0.34</td>
<td>-0.10</td>
</tr>
<tr>
<td>Poor knowledge of soil related factors</td>
<td>0.51</td>
<td>-0.07</td>
<td>-0.40</td>
<td>0.16</td>
</tr>
<tr>
<td>Climate variation (drought)</td>
<td>-0.03</td>
<td>0.10</td>
<td>-0.28</td>
<td>-0.33</td>
</tr>
<tr>
<td>Poor infrastructural facilities</td>
<td>0.44</td>
<td>-0.02</td>
<td>-0.21</td>
<td>-0.36</td>
</tr>
<tr>
<td>Poor pricing system</td>
<td>0.03</td>
<td>0.39</td>
<td>-0.13</td>
<td>0.21</td>
</tr>
<tr>
<td>Poor technical know-how on producing</td>
<td>0.62</td>
<td>0.01</td>
<td>0.11</td>
<td>-0.11</td>
</tr>
<tr>
<td>Poor storage system</td>
<td>-0.17</td>
<td>0.38</td>
<td>0.01</td>
<td>0.33</td>
</tr>
<tr>
<td>Inadequate storage facilities</td>
<td>-0.00</td>
<td>0.56</td>
<td>0.09</td>
<td>-0.06</td>
</tr>
<tr>
<td>Unsuitable marketing channel</td>
<td>0.50</td>
<td>0.16</td>
<td>0.55</td>
<td>0.24</td>
</tr>
<tr>
<td>Inadequate transport facilities</td>
<td>-0.28</td>
<td>0.24</td>
<td>0.01</td>
<td>-0.33</td>
</tr>
<tr>
<td>High cost of transportation</td>
<td>-0.52</td>
<td>0.03</td>
<td>-0.36</td>
<td>0.30</td>
</tr>
<tr>
<td>Unsuitable time of transactions</td>
<td>-0.50</td>
<td>0.03</td>
<td>0.02</td>
<td>-0.30</td>
</tr>
<tr>
<td>Instability of price</td>
<td>-0.07</td>
<td>0.05</td>
<td>0.09</td>
<td>0.24</td>
</tr>
</tbody>
</table>

Conclusion
Agricultural extension need of Telfairia producers were identified in the following areas: sourcing farm credit, farm input, appropriate marketing channel, fertilizer application, pest disease and weed control. Farmers produce the crop at a small scale and sold in village markets. Infrastructural,
technical, logistic and financial problems were identified as constraints in production and marketing of *Telfairia*. There is need for extension to establish or explore viable markets where farmers will sell their products at a favourable price in relation to the quantity and quality of the produce. Non-Governmental Organizations (NGO) should also help to provide inputs, infrastructures, logistics, marketing information and finance needed for effective production and marketing of the crop.

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Fadama III Beneficiaries’ Adherence to Project Guidelines in Ogun State, Nigeria

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Abstract

Fadama III project in Nigeria like other community driven development projects is faced with a lot of challenges in spite of the laudable goals and approach. A major challenge of the projects is non-adherence to implementation guidelines among the implementers and beneficiaries. This study therefore assessed the adherence of project beneficiaries in Ogun state to the Fadama III implementation guidelines in order to make necessary recommendations to the implementers for proper management. Ijebu division was randomly selected out of the four (4) divisions in Ogun state. Two (2) out of the six (6) local government areas (LGAs) constituting the division were randomly sampled for the study. All the eight (8) registered Fadama Community Associations (FCAs) in the two LGAs were sampled. Eight focus group discussions (FGDs) and four in-depth interviews with key informants (IDIs) were used to verify secondary data obtained from the records of the FCAs. Adherence to project implementation guidelines ranged from fair to high while adherence to procurement guidelines and Fadama users’ equity fund (FUEF) requirements needed to be improved. Beneficiaries were over expectant of the benefits accruable from the project, which led to reduction in their enthusiasm towards the project because of its slow implementation. It was recommended that the implementers should keep up their efforts at sensitising beneficiaries on the implementation guidelines of the project, re-work their strategies at addressing procurement and FUEF inadequacies among the beneficiaries and fast-track the delivery of project benefits in the communities.

Key words: Beneficiaries’ adherence, implementation guidelines and Fadama users’ equity fund compliance

Introduction

Fadama III is a World Bank assisted project aimed at alleviating the poverty situation among rural people in Nigeria. It has the development objective of increasing the income of users of rural land and water resources on a sustainable basis. By increasing the incomes of the users, it hopes to reduce the prevalence of rural poverty and increase food security. This is expected to contribute to the achievement of the Millennium Development Goals (MDGs). The project adopts a demand-driven approach whereby all users of Fadama resources are encouraged to develop participatory and socially-inclusive local development plans (LDPs). Approved eligible sub-projects contained in the LDPs are financed by the implementing agency (Fadama, 2009).
As in many other community driven development (CDD) projects, Fadama III project gives control of decisions and resources to community groups called fadama community associations (FCAs) and fadama user groups (FUGs). This control could be abused if not properly monitored hence, the need for the implementation guidelines to eliminate or reduce the abuse.

The project implementation manual (PIM) which contains the guidelines was designed to guide staff of the National and State Fadama Coordination Offices (NFCO & SFCOs), the National Food Reserve Agency (NFRA), and other stakeholders in implementing the Third National Fadama Development Project. It was also designed to assist project-contracted facilitators and participating LGAs to undertake project-related activities at the level of FCAs and other beneficiary groups. In essence, implementation guidelines are frameworks which are intended to promote the smooth running of projects. They guide the implementers and beneficiaries in the delivery of project benefits to intended beneficiaries. With respect to the beneficiaries, these guidelines can be divided into two broad categories;

1) Administrative and corporate existence guidelines
2) Fiduciary management and procurement guidelines

The administrative and corporate existence guidelines are explained in the form of eligibility guidelines or selection criteria for FCAs and FUGs. According to OGSFCO (2009), they include the following:

a) FCAs and FUGs must be formed on the basis of voluntary membership;
b) Members of the FCAs and FUGs are from the same local government;
c) Family members can be registered in more than one FUG;
d) FCAs and FUGs must have due legal status and have written constitution;
e) FCAs and FUGs must have elected leadership with at least three designated authorities;
f) They must not have more than one member of a family in a leadership position;
g) FCAs and FUGs must have operational bank accounts;
h) FCAs and FUGs prove commitment to adhere to CDD principles; and
i) Are ready to comply with other requirements made, through a specific subproject financing agreement, in relation to the use of matching grants received from the project e.g. operation of the FUEF.

The second category of guidelines, fiduciary management and procurement guidelines are vital to the success of the CDD approach when one considers the fact that CDD confers the control of resources on the community members, which makes handling of finances and procurement of goods and services to take a center stage. Therefore, how the groups handle finances and procurement of goods and services can be a critical indicator of the successful utilisation of the CDD approach by the community. Like it is for other World Bank assisted projects, fiduciary management and procurement guidelines are put in place and expected to be complied with to promote best practices. These guidelines, if properly followed will distinguish the project from other government or donor funded projects which preceded it.

According to World Bank (2004), the objectives of the procurement guidelines are efficiency and cost-effectiveness, quality of goods and services, transparency, and competition among qualified suppliers. These are expected to promote the provision
of excellent services at appropriate costs or in other words, having value for the money expended; check fraud and sharp practices by ensuring accountability and transparency at all levels and providing a level playing ground for all the service providers. However, since these procurement procedures are developed for larger institutions, they do not always fit perfectly at the community level where the project is being implemented. This is because the transactions may be too frequent and small to warrant the methods and attendant costs usually considered to be good practice for the larger and less frequent transactions which the guidelines were designed for. This therefore makes the management of procurement responsibilities in CDD guided community projects such as Fadama to be faced with a lot of challenges because:

i. CDD embraces a range of projects, and CDD projects often have a multiplicity of actors.

ii. Communities and subprojects are scattered, sometimes in remote locations with poor communications.

iii. Bank policies and procedures are typically constructed to respond to larger-scale initiatives than those undertaken at the community level. CDD procedures thus need to be tailored to project-specific situations while remaining consistent with Bank procedures.

In spite of the challenges, the implementers of the project are fully aware of the fact that the project could not have been said to have succeeded without complying with the procedures. They were thus simplified and tailored to the prevailing local situation without compromising the core values espoused by the guidelines. Nkonya et al (2008), report that the precursor of the project i.e. Fadama II project increased the incomes of beneficiaries by 60% as against the 20% it set to achieve while Fadama (2012) reported that as at mid line, Fadama III is on track towards achieving the 40% increase in income target set for 75% of its beneficiaries. However, scanty information is available on the adherence or otherwise of the project beneficiaries to the implementation guidelines, thus the need for this study.

Objectives
This study was designed to assess Fadama III beneficiaries’ adherence to project implementation guidelines in Ogun state. The specific objectives were to:

1. examine the enterprise characteristics of the FCAs;
2. ascertain the corporate statuses of the FCAs and constituent FUGs;
3. assess adherence to fiduciary management and procurement guidelines; and
4. find out the beneficiaries’ compliance with the FUEF requirements.

Methodology
The study was carried out in Ogun state. Ijebu division was randomly selected out of the four divisions in Ogun state. Two out of the six LGAs constituting the division were also randomly sampled. All the eight registered FCAs in the two LGAs were sampled. This study was essentially based on secondary data derived from the physical verification of groups’ records. However, eight FGDs (adult male 2, adult female 2, male youth 1, female youth 1, aged 1 and People Living with HIV/AIDS
(PLWHA) 1 and four IDIs were conducted to verify information generated from records.

Measurement of variables

Adherence to project implementation guidelines was measured by considering the four different components constituting implementation guidelines separately. These included; enterprise characteristics made up of enterprise types and mix, corporate status, adherence to fiduciary and procurement guidelines and compliance with FUEF requirements.

Enterprise characteristics were measured by asking the respondents to state the types of enterprises the FUGs specialised in. These could be crop, livestock, fish, processing, marketing, artisans and vulnerable. The more the types of enterprise constituting the FCA, the higher the score assigned.

Corporate status was measured by asking the respondents to provide information on their legal status and this was ascertained by verifying the registration status of the FCAs and FUGs as registered (which was scored 1) or not registered (scored 0). Statements of bank account were verified to know if the FCAs and FUGs had operational bank accounts (operational account scored 2, non-operational scored 1 while no account scored 0), and minutes of the first meeting were scrutinised to ascertain the democratic election of group leaders (democratic leadership scored 1 and undemocratic leadership scored 0). Furthermore, other minutes of meetings were checked to determine regularity of meetings (regular scored 2, less regular 1 and moribund scored 0).

Adherence to fiduciary management and procurement guidelines was measured by enquiring into the process of financial records keeping (proper filing of receipts, invoices, bills of quantities etc. scored 2, improper filing scored 1 and no filing scored 0). Respondents were also asked to describe the steps followed in procuring what they had benefitted so far from the project with a view to comparing those with the standard procedure (the use of committee system in procurement scored 1, FCA/FUG chairmen’s handling procurement scored 0).

Compliance with FUEF requirements was measured by asking the group leaders to state the last amount deposited in their FUEF account as well as the last date of making deposit. Physical verification of bank documents was also done to ascertain the regularity as well as correctness of the amount given ( highly operational FUEF account scored 3, moderately operational FUEF account scored 2, non-operational FUEF account scored 1 and no FUEF account scored 0).

Results and discussion

Enterprise characteristics

Table1 shows that the modal enterprise type in the study area was fisheries (27.0%) while the least was agro forestry (4.0). Majority of the FUGs (78.3%) were involved in direct production while 14.9% were into marketing and 6.8% into processing. This shows that the project is on track towards achieving the second project development
objective which is to record a 20 percent increase in the yield of agricultural produce at the end of the project year (World Bank, 2008). Meanwhile, some level of inclusion of groups responsible for value addition (processing) and marketing was also noticed. These are expected to stimulate continuous production by increasing the access of the producers to the market, thereby solving a major problem encountered during the first phase of the project as reported by Nkonya et al (2008). This is further explained in Table 2 which shows that the FCAs were evenly mixed as 50 percent each of the FCAs had medium and high enterprise mix. This implies that efforts of the project implementers to attain social inclusion are being. This will assist in making the project sustainable in the long run.

FGDs revealed that among the enterprise types, some of the groups were classified as vulnerable groups. These included the aged, physically challenged, widows and people living with HIV/AIDS (PLWHA). It was also revealed that the community facilitators made conscious effort at mainstreaming the vulnerable groups within the FCA to promote social inclusion.

<table>
<thead>
<tr>
<th>FCA</th>
<th>Number of FUGs</th>
<th>Number of enterprises</th>
<th>Enterprise mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akalaopo Isiwo</td>
<td>13</td>
<td>6</td>
<td>High</td>
</tr>
<tr>
<td>Ayonitemi Obalende</td>
<td>7</td>
<td>4</td>
<td>Medium</td>
</tr>
<tr>
<td>Temidayo Onirugba</td>
<td>10</td>
<td>5</td>
<td>High</td>
</tr>
<tr>
<td>Ifowosowopo Irawo</td>
<td>10</td>
<td>5</td>
<td>High</td>
</tr>
<tr>
<td>Igbile</td>
<td>9</td>
<td>5</td>
<td>High</td>
</tr>
<tr>
<td>Istanrin</td>
<td>8</td>
<td>4</td>
<td>Medium</td>
</tr>
<tr>
<td>Imosan</td>
<td>6</td>
<td>4</td>
<td>Medium</td>
</tr>
<tr>
<td>Akio</td>
<td>11</td>
<td>4</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Table 1

<table>
<thead>
<tr>
<th>Enterprise type</th>
<th>FUGs</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop</td>
<td>17</td>
<td>23.0</td>
</tr>
<tr>
<td>Livestock</td>
<td>18</td>
<td>24.3</td>
</tr>
<tr>
<td>Fisheries</td>
<td>20</td>
<td>27.0</td>
</tr>
<tr>
<td>Agro forestry</td>
<td>3</td>
<td>4.0</td>
</tr>
<tr>
<td>Marketing</td>
<td>11</td>
<td>14.9</td>
</tr>
<tr>
<td>Processing</td>
<td>5</td>
<td>6.8</td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th>FCA</th>
<th>Number of FUGs</th>
<th>Number of enterprises</th>
<th>Enterprise mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akalaopo Isiwo</td>
<td>13</td>
<td>6</td>
<td>High</td>
</tr>
<tr>
<td>Ayonitemi Obalende</td>
<td>7</td>
<td>4</td>
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</tr>
<tr>
<td>Temidayo Onirugba</td>
<td>10</td>
<td>5</td>
<td>High</td>
</tr>
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<td>Ifowosowopo Irawo</td>
<td>10</td>
<td>5</td>
<td>High</td>
</tr>
<tr>
<td>Igbile</td>
<td>9</td>
<td>5</td>
<td>High</td>
</tr>
<tr>
<td>Istanrin</td>
<td>8</td>
<td>4</td>
<td>Medium</td>
</tr>
<tr>
<td>Imosan</td>
<td>6</td>
<td>4</td>
<td>Medium</td>
</tr>
<tr>
<td>Akio</td>
<td>11</td>
<td>4</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Corporate status

Table 3 shows that the FCAs and FUGs performed highly (90.6% and 83.5%, respectively) with respect to their corporate statuses. Further breakdown shows that all the FCAs (100.0%) and 90.5% of the FUGs satisfied legal registration status. The performance with respect to bank status was high (75.0%) among the FCAs and fair (51.4%) among the FUGs. All the FCAs and FUGs (100.0%) had democratic leadership status. Meanwhile, FCAs and FUGs recorded high level of regularity at
meetings (90.6 and 83.5% respectively). These imply maintenance of high level of corporate status among the FCAs and FUGs. This will enhance the chances of the groups to benefit from facilities such as bank and government loans as well as assistance from non-governmental organisations who may be interested in providing assistance to registered rural groups.

FGDs and IDIs also confirmed that the groups did not merely exist on paper but met regularly to discuss issues of common interests. It was also found that group members actively participated in the election of their leaders. However, election had not been held recently in most of the groups contrary to the provisions of the bye-laws that elections should be held periodically. This was explained by the absence of a need to do so by the members who saw nothing wrong in overstaying leadership of the groups. On enquiry, most of the members were not aware of the provisions of the cooperative bye-laws stipulating the need for periodic election of executives.

Table 3

<table>
<thead>
<tr>
<th>Corporate status</th>
<th>FCA</th>
<th>Percent</th>
<th>FUG</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum Obtainable</td>
<td>Scores Obtained</td>
<td>Maximum Obtainable</td>
<td>Scores Obtained</td>
</tr>
<tr>
<td>Legal status</td>
<td>8</td>
<td>8</td>
<td>100</td>
<td>74</td>
</tr>
<tr>
<td>Bank status</td>
<td>16</td>
<td>12</td>
<td>75.0</td>
<td>148</td>
</tr>
<tr>
<td>Democratic</td>
<td>8</td>
<td>8</td>
<td>100</td>
<td>74</td>
</tr>
<tr>
<td>leadership status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regularity meeting</td>
<td>16</td>
<td>14</td>
<td>87.5</td>
<td>148</td>
</tr>
<tr>
<td>Average performance</td>
<td>90.6</td>
<td></td>
<td></td>
<td>83.5</td>
</tr>
</tbody>
</table>

Adherence to fiduciary management and procurement guidelines

Table 4 shows that the FCAs and the FUGs recorded high adherence (62.5 and 82.1% respectively) to fiduciary and procurement guidelines of the project. Although group records showed that there is high adherence to fiduciary and procurement guidelines among the groups, FGD however revealed that in some cases, the procurement committees were sometimes dispensed with and fewer service providers were engaged in the procurement of services and equipments than expected. Further scrutiny of the group records showed that a single service provider won all the contracts awarded by a particular FCA, while two service providers were responsible for the supply of equipments to another FCA. This development is unusual considering the fact that the ‘shopping’ exercise took place on different days and the coincidences appear questionable.

In addition, FGD revealed that the lower score recorded by the FCAs in contrast to the FUGs was as a result of the FCAs being more active in procurement activities than the FUGs, thereby predisposing the leadership to making more mistakes in the area of procurement than the FUGs.
Table 4
Distribution of respondents’ adherence to fiduciary management and procurement guidelines

<table>
<thead>
<tr>
<th>Fiduciary and procurement status</th>
<th>FCA</th>
<th>Percent</th>
<th>FUG</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum Obtainable</td>
<td>Scores Obtained</td>
<td>Maximum Obtainable</td>
<td>Scores Obtained</td>
</tr>
<tr>
<td>Financial management</td>
<td>16</td>
<td>10</td>
<td>62.5</td>
<td>148</td>
</tr>
<tr>
<td>Procurement management</td>
<td>16</td>
<td>10</td>
<td>62.5</td>
<td>148</td>
</tr>
<tr>
<td>Average performance</td>
<td></td>
<td></td>
<td>62.5</td>
<td></td>
</tr>
</tbody>
</table>

Compliance with FUEF requirements

Table 5 shows a fair compliance with FUEF requirements among the FCAs and FUGs (50.0 and 51.8% respectively). FGD and IDIs confirmed a fair compliance of the groups with FUEF requirements, while, a high level of understanding of the essence of the FUEF component was displayed by the groups. Meanwhile, participants at the FGDs complained about the non-meeting of their bloated expectations by the project which led to some group members withdrawing their membership in a few of the FCAs and many others being skeptical of future expectations from the project, thus affect affecting their willingness to fulfill their FUEF obligations.

Table 5
Distribution of respondents based on compliance with FUEF requirements

<table>
<thead>
<tr>
<th>FCA</th>
<th></th>
<th>FUG</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Obtainable</td>
<td>Scores Obtained</td>
<td>Percent</td>
<td>Maximum Obtainable</td>
</tr>
<tr>
<td>24</td>
<td>12</td>
<td>50.0</td>
<td>222</td>
</tr>
</tbody>
</table>

Conclusion and recommendations

This study revealed that groups in the study area generally have a fair to high level of adherence to the four measures of project implementation guidelines. Adherence to procurement guidelines and FUEF requirements are areas where much improvement is needed. The project is however, expected to achieve its stated objectives in the study area if the implementers uphold their own side of the covenant and the policy environment remains stable. It is therefore recommended...
that the Fadama III project implementers reward beneficiaries' adherence to the implementation guidelines by disbursing funds promptly to the groups while ensuring the gaps noticed in the area of adherence to procurement guidelines and FUEF requirements are improved upon to maintain standards.

References


Use of Information and Communication Technology (ICT) among Extension Workers in Borno State, Nigeria

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Abstract
The study examined the utilization of Information and Communication Technologies (ICTs) by agricultural extension workers in Borno State. Data were collected from 138 extension workers spread across the three Agricultural Development Programme (ADP) Zones in the state. Data were collected using structured questionnaire and analyzed using both descriptive and inferential statistical tools. The results revealed that 54% of the respondents were 40 years of age or younger, with virtually all (98%) having at least the Ordinary National Diploma (OND). Radio was the most popular ICT facility accessed by the respondents while the Internet was the least. However, in terms of appropriateness of the ICT facilities as source of information for extension purposes, it was perceived that the Internet was the most important ICT facility. This was followed by radio, while telephone was the least in importance. The level of education of the respondents was the most important factor that significantly influenced utilization of ICTs for extension purposes (ρ ≤ 0.01). Age of the respondents (ρ ≤ -0.05) and working experience (ρ ≤ 0.05) also significantly influenced utilization of ICTs for extension purposes. The major constraints to the utilization of ICTs for extension purposes were poor infrastructure, as reported by 78.67% of the respondents and non availability of ICT facilities, as reported by 62.00% of the respondents. It was therefore recommended that rural areas should be provided with basic infrastructure such as electricity; and extension workers should be encouraged to upgrade their educational levels as well as their competencies in the use of ICTs.

Introduction
Information and Communication Technology (ICT) has been defined in many ways by various authorities. For instance, Adebayo and Adesope (2007) define ICT as the tools and processes used to access, retrieve, store, organize, manipulate, produce and exchange information by electronic and other automated means. Also, the Technical Center for Agricultural and Rural Cooperation (CTA) (2003) defined ICT as technologies that facilitate communications as well as the processing and transmission of information by electronic means. The above definitions encompass the full range of ICTs from radio and television to telephones (both fixed and mobile), computers and the Internet.

The agricultural sector is confronted with the challenge of increasing production to feed the ever growing population in a situation of decreasing availability of natural resources. Factors of particular concern are water shortages, declining soil fertility,
effect of climate change and rapid decrease of arable land due to urbanization. This calls for transformation in the ways of sourcing and dissemination of technical information by extension workers, which will eventually transform the agricultural sector. Realizing these opportunities requires using channels of information delivery that can take current and appropriate technical knowledge to extension workers and eventually to farmers without much distortion. This is perhaps, a possible reason why the role of ICT in enhancing the performance of agricultural extension workers is gaining recognition. Agricultural extension, being the knowledge subsector of the agricultural sector depends largely on information exchange among extension workers. It also depends on information exchange between agricultural extension workers and researchers on one hand and between agricultural extension workers and the farmers on the other hand. Such information exchange mechanism needs to be up-dated to be in line with current realities. Up-dating the information exchange mechanism will make extension workers keep abreast with the current needs of farmers as well as what current technological realities offer, hence ensuring the transformation of agriculture. Adesope (2004) and Omotayo (2005) are also of the view that, field extension workers who are in direct contact with farmers should make good use of ICT in order to access current and relevant knowledge or information that could facilitate the accomplishment of their routine activities. ICT in agricultural extension is significant, especially now that its use has witnessed upsurge in almost all aspects of life. The ability of the extension workers to access expert knowledge from the other actors in the agricultural knowledge and information system will go a long way in accomplishing their jobs as front liners in agricultural extension delivery system. One way of doing this is by the means of using information exchange mechanism over the cyber space, the imaginary space behind the interconnected computer network through telecommunication. This has been noted as a crucial part of extension development (Martins et al., 2001). It has the capacity to provide access to knowledge to extension workers within a short period of time.

The need for ICT in agricultural extension is further informed by the fact that agriculture is highly dynamic and progress in the sector is almost a daily affair. Research findings which go a long way in bringing about changes in agricultural production, processing and storage methods are continuously being generated at research stations. However, due to gap in communication between research stations and extension workers on the one hand and among extension workers on the other hand, these promising research findings usually become obsolete by the time they reach the extension workers. As a result, farmers receive information or knowledge that is out of date. This situation cannot bring about meaningful transformation of the agricultural sector, which is required for ensuring food security, employment generation, poverty reduction and the overall economic development of the rural communities. For the agricultural sector to truly transform, it is necessary that the frontline extension workers have access to current and up to date agricultural knowledge/information for onward transmission to farmers. It is against this backdrop that this study was designed to examine the accessibility and utilization of ICT by extension workers in Borno State, Nigeria. The specific objectives of the study are to:

i. identify the various types of ICT used by the respondents;
ii. examine the level of utilization of ICT for extension purposes;
iii. identify the factors that influence the utilization of ICTs by the respondents; and

70
iv. examine the constraints to utilization of ICT among the respondents.

Methodology

The study was conducted in Borno State. Borno State is located in the North Eastern part of Nigeria. The state lies between latitudes 11°N and 14°30’N of the Equator and longitude 10°E and 15°E of the Meridian (Ajaegbun et al, 2000), Covering a land area of 6,816 square Kilometers and having population of 4,151,193 (NPC 2006). The state has a total of 536,222 farming families and 253 extension workers (Idrisa and Ogunbameru, 2008). The state is divided into three agricultural zones – Zone one has its headquarters in Biu LGA, while zone two and three have their headquarters in Bama and Kukawa LGAs, respectively. From each of the zones, 50 respondents were randomly selected for this study and subsequently administered questionnaires. One hundred and thirty eight copies of the questionnaire were received successfully and analyzed for this study. The main dependent variables used in the study were the access to ICT facilities and the utilization of ICT facilities for accessing relevant information for extension purposes. Access to ICT facilities was measured in terms of the frequency of use of a particular ICT facility by extension workers. On the other hand, utilization of ICT was measured in terms of the appropriateness of a particular ICT facility in providing information relevant to the needs an extension worker (i.e specific information as against general information). Both descriptive and inferential statistics were used to analyze the data for this study. Descriptive statistical tools, mainly the frequency and percentages were used to achieve objectives I, II and IV while inferential statistical tool, the Tobit regression model was used to achieve objective III.

Results and Discussion

Socio-economic characteristics of the respondents

Entries in Table 1 show the socio-economic characteristics of the respondents. The results show that 44.20% of the respondents were between 31 to 40 years of age with mean age of 38 years. This implies that agricultural extension workers in the study area were in their middle ages. The study also reveals that majority (90.58%) of the respondents were males, implying that males dominated agricultural extension in Borno state. In a study of the influence of ICT on the dissemination of agricultural information among urban farmers in the northern Guinea Savannah zone of Nigeria, Sanusi et al., (2010) found that more than half of his respondents were youths (30 years of age and below). However, the study did not find any significant relationship between age of the respondents and their utilization of ICTs for extension purposes. More than half (54.35%) of the extension agents had 15-20 years working experience with average working experience of 18 years. The findings further show that 52.17% of the extension worker had Higher National Diploma as their highest educational qualification. This implies that they should be able to appreciate the use of ICTs in their agricultural extension services. Arokoyo (2005) identified low level of education as a constraint to ICT utilization by extension workers.
Table 1

Distribution of respondents based on their socio-economic characteristics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-30</td>
<td>12</td>
<td>08.00</td>
</tr>
<tr>
<td>31-40</td>
<td>69</td>
<td>46.00</td>
</tr>
<tr>
<td>41-50</td>
<td>55</td>
<td>36.67</td>
</tr>
<tr>
<td>&gt;50</td>
<td>14</td>
<td>09.33</td>
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<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>125</td>
<td>83.33</td>
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<tr>
<td>Female</td>
<td>25</td>
<td>16.67</td>
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<td>Working experience (years)</td>
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<td></td>
</tr>
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<td>3-8</td>
<td>11</td>
<td>07.33</td>
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<tr>
<td>9-14</td>
<td>28</td>
<td>13.00</td>
</tr>
<tr>
<td>15-20</td>
<td>75</td>
<td>50.00</td>
</tr>
<tr>
<td>&gt;20</td>
<td>36</td>
<td>24.00</td>
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<tr>
<td>Educational level</td>
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</tr>
<tr>
<td>SSCE/TCII</td>
<td>3</td>
<td>02.00</td>
</tr>
<tr>
<td>OND</td>
<td>44</td>
<td>29.33</td>
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<tr>
<td>HND</td>
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<td>52.00</td>
</tr>
<tr>
<td>BSc</td>
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<td>16.00</td>
</tr>
<tr>
<td>MSc</td>
<td>1</td>
<td>00.67</td>
</tr>
</tbody>
</table>

Source: Field survey data 2012

Access to ICT facilities by respondents

The various ICT facilities used by the respondents are shown in Table 2. The results indicate that the radio was the most frequently accessed source of information among the respondents. This could be because of the relative popularity of the radio as a source of information among rural dwellers. Such popularity of the radio as a source of information could be due to its affordability and accessibility of its signals. The reliance of other sources of information like the television and the computers on electricity can make them less popular in rural areas. Aroko (2003) posited that access to radio is extensive compared to any other ICT for persons living in rural areas. This was followed by the television, the mobile telephone (GSM) and the internet.

Table 2

Distribution of respondents based on ICTs used in accessing extension information

<table>
<thead>
<tr>
<th>Type of ICT</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Always (daily)</th>
<th>Sometimes (at least once/week)</th>
<th>Rarely (once/month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Television</td>
<td>38</td>
<td>25.33</td>
<td>62</td>
<td>41.33</td>
<td>20</td>
</tr>
<tr>
<td>Radio</td>
<td>74</td>
<td>49.33</td>
<td>40</td>
<td>26.67</td>
<td>06</td>
</tr>
<tr>
<td>Mobile Telephone</td>
<td>39</td>
<td>26.00</td>
<td>49</td>
<td>32.67</td>
<td>32</td>
</tr>
<tr>
<td>Telephone (GSM)</td>
<td>46</td>
<td>30.67</td>
<td>22</td>
<td>14.67</td>
<td>52</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2012
Utilization of ICT facilities for accessing extension information

Entries in Table 3 show the types of information sourced through ICT by respondents. The information covers areas such as: improved crop varieties and crop husbandry, sources/utilization of agricultural inputs, storage/processing techniques, market linkages/commodity prices, livestock husbandry, home management/nutrition and cooperatives/farmers organization. The Table also shows the role played by the various types of ICT used as source of information in these areas. From the results, the internet is the leading source of information in virtually all the areas, except information on cooperatives/farmers organization where the radio was the leading source of information. This was followed by the radio, which was ranked first as information source on cooperatives/farmers organization, ranked second in three other areas and ranked third in five other areas (Table 3).
### Table 3

<table>
<thead>
<tr>
<th>Type of information</th>
<th>Television</th>
<th>Radio</th>
<th>Mobile telephone (GSM)</th>
<th>Internet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>%</td>
<td>Frequency</td>
<td>%</td>
</tr>
<tr>
<td>Improved crop variety and crop husbandry</td>
<td>31</td>
<td>20.67</td>
<td>42</td>
<td>28.00</td>
</tr>
<tr>
<td>Sources and utilization of farm inputs</td>
<td>36</td>
<td>24.00</td>
<td>40</td>
<td>26.67</td>
</tr>
<tr>
<td>Storage and processing techniques</td>
<td>30</td>
<td>20.00</td>
<td>31</td>
<td>21.33</td>
</tr>
<tr>
<td>Market linkages and commodity prices</td>
<td>12</td>
<td>08.00</td>
<td>18</td>
<td>12.00</td>
</tr>
<tr>
<td>Livestock breeding techniques</td>
<td>15</td>
<td>10.00</td>
<td>20</td>
<td>13.33</td>
</tr>
<tr>
<td>Animal husbandry</td>
<td>13</td>
<td>08.67</td>
<td>18</td>
<td>12.00</td>
</tr>
<tr>
<td>Animal health and management</td>
<td>15</td>
<td>10.00</td>
<td>15</td>
<td>10.00</td>
</tr>
<tr>
<td>Home management and nutrition</td>
<td>28</td>
<td>18.67</td>
<td>32</td>
<td>21.33</td>
</tr>
<tr>
<td>Cooperatives and farmer organization</td>
<td>43</td>
<td>28.67</td>
<td>58</td>
<td>38.67</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2012

The mobile telephone (GSM) followed the radio in importance as source of information for extension purposes, while the television ranked fourth in importance. The possible reason for the Internet ranking first as the source of information for extension purposes could be attributed to the fact that information obtained through the internet are specific and in most instances, they directly address the issues relating to the areas on which the extension worker seeks information. Sometimes, extension workers access the websites of research organizations, other extension outfits or their fellow extension worker to get information on their specific needs. In most instances, such information come in tandem with the needs of the extension workers. On the other hand, information obtained through radio and television programmes may not directly address the needs of a particular extension worker. The programmes are mostly designed with general perspective.
Effects of selected socio-economic characteristics of respondents on ICT utilization

Table 4 shows the results of regression analysis between the socio-economic characteristics of respondents and ICTs utilization. The results show that Age of the respondents was significantly related to the utilization of ICTs among the respondents, but negatively ($\rho \leq -0.05$). This suggests that younger extension worker were better able in the utilization of ICTs compared to their counterpart who are of older age. This can be an advantage to extension service in Borno State as more than half (52%) of the respondents are 40 years of age or younger. In a study of ICT use among rural people in Oyo State, Nigeria, Adekoya (2006) found that age of respondents was negatively related to the utilization of ICTs. Entries in Table 4 also revealed that educational level of the respondents had a significant relationship with the utilization of ICTs ($\rho \leq 0.01$). This underscores the importance of education in the access to and utilization of ICTs by extension worker. The finding implies that the higher the level of education, the higher would be the level of ICT utilization by an extension worker and vice versa. The working experience of the respondents was also significantly related to the utilization of ICTs ($\rho \leq 0.05$). This implies that extension worker with more working experience were better able to utilize ICTs compared to their counterpart with less working experience.

Table 4
Regression analysis of the effects of socio-economic characteristics on utilization of ICTs for sourcing extension information

| Socio-economic variable | Coefficient | Std. Error | Z     | P>|z|   | (95% Conf. Interval) |
|-------------------------|-------------|------------|-------|-------|---------------------|
| Age                     | -.6723619   | .2962722   | -2.27 | 0.023* | -1.253045 to -0.0916791 |
| Sex                     | .4067453    | .2688421   | 1.51  | 0.130  | .9336661 to .1201756 |
| Education               | .040479     | .03907     | 1.021* | 0.0165914 to 0.006419 |
| Working Experience      | .0000249    | .0000115   | 2.15  | 0.031* | 2.230806 to .0000475 |
| Cons                    | .189562     | .73451     | 0.26  | 0.796  | 1.250051 to 1.629175 |

***= Significant at 1%
**= Significant at 5%
Source: Computed from data, 2012

Constraints to effective use of ICT for extension purposes

The leading constraint to effective utilization of ICTs as revealed by 78.67% of the respondents was lack of electricity (Table 5). Power supply is erratic and unstable in most rural areas in Nigeria. This poses a major challenge to the use of ICTs for the transformation of the agricultural sector in Nigeria. Non availability of the ICT facilities, such as computers ranked second as reported by 62.00% of the respondents. Access to ICT is crucial to the utilization of the facilities. Most of the facilities such as the Internet Café are located only in major towns. Extension workers who are supposed to be resident in rural areas and serving farmers may not have adequate access to them. Other factors that serve as constraints to the utilization of ICTs among extension workers in Borno State are low technical know-how among...
the extension workers and poor connectivity of the internet services as revealed by 30.67% and 25.00% of the respondents, respectively.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor electricity services</td>
<td>109</td>
</tr>
<tr>
<td>Non-availability of facilities</td>
<td>86</td>
</tr>
<tr>
<td>Low technical know-how</td>
<td>42</td>
</tr>
<tr>
<td>Poor internet connectivity</td>
<td>35</td>
</tr>
</tbody>
</table>

Source: Field survey data, 2012

### Conclusion and Recommendations

This study examined the utilization of Information and Communication Technologies for the purpose of extension services by extension workers in Borno State. From the results of this study, it was concluded that the main ICT facility used by the extension workers was the radio. It was also the conclusion of this study that even though the Internet was used by only few of the respondents, it was still the most important sourcing information for extension purposes. The main constraints to the utilization of ICTs for extension purposes by the extension workers include poor infrastructure (e.g. Electricity) and non-availability of internet facilities.

Based on the findings of this study, it was recommended that:

- Rural areas should be provided with necessary infrastructure such as electricity network so as to bring services like internet closer to the people.
- Extension workers should be encouraged to upgrade their level of education in general and be sponsored for training in the use of ICTs in particular so as to enable the source and disseminate up-to-date information on agriculture. This will go a long way in transforming the agricultural sector.
- Young graduate should be encouraged to take up the job of agricultural extension so as to bring in their youthful knowledge and skills into extension services for effective transformation of the agricultural sector.

### References


submitted to the School of Postgraduate Studies, Federal University of Technology, Oweri (Un-published).


Building the capacity of agricultural extension personnel for effective implementation of agricultural transformation agenda in Nigeria

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Abstract
This paper reviews the capacity (number, quality and motivation) of the extension personnel in Nigeria; and describes farmers’ perception of the quality of extension service delivery using evidences from literature, reports of organizations as well as experiences from field research. Findings reveal a tremendous shortage in the number and quality of extension personnel across the country as major reason for the poor performance of the ADPs thereby leaving no hope for the “beautiful” transformation agenda. This paper strongly recommends immediate recruitment of new hands as well as full implementation of a well-designed capacity building programme so as to ensure a sustainable extension service delivery system where extension personnel can operate in the expected commercial (agriculture-driven) economy.

Keywords: Capacity building, training, extension personnel, sustainability, Agricultural transformation Agenda (ATA)

Introduction
Capacity building is the ability of people, organization and society as a whole to manage their affairs to achieve set goals. The existence of capacity is indicated by the functional presence of one or the combination of the following: viable institutions and related organization; commitment and vision of leadership, financial and material resources; and skilled human resources. In agricultural extension, capacity building is the process whereby relevant stakeholders and organizations unleash, strengthen, create, adapt and maintain capacity over time, usually with the objective of assuring sustainable agricultural growth and improving the lives of the stakeholders (Eremie, 2006). It requires the acquisition of individual skills as well as development of opportunities to put the skills to productive use (Issa et al., 2010). The task of transforming agriculture from the shackle of peasantry to a modern one (as embedded in the Agricultural Extension Transformation Agenda (AETA) under the overall Agricultural Transformation Agenda (ATA) requires extension personnel with good mental and physical ability to give the maximum output. Extension personnel must be skilled in the following: technical subject-matter area, extension service administration and operation, human resource development, programme development process, pedagogical skills, communication strategies, and evaluation techniques (Issa, 2010). This will ensure a high level of professional competence in the discharge of official functions as may be demanded of him/her.

The roles of various stakeholders in the ATA should be clearly spelt out. The 2001 Agricultural Policy was perhaps the first to address the issues of public agricultural
extension service in Nigeria with particular reference to, the roles and responsibilities of the various tiers of government and the private. The new policy thrust was premised on the fact that “self-sufficiency in food production (as embedded in the 1988 Policy) was too limited in scope. Policy objective must transcend self-sufficiency to cover food security” (FMARD, 2002). In order to achieve the objective of food security, the 2001 agricultural policy assigned roles and responsibilities to the different tiers of government and the private sector. However, the participation of the private sector in agricultural research and extension has remained low and the most sited excuse has been “the inconsistencies and somersaults" in government policies.

Although agricultural extension is on the concurrent list of the constitution, the federal government to-date, has always taken the responsibility for a major portion of the funding, policy formulation and direction, while the States’ Agricultural Development Projects (ADPs), are the primary agencies responsible for public extension delivery at the grassroots nationwide. The quality of staff and the resources of the Local Government Authorities (LGAs) are such that their participation in agricultural extension delivery has only been very minimal, as against the provisions. Even with this policy in place, none of the three tiers of government has had the commitment and the will power to implement the tenets of the document with respect to the financing and provision of an effective and efficient agricultural extension service in Nigeria. Worse still, most of the local governments chairmen are neither aware of the document nor its provisions. (Arokoyo, 2009).

Against this background, this paper reviews the capacity (number, quality and motivation) of the extension personnel in Nigeria; and assesses their training needs using evidences from literature, reports of organizations as well as experiences from field research.

The Nigeria Agricultural Transformation Agenda (ATA)

Nigeria investment in agriculture is exceptionally low averaging approximately 2% of government expenditure. This is exemplified by poor ranking in agricultural indices e.g. mechanization intensity of 10 tractors per 100 ha of land (Indonesia is 241 tractors per 100ha); irrigation of 0.8% of arable land (Thailand has irrigated 28% of arable land). Nigeria is the World largest importer of US wheat to the tune of N635b per annum; the second largest importer of rice N356billion per annum. Sugar and fish importation remains N217 and N97 billion per annum. Food importation grows at 11% per annum. Unfortunately, the imported items are those that can be produced in abundance in the country. This ugly situation prompted the formulation of ATA to revitalize the agricultural sector.

The ultimate goal was to create an industrialized, high growth, diversified economy, creating jobs and wealth as well as providing security for the people. This is intended to be achieved through i) import substitution agricultural development; ii) export-oriented agricultural sector; iii) growing value-added agro-processing sector; and iv) backward integration into higher value added manufacturing. Provision of correct policy, regulations and efficient administrative framework also remained a major objective. Under the arrangement, the Government intended to i) focus on agriculture as a business and not as development project; ii) focus on value chain for commodities where Nigeria has comparative and competitive advantage; iii) develop strategic partnership (with State Government, local Government, related ministries,
private sector, farmers groups and civil society) to stimulate investment to drive the market-led agricultural transformation; and iv) focus sharply on youth and women (FMARD, 2011). The commodities being promoted under the value chain approach include cassava, rice, cocoa, soybean, sorghum, maize, oil-palm, cotton, livestock, fisheries and horticulture.

To effectively drive the ATA, an Agricultural Extension Transformation Agenda (AETA) was articulated with the following objectives:

i) To establish a Federal Department of Agricultural Extension (FDAE) which will oversee, monitor and provide the leadership needed for an efficient and effective agricultural extension and advisory service delivery in Nigeria.

ii) To review the agricultural extension policies within the subsisting agricultural policies and recommend appropriate policies that will ensure the effective participation of all stakeholders in a stable policy environment and adequate funding for the delivery efficient and effective agricultural extension and advisory services.

iii) To recommend appropriate institutional structures and arrangements for the delivery of effective and efficient multi-plural agricultural extension and advisory services in Nigeria, using the value chain approach.

iv) To recommend demand-responsive extension systems/approaches and tools that will ensure the delivery of efficient and effective agricultural extension and advisory services for all the multi-actors in the targeted commodity value chains of interest to government.

It is expected that the FDAE will remain focused and committed to the stated objectives bearing in mind the political circumstances of the country.

Agricultural Extension Personnel (AEP)

Agricultural extension personnel include all professional staff working in the extension organization. Importantly, the staff of extension component of the ADPs i.e. Director of extension, zonal extension officers (ZEOS), block extension supervisors (BESs), block extension agent for Women in Agriculture (BEA/WIA), and village extension agents (VEAs). Other categories of extension personnel include those who work directly with the Ministry of Agriculture including the newly created Federal Department of Agricultural Extension (FDAE). Others are found in the research institutes across the country. Possession of basic professional training in agricultural extension at a degree level remains the hub. However, OND and HND holders abound in the ADPs across the country. For effective job performance, the number and qualification of such personnel must not be compromised.

Training Needs and Expected Capacity Building

Using the value chain approach requires a more knowledge and skills-based, demand-responsive extension and advisory services which make capacity building an absolutely important requirement which will be addressed using a public-private-partnership approach (PPP) with appropriate incentives. Capacity building will cover the following groups: unemployed youths and graduates, all categories of field extension staff including agricultural quarantine; farmers, producers and processors,
and all other actors on the targeted value chains and the private advisory service providers. Continuous direct link with training institutions remains very vital for the success of any capacity building effort. A clear and definitive career path must be created for extension personnel in the nation’s ADPs. The staff of the new Federal Department of Extension should be trained to effectively posit them for the future responsibilities of the Department. Experience professionals should be mopped from relevant agencies to hold the Department very strongly. It is expected that professionalism will be a major consideration for the staffers of the new Department. NAERLS and NPAFS (2011) reported 31 areas of training needs across the ADPs. Data gathering skills, crop improvement and pests and diseases management, pre- and post-season training other refresher trainings as well as use of computer were the most prominent areas of training needs (Table 1).
### Table 1
Training Needs of ADPs in Nigeria

<table>
<thead>
<tr>
<th>Subject Matter of Training</th>
<th>No. of ADPs Requesting</th>
<th>ADPs</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounting management</td>
<td>1</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>Agricultural extension and communication methods</td>
<td>6</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>Agricultural policy analysis</td>
<td>1</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>Agricultural products storage and preservation</td>
<td>3</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>Agricultural Projects Monitoring &amp; Evaluation</td>
<td>3</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>Agricultural projects planning and management</td>
<td>9</td>
<td>8.1</td>
<td></td>
</tr>
<tr>
<td>Artificial insemination in cattle</td>
<td>1</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>Audio-visual Media Production</td>
<td>2</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>Community Demand-driven Development approach</td>
<td>2</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>Conflict resolution &amp; management skills</td>
<td>1</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>Crop improvement and pests/diseases management</td>
<td>12</td>
<td>10.8</td>
<td></td>
</tr>
<tr>
<td>Farm Radio &amp; TV programmes production</td>
<td>1</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>Farmer Field Schools (FFS) extension approach</td>
<td>2</td>
<td>1.8</td>
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<tr>
<td>Fisheries culture, nutrition and breeding</td>
<td>5</td>
<td>4.5</td>
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<tr>
<td>Food processing</td>
<td>1</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>Full-time academic training courses</td>
<td>1</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>Human resource management and office administration</td>
<td>5</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>Livestock extension methods</td>
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<td></td>
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<tr>
<td>Livestock pests &amp; diseases management</td>
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<td>Livestock production and nutrition</td>
<td>2</td>
<td>1.8</td>
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<tr>
<td>Management of agricultural extension services</td>
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<td>Market linkages</td>
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<td>Meteorological training</td>
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<td>On-farm soil erosion control</td>
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<td>Participatory Agricultural Extension (PAE) approach</td>
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<td>Participatory training techniques</td>
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<td>Pre-season, post-season &amp; other refresher trainings</td>
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<tr>
<td>Records and information management</td>
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<td>2.7</td>
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<tr>
<td>Survey methods and statistical analysis packages</td>
<td>8</td>
<td>7.2</td>
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<tr>
<td>Use of Computer, Web and other ICTs in agriculture</td>
<td>13</td>
<td>11.7</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td>99.9</td>
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</table>

*Source: NAERLS and NPAFS (2011)*
Current Status of Extension Personnel in Nigeria: Number, quality, motivation

Very high Extension Agent (EA): Farm family ratio as well as poor staffing and non-replacement of retired staff had been long identified as the major problem plaguing extension service thereby rendering the country’s ADPs inactive. In 2012, the number of extension agents reduced in many States owing to retirements, mortalities and movement of staff to other jobs (NAERLS, 2012).

Extension commonly has staffing problems. In most cases, extension organizations have posts that are either vacant or filled by under-qualified personnel (Contado, 1997). Table 2 shows that most ADPs are grossly understaffed. NAERLS and NPAFS (2011) reported that extension staff are poorly exposed to relevant trainings due to funding inadequacy. This has resulted in increased EA: Farm family ratio in all the States. Given the mission, scope of the work, and available resources, the ADPs are in dire need of not just full complement of frontline extension agents but qualified and well trained ones in order for the system to function properly in capacitating the rural actors in a bid to transform the country’s agriculture.
## Table 2
Adequacy and Quality of Staffing in ADP (2008 – 2011)

<table>
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<tr>
<th>Zone</th>
<th>State</th>
<th>Adequacy and Quality of Staffing</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
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<td>NA</td>
<td>Adequate</td>
<td>Fair</td>
<td>Inadequate</td>
<td></td>
</tr>
</tbody>
</table>


NA = Data Not Available
Farm families: The high number of farm families across the country underscores the need for more village extension agents (VEAs) if farmers must be covered effectively. Kano State had the highest number of farm families of 840,095 followed by Akwa Ibom State with 685,095 farm families (NAERLS and NPAFS, 2010).

EA:Farmer ratio: The UN standard for EA: Farmer ratio remained 1:500 – 800. This ratio is the ideal for ease of coverage by VEAs. Unfortunately, the realization of this ratio has being a wild goose chase. Bauchi, Yobe and Ebonyi States had the highest number of VEAs of 306, 265 and 257 respectively (NAERLS). However, only Ebonyi recorded an increase of 65% over the 2010 record. The EA:Farm family ratio record was highest in Bayelsa (1:10,568); Anambra (1:9,409); and Cross-Rivers (1:4,729). In each of the States, the large ratio was worsened by the low number of frontline EAs on board. This trend of dwindling number of VEAs had persisted over the years (Table 2) as most ADPs could not recruit new VEAs even with the dire needs.

Number of Subject Matter Specialists (SMSs): The SMSs (who are the immediate teacher of extension agents) are the main link between the research institutes and the ADPs. Proven and relevant technologies from research are taught by the SMSs to the VEAs. Feedback to research as a way of evaluating progress is also achieved through the SMSs during the FNTs and MTRMs. Hence, the availability of SMSs in different agricultural enterprise – crop, livestock, fisheries, agro-processing and women-in-agriculture – remains a major performance indicator in the ADP system. NAERLS and NPAFS (2011) reported that Taraba State had only 1 SMS, Yobe State had only 7 SMSs. Generally, there is low number of SMSs across the country. This implies that technology transfer is inefficient.

Number of Block Extension Supervisors (BESs): The role of BESs is very crucial in extension especially under the Training and Visit system. The BESs are the frontline supervisory agent. The number of BES should depend on the number of VEAs with a standard of 1:8 BES:VEA ratio. Ebonyi State has an average of 1:11 BES:VEA ratio. Most States ADPs have low BES:VEA ratio. This should be an advantage to supervision all things being equal.

Number of BEA(WIA): Extension contact to women (which is a major avenue where women can be empowered in order to meet their challenges) is bedeviled by lack and inadequacy of BEA(WIA) in most ADPs. NAERLS and NPAFS (2011) reported that Jigawa, Kano, Osun, Cross-Rivers and Bayelsa States did not have BEA(WIA) while Edo State had only 1. Zamfara State had the lowest (56) record of extension visit to farmers according to NAERLS and NPAFS (2011). This indicates that technology transfer is unrealistic. In order to improve the staffing situation in ADPs, an innovative Federal government intervention is required.

Quality of Extension Service as Perceived by Farmers

Figure 1 indicates the rating of the quality of extension services as perceived by farmers across the agro-ecological Zones. It indicates a general score of between “fair” and “just good”. This gives the impression that farmers do not derive total satisfaction from the extension system as it is currently operated and do expect better extension delivery services (Ikani et al., 2010).
Way Forward:

1. **Professionalization of extension practice**
A cursory look at the nation’s ADPs reveals that there are Programme Managers (PMs) and Directors of extension (including other practitioners) who do not have background in agriculture. A situation where extension work has been reduced to ‘everybody’s’ work (thereby making mockery of the underlying principles of extension) is not too tidy. There is need for extension policy to regulate its practice. This can be achieved by creating a professional institute of agricultural extension (IAE). A long-term human development programme should be instituted in order to ensure dynamism within the extension organizations.

2. **Review of Curriculum at Various Levels for Extension Education**
Curriculum is about subjects taught at an educational institution, or the topics taught within a subject. Presently, products from our agricultural institutions are poorly equipped. For practical engagement in modern agricultural operation, the curriculum should not place emphasis on theories and paper qualifications only. To produce next generation farmers who will transform our agricultural development the followings are recommended:

- The National Board for Technical Education (NBTE) should overhaul the current colleges of agriculture curriculum to lay more emphasis on practical and skill acquisitions during pre-service and in-service trainings at the diploma levels.
- Industrial attachments of students of agriculture for a minimum of six months in the course of their training to well establish farms should be mandatory.
- The newly established FDAE should be fully engaged in the standardization and accreditation of curriculum operated in the agricultural tertiary institutions.
- Agricultural science should be made compulsory in secondary schools to catch the interest of the youth young in modern farming principle.
Modern agricultural entrepreneurship should be made a core course in all the departments of agriculture, to help produce self-employable market oriented farmers.

Evidence of real skill acquisition should bases for offer of certificates on graduation and employment.

3. **Review of Allowances of Extension Workers**

Extension staff is at 3 tiers of government and they should be provided for appropriately as follows:

1. At the federal level, they should be provided with motor vehicles and allowances to enable them supervise and monitor the activities;
2. At the State level, vehicles should be provided and allowances for the field activities;
3. At the Local government level where the bulk of extension agents should be either BESs, BEAs and EAs, motor cycles should be provided to them on loan and appropriate allowances given for the maintenance.
4. Other field services allowances should be paid to all categories of staff depending on the rank and activities.
5. Hazard allowances would be paid because of the risk involve in extension work.

**Conclusion and Recommendations**

This paper strongly recommends immediate recruitment of new hands as well as full implementation of a well-designed capacity building programme so as to ensure a sustainable extension service delivery system where extension personnel can operate in the expected commercial (agricultural-driven) economy as enshrined in the ATA.

**References**


Training Needs of Pineapple Farmers in Enugu State, Nigeria

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Abstract

The study identified training needs of pineapple farmers in Enugu State, Nigeria. Purposive sampling technique was used to select two zones (Awgu and Nsukka zones), four blocks, eight circles and eighty pineapple farmers that were used for the study. Some of the data were analysed with percentage and mean score while some were presented in charts. Majority (77.5%) of the respondents did not have contact with extension agents in 2011 and they sourced information on pineapple from neighbours (86.3%). The mean annual expenditure and income from pineapple were ₦27,568 and ₦235,530 respectively. Majority (96.2%) of the respondents had no training on processing and preservation of pineapple and off season production of pineapple (85%). Majority of the respondents indicated that training on pineapple should be organized by researchers (65%) through interpersonal communication (83.8%) using local language (Igbo) (78.8%). Provision of effective micro-credit facilities (M=2.84) and stability of government policy (stability of price of pineapple) (M=2.68) were perceived by the respondents as major strategies that will improve pineapple production in the area. The study encouraged building capacities of pineapple farmers through informal training especially in the areas of processing, preservation and off-season production of pineapple so that they can face challenges of the enterprise, boost their farm size and income.

Key words: Training needs Pineapple Farmers Enugu State

Introduction

Pineapple is a tropical fruit. It is also a delicious fruit that is eaten fresh, canned or juiced. Until recently, about 80% of pineapple produced in Nigeria came from small scale farms managed under mixed cropping systems (Fawole, 2008). Current production figures show that Nigeria is the 6th largest producer of pineapple in the world and if current production and marketing trends are encouraged, commercial production for export and consumption will be enhanced (FAO/World Bank, 1999 in Fawole, 2008). Pineapple current production in Nigeria is about 17,000 metric tons per annum (Onwualu, nd). According to the author, Nigeria can produce 364,490 metric tons of pineapple per annum if its production challenges are properly addressed.

The popularity of pineapple is due to its sweet-sour taste containing 15% sugar, malic and citric fruit acids. It is also high in vitamin B1, B2, B6 and C. Its protein digesting enzyme, bromelain seems to help digestion at the end of a heavy protein meal (Nwosu, 2011). Pineapple is an excellent cerebral toner; it combats loss of memory, sadness and melancholy (Joy, 2013). Pineapple has many by products that are very much needed by the people. It can be made into jam, juice, vinegar and...
other different food types. It can also be made and processed into a high quality cloth. Its covering and other waste coming from canning may be used as livestock feeds. Pineapple is therefore an economic crop that has encouraging potentials for foreign exchange earnings (Fawole, 2008).

Today's work environment and problems require that workers be skilled in performing complex tasks in an efficient, cost-effective, and safe manner. Similarly, for agriculture to become sustainable, it needs more cohesion, stronger voice and more than ever, skilled, active, proactive and visionary farmers that will address key issues that affect the sector. Also, enhancing agricultural production in Nigeria is often linked to farmers’ access and use of agricultural information (Fawole, 2008). Farmers can adopt/use these information well when they have been properly trained on how to apply them.

Training by nature, is an organized activity aimed at imparting information and/or instructions to improve the recipients performance or to help him or her attain a required level of knowledge or skill (New business dictionary.com). Hence it is an activity leading to skilled behaviour (Compare infobase Limited (nd)) and a performance improvement tool. Since, it is counter-productive to offer training to individuals who do not need it or to offer the wrong kind of training (HR Guide 2012), successful training needs analysis identifies those who need training and what kind of training is needed thereby putting training resources to good use and enhancing productivity.

Given the importance of pineapple and the possibility of exceeding current production estimates in Nigeria, it becomes pertinent to identify training needs of pineapple farmers which will serve as critical factors that needs to be addressed in other to ameliorate challenges and hence realize potentials of the fruit. In view of the aforementioned facts, the study assessed training needs of pineapple farmers in Enugu State, Nigeria. Specifically, the study examined characteristics of pineapple farmers in the study area, sources of information, areas of training and strategies for enhancing pineapple production in the area.

**Methodology**

The study was carried out in Enugu state, Nigeria. The state has seventeen Local Government Areas and six agricultural zones. Pineapple farmers in the state constituted the population for the study. A multi-stage sampling technique was used in the selection of the respondents. From the six agricultural zones, two (2) zones; (Awgu and Nsukka) were purposively selected because of their high involvement in pineapple production. Two (2) blocks were also purposively selected from each of the selected zones because of the same reason given above. This gives a total of four (4) blocks for the study. From each of the selected blocks, Two circles where pineapple farmers dominate were also purposively selected from each of the selected blocks giving a total of eight (8) circles for the study. Ten pineapple farmers were purposively selected from each of the circles giving a total of eighty (80) respondents for the study.

Data were collected from the respondents through the use of structured interview schedule. It contained relevant questions based on the objectives of the study.
Respondents were asked to indicate the number and types of organization(s) they belong to, their sources of information on pineapple production, number of extension contact in 2011, total income and expenditure on pineapple production in one season (2011).

Farmers were asked to tick from the list provided areas they had training on pineapple production. Some areas indicated in the list were irrigation, fertilizer application, pest and disease control etc. They were also asked to indicate who they will want to organize training for them, resource person, method and language that they will want to be used in training them. List of perceived enhancing factors was provided in a three (3) point Likert-type scale with responses as; to a great extent (3), to a little extent (2), and to no extent (1) with a mean of 2.0 in other to ascertain strategies for enhancing pineapple production in the area. Any variable with a mean score higher or equal to 2.0 was regarded as a major strategy while variable with a mean score less than 2.0 was regarded otherwise. Some of the data were analysed with percentage and mean score while some were presented in charts. These analyses were executed with the help of Statistical Product and Service Solution (SPSS) version 16.

Results and discussions

Membership of social organization

Table 1 reveals that 93.8% of the respondents belonged to social organizations. Among respondents that belonged to social organizations, 73.8% were members of religious group, 25% of them belonged to farmers group while 20% and 8.8% of them belonged to cooperative and political organizations, respectively. Involvement of farmers in social organizations especially farmers group and cooperative could enhance diffusion of information and reception of government assistance in form of loans, subsidies and other inputs.

Agricultural extension contact

Table 1 reveals that 77.5% of respondents didn’t have contact with extension agents in 2011 while 22.5% had contact with extension agents. This finding is in line with what is happening in most developing countries like Nigeria where farmer-extension contact is almost non-existent probably due to poor remuneration and logistical problems.
Table 1
Distribution of the respondents according to their social characteristics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Percentage (n=80)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membership of social organization</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>6.2</td>
</tr>
<tr>
<td>Yes</td>
<td>93.8</td>
</tr>
<tr>
<td>*Social organization(s) belonged to</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>6.2</td>
</tr>
<tr>
<td>Farmers group</td>
<td>25</td>
</tr>
<tr>
<td>Religious group</td>
<td>73.8</td>
</tr>
<tr>
<td>Cooperative society</td>
<td>20</td>
</tr>
<tr>
<td>Political group</td>
<td>8.8</td>
</tr>
<tr>
<td>Contact with extension agents in 2011</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>22.5</td>
</tr>
<tr>
<td>No</td>
<td>77.5</td>
</tr>
</tbody>
</table>

*Multiple responses  Source: Field survey July, 2012

Sources of information on pineapple farming

Figure 1 reveals that majority (86%) of the respondents sourced information on pineapple farming from their neighbours. Those that got it from extension agents accounted for 9% while 8% and 3% of the respondents got it from radio and television respectively. It is certain that most of these farmers will not source information on pineapple production from extension agents since most of them lacked extension contact (Table 1). When farmers do not have access to formal extension services, they use other sources of information or ask other farmers and their input suppliers (Global Forum for Rural Advisory Services (GFRAS), 2012).

Figure 1: Sources of information of the respondents on pineapple production
Annual income and expenditure from pineapple production in a season/year

From Table 2, it can be inferred that 27.5% of the respondents earned more than N250,000 from pineapple in a season/year, 21.2% of the respondents earned between N1,0001 to N50,000 while 20% of them earned between N50,001 to N100,000. The mean annual income of the respondents from pineapple in a season was N235,530.

Entries in Table 2 also show that greater proportion (38.8%) of the respondents spent between N1,001 to N10,000 while 13.8% spent between N10,001 to N20,000 on pineapple production in a season/year. The mean annual expenditure of the respondents on pineapple production per season was N27,568. The finding shows that the farmers spent less and earn high income (Table2) from pineapple indicating that pineapple production is a lucrative business in the area. The finding tend to supports the fact that pineapple production has become the key source of economic growth in Costa Rica (www.rainforest.alliance.org).

<table>
<thead>
<tr>
<th>Variables</th>
<th>percentage (n=80)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual income from pineapple</td>
<td></td>
</tr>
<tr>
<td>235,530</td>
<td>5.0</td>
</tr>
<tr>
<td>No response</td>
<td></td>
</tr>
<tr>
<td>1,001-50,000</td>
<td>21.2</td>
</tr>
<tr>
<td>50,001-100,000</td>
<td>20.0</td>
</tr>
<tr>
<td>100,001-150,000</td>
<td>17.5</td>
</tr>
<tr>
<td>150,001-200,000</td>
<td>3.8</td>
</tr>
<tr>
<td>200,001-250,000</td>
<td>5.0</td>
</tr>
<tr>
<td>&gt;250,000</td>
<td>27.5</td>
</tr>
<tr>
<td>Expenditure on pineapple production</td>
<td></td>
</tr>
<tr>
<td>27,568</td>
<td></td>
</tr>
<tr>
<td>No response</td>
<td>15.8</td>
</tr>
<tr>
<td>1,001-10,000</td>
<td>38.8</td>
</tr>
<tr>
<td>10,001-20,000</td>
<td>13.8</td>
</tr>
<tr>
<td>20,001-30,000</td>
<td>10.0</td>
</tr>
<tr>
<td>30,001-40,000</td>
<td>3.8</td>
</tr>
<tr>
<td>40,001-50,000</td>
<td>10.0</td>
</tr>
<tr>
<td>&gt;50,000</td>
<td>10.0</td>
</tr>
</tbody>
</table>

Source: Field survey July, 2012

Areas respondents had training on pineapple production

Data in Table 3 show that majority (81.2%) of the respondents had no training on suitable site/land for pineapple production while (18.8%) had training on it. Selection of good site/land for specific agricultural crop is likened to productivity/yield, hence the need for these farmers to be properly trained on ideal site/land for pineapple production.
Majority (71.2%) of the respondents had no training on soil management and conservation practices while (28.8%) had training on these practices (Table 3). Many people that are engaged in farming report that their livelihood is becoming less viable due to lack of access to farmland, rising land costs, unfavourable agricultural and land tenure policies, population growth, fragmentation of holdings, over use and degradation of cultivated lands (World Bank, 2000). Training related to land/soil will help farmers to manage and conserve this important factor of production.

Table 3 show that majority (61.2%) of the respondents had training on identification of good species/varieties of pineapple while (38.8%) had no training on it. Training of these farmers on the good varieties may invariably motivate them to use them in their production in order to increase output.

As shown in Table 3, majority (85.0%) of the respondents had no training on off-season production of pineapple while (15.0%) had training on it. Since majority of these respondents did not undergo training on off-season pineapple production, it is unlikely that they will produce pineapple during off-season which tends to generate more income than main season production.

About 51% of the respondents had training on pruning techniques while (48.8%) had no training on it (Table 3). This shows that greater proportion of the farmers had training on pruning technique which is meant to remove extra suckers from a stand thereby allowing the growing ones to give maximum yield.

Table 3 further reveals that greater proportion (58.8%) of the respondents had no training on irrigation while the remaining 41.2% had training on irrigation. Since majority of these farmers did not have training on off-season production, it is likely that they will not have on irrigation which is a supplementary water supply to plants/crop especially during dry/off season.

Data in Table 3 show that majority (61.2%) of the respondents had training on fertilizer application while (38.8%) had no training on it. Majority of the respondents may have undergone training on fertilizer application because it is one of the commonest inputs used by farmers in growing their crops.

Table 3 also shows that majority (62.5%) of the respondents had no training on pest and disease control on pineapple while the remaining (37.5%) had training on it. Training the farmers on how to combat disease and pest infestation in the farm will reduce cost of production as well as increasing the quality of pineapple produced.

Entries in Table 3 show that majority (81.2%) of the respondents had no training on pineapple harvesting operation while (18.8%) had training on it. This training is pertinent as premature harvest, late harvest, poor method of harvesting etc are detrimental and can lead to heavy losses. Yet most of these farmers were not trained on it.

It is obvious in Table 3 that a greater proportion (96.2%) of the respondents had no training on processing and preservation of pineapple while (3.8%) had training on them. Processing aims at preserving the nutrients in the food in order to make them available to the consumers (Hassal, Osman and Babiker, 2005). Seasonality of
agricultural products like pineapple makes it necessary that farmers be trained on how to process and preserve this product during period they are abundant to reduce losses and ensure year round supply of this product.

From Table 3 it can be seen that majority (66.2%) of the respondents had no training on record keeping while (33.8%) had training on it. Farm records and accounts are very important as they help farmers to obtain exact knowledge about present & potential gross income and operating costs (Agriculture information bank, 2011). These information help them to manage their farms profitably.

<table>
<thead>
<tr>
<th>Variables</th>
<th>percentage (n=80)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selection of suitable site/land</td>
<td>Yes 81.2</td>
</tr>
<tr>
<td>Soil management and conservation</td>
<td>28.8</td>
</tr>
<tr>
<td>Identification of good species</td>
<td>61.2</td>
</tr>
<tr>
<td>Off season production</td>
<td>15.0</td>
</tr>
<tr>
<td>Pruning technique</td>
<td>51.2</td>
</tr>
<tr>
<td>Irrigation system</td>
<td>41.2</td>
</tr>
<tr>
<td>Fertilizer application</td>
<td>61.2</td>
</tr>
<tr>
<td>Pest and disease control</td>
<td>62.5</td>
</tr>
<tr>
<td>Harvesting operations</td>
<td>18.8</td>
</tr>
<tr>
<td>Processing and preservation</td>
<td>3.8</td>
</tr>
<tr>
<td>Record keeping</td>
<td>33.8</td>
</tr>
</tbody>
</table>

Source: field survey July, 2012

Organization of the training

Entries in Table 4 reveal that majority (65%) of the respondents indicated that they would want research institute to organize training on pineapple for them, 45% indicated government, 10% indicated NGOs, while 8.8% indicated community based organization as outfit that they would want to organize training for them. It is surprising that none of the respondents pointed out extension agency that has the mandate of training farmers on recommended practices. This exposes lapses and inefficiency of extension services in Nigeria probably due to logistic problems which may consequently undermine its contribution and impact on agricultural growth.

Method of conducting training

Table 4 further reveals that interpersonal communication (83.8%), workshop (82.5%) and demonstration (82.5%) were indicated by majority of the respondents as methods that will be used in conducting training for them. Being rural farmers who are oftentimes illiterates, they will prefer the aforementioned methods that are participatory and allow physical interactions between the trainer and the trainee with direct feedback thereby enhancing effectiveness of training.
Trainer/resource person

Data in Table 4 show that majority (88.8%) of the respondents indicated that they will prefer researchers to be their trainer/resource person, 26.3% indicated clergy while 10% indicated lecturers. Their preference for researchers may be derived from the fact that researchers generate credible information/technology on agriculture and are more likely to transfer it to farmers in an undiluted form.

Language of communication during training

Data in Table 4 show that majority (78.8%) of the respondents pointed out local language (Igbo) only; 17.5% indicated combination of Igbo and English languages while 3.8% indicated English language only as medium of communication during training. Being rural farmers who usually have poor educational status, they will prefer local language as medium of communication during training.

<table>
<thead>
<tr>
<th>Organization</th>
<th>Percentages (n=80)</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Organizers of the training</td>
<td></td>
</tr>
<tr>
<td>Government</td>
<td>45</td>
</tr>
<tr>
<td>NGO</td>
<td>10</td>
</tr>
<tr>
<td>Researchers</td>
<td>65</td>
</tr>
<tr>
<td>Community organization</td>
<td>8.8</td>
</tr>
<tr>
<td>*Method of conducting training</td>
<td></td>
</tr>
<tr>
<td>Formal training</td>
<td>13.8</td>
</tr>
<tr>
<td>Demonstration</td>
<td>82.5</td>
</tr>
<tr>
<td>Workshop</td>
<td>82.5</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>83.8</td>
</tr>
<tr>
<td>Mass media</td>
<td>47.5</td>
</tr>
<tr>
<td>Internet</td>
<td>3.8</td>
</tr>
<tr>
<td>*Trainer/resource person</td>
<td></td>
</tr>
<tr>
<td>School teachers</td>
<td>3.8</td>
</tr>
<tr>
<td>Lecturers</td>
<td>10.0</td>
</tr>
<tr>
<td>Researchers</td>
<td>88.8</td>
</tr>
<tr>
<td>Clergy</td>
<td>26.3</td>
</tr>
<tr>
<td>Language</td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>3.8</td>
</tr>
<tr>
<td>Local(Igbo)</td>
<td>78.8</td>
</tr>
<tr>
<td>Both</td>
<td>17.5</td>
</tr>
</tbody>
</table>

*Multiple responses Source: field survey July, 2012
Strategies for improving pineapple production

It can be inferred from Table 5 that all the factors in the table were perceived by the respondents as major strategies for improving pineapple production in the area. Some of these major strategies as indicated by the respondents were increased extension contact (M=2.94), investing in pineapple research to solve pineapple farmers problems (M=2.91), labour availability (M=2.89), establishment of effective farmers association to enable them solve their problem together (M=2.85), Provision of good market (M=2.84), provision of effective micro-credit facilities (M=2.84), provision of incentives and subsidies like fertilizers, improved seedlings agrochemicals etc (M=2.80) and construction of road (M=2.74). These findings may be said to agree with current policy directions in agriculture which emphasize on extending public private (including public NGO) partnerships in service and input delivery, strengthening farmers associations and demand for advisory services and tackling gaps and failures in private marketing systems (Ellis, 2004).

Table 5

<table>
<thead>
<tr>
<th>Perceived strategies</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision of effective micro-credit facilities</td>
<td>2.84*</td>
<td>0.462</td>
</tr>
<tr>
<td>Stability of government policy on pineapple enterprise</td>
<td>2.68*</td>
<td>0.546</td>
</tr>
<tr>
<td>Labour availability</td>
<td>2.89*</td>
<td>0.318</td>
</tr>
<tr>
<td>Use of organic manure only</td>
<td>2.41*</td>
<td>0.567</td>
</tr>
<tr>
<td>Construction of available road network</td>
<td>2.74*</td>
<td>0.545</td>
</tr>
<tr>
<td>Provision of irrigation systems</td>
<td>2.34*</td>
<td>0.635</td>
</tr>
<tr>
<td>Establishment of farmers association</td>
<td>2.85*</td>
<td>0.453</td>
</tr>
<tr>
<td>Involvement of youth in pineapple production</td>
<td>2.69*</td>
<td>0.493</td>
</tr>
<tr>
<td>Provision of incentives and subsidy</td>
<td>2.80*</td>
<td>0.488</td>
</tr>
<tr>
<td>Investing in pineapple research</td>
<td>2.91*</td>
<td>0.363</td>
</tr>
<tr>
<td>Increase extension contact</td>
<td>2.94*</td>
<td>0.244</td>
</tr>
<tr>
<td>Provision of good market</td>
<td>2.84*</td>
<td>0.434</td>
</tr>
</tbody>
</table>

Source: field survey, June 2012

Conclusion

Majority of the respondents were members of religious group, lacked extension contact and sourced information on pineapple production from mainly neighbors. Although most of them had no training on specific area of pineapple production, they realized big income from the business. These indicate that pineapple production is a lucrative business.

Recommendations

Based on the major findings of this work, the following recommendations were made:
1. Research institutes, universities, colleges of agriculture etc should invest in pineapple research to solve pineapple farmer’s problems. The research should focus mainly on areas like suitable land/soil for pineapple production, soil conservation and management practices, off-season production, harvesting and processing operations, as well as record keeping.
2 Agricultural extension system should be strengthened by provision of conducive environment for their operations so that output of the research can be transferred by them through training and ultimately utilized by the targeted audience for increased output.

3. Government and non-governmental organizations, like community based organisation and even patriotic citizens should embark on development programme and projects in the area. Provision of basic infrastructural facilities such as construction of good market and road network for easy transportation of agricultural produce especially pineapple from the point of production to utilization should be given utmost priority.

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Poultry farmers’ adaptation to climate change in Enugu North Agricultural Zone of Enugu State, Nigeria

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Abstract
The study surveyed the perceived effect and adaptation of climate change on poultry production in Enugu-North Agricultural Zone of Enugu State. A questionnaire/interview schedule was used to collect information from 60 poultry farmers. Percentage and mean score were used to analyze the data. Reduced body weight (M=3.1); reduced fertility (M=3.3) and reduced feed intake (M=3.1) were perceived by farmers as effects of climate change on poultry. Coping strategies used by farmers included keeping of resistant varieties (56.5%); adapting extensive poultry management (65.8%) and keeping other livestock (53.8%). Respondents perceived climate change as excessive sunshine (90%); excessive rainfall (80%) and increased incidence of drought (66%). The perceived causes of climate change included burning of fossil fuels from industries (M=4.2); burning of firewood (M=4.0) and deforestation (M=3.7). Sources of information available to the farmers were radio (33.3%); farmers’ meeting (28.3%), and friends (26.7%). Technical innovations (adaptation measures) should be made available to farmers to enable them cope with the challenges of climate change.

Keywords: Climate change, poultry farmers, adaptation

Introduction
Poultry keeping is makes an important contribution to the livelihoods of the most vulnerable rural households in developing countries. Poultry has become a popular industry for the small holders that have great contribution to the economy of the country (Nigeria). The poultry profession has assumed greater importance in improving employment opportunity and animal food production. (Olagunju and Babatunde, 2011). The poultry industry has also been described as the fastest means of bridging the protein deficiency gap prevailing in the country (Eekeren, Mass, Saatkamp and Verschuur 1995; Apantaku, Omotaya and Oyesola 1998). A report by Okonkwo and Akubuo (2001) shows that about ten (10) percent of the Nigerian population is engaged in poultry production, mostly on subsistence and small or medium-sized farms. People depend on poultry for food and poultry farming serves as part-time work to supplement the income of small and marginal farm families. Poultry production is essential activity because of its vast potential to bring about rapid economic growth, particularly benefiting the weaker or the less privileged in the community. Furthermore, it needs low capital and short period of time to make quick returns within weeks and months in case of broilers and layers, respectively (Ekunwe, Soniregun and Oyedeji, 2006)

However, it is obvious that temperature has influence on poultry farming. This influence has amplified as there is climate change across the globe. Climate change is any change in climate over time, whether due to natural variability or as a result of human activity (BNRCC, 2011). Evidence from the Intergovernmental Panel on
Climate Change (IPCC, 2007) is now overwhelmingly convincing that climate change is real, that it will become worse, and that the poorest and most vulnerable people will be the worst affected. The IPCC predicts that by 2100 the increase in global average surface temperature may be between 1.8° C and 4.0° C. With increases of 1.5° C to 2.5° C, approximately 20 to 30 per cent of plant and animal species are expected to be at risk of extinction (FAO, 2007) with severe consequences for food security.

The International Fund for Agricultural Development (IFAD, 2009) acknowledges climate change as one of the factors affecting rural poverty. While climate change is a global phenomenon, its negative impacts are more severely felt by poor people in developing countries such as Nigeria who rely heavily on the natural resource base for their livelihoods, and due to their low level of coping capabilities (Nwafor, 2007; Jagtap, 2007). Changes in climate are severely affecting agricultural production in many African countries (APF/NEPAD, 2007). Studies by Deressa, Hassan, Alemu, Yesuf et al. (2009) reveal that African’s agriculture is negatively affected by climate change and its rural poor communities rely greatly for their survival on agriculture and livestock keeping that are also amongst the most climate-sensitive economic sectors. The weather is erratic, vulnerable and unreliable to livestock farmers. Todaro and Smith (2009) conclude that worst impacts of climate change are felt by livestock farmers.

Climate changes in form of drought, temperature variability, too much sunshine and windstorm (Gueye, 2003) have negative effects on poultry production. High or low temperatures lead to diseases infection while wind may serve as agent for spread of air-borne diseases that affects poultry (Guey, 2003). Furthermore, Rajkuma, Reddy, Rama Rao, Radhika et. al. (2011) reported that poultry flocks are particularly vulnerable to climate change because birds can only tolerate narrow temperature ranges. Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC, 2001). Poultry farmers therefore need to consider making adaptations now to help reduce cost, risk and concern in the future (Farming Features, 2009). Therefore, this study answers the following questions: What are farmers perceive evidence to climate change? What are their perceive effects of Climate change? What are the effects of climate change on poultry? What adaptive measures do the farmers undertake and what are the constraints for carrying out these measures successfully.

Therefore this study was designed to ascertain poultry farmers’ adaptation measures to climate change in Enugu North agricultural zone of Enugu State, Nigeria. Specifically the study sought to: ascertain perceived evidence of climate change by the farmers; determine perceived causes of climate change by the respondents; ascertain the perceived of climate change on poultry production; determine adaptation measures undertaken by farmers; and identify constraints to the use adaptive measures.
Methodology

The population for the study comprised all poultry farmers in Enugu North Agricultural Zone of Enugu State. Six blocks were randomly selected out of eight blocks in the zone. Two cells were selected from each of the six blocks using simple random sampling procedure. A list of all poultry farmers was collected with the help of extension agents from each of the cells. Five poultry farmers were then selected by simple random sampling technique giving a total of 60 poultry farmers. Pre-tested questionnaire/structured interview schedule was developed based on objectives and used to collect data.

The socioeconomic characteristic of the respondents were measured thus: age (years), sex (male or female) etc. In order to ascertain the perceived evidence of climate change by poultry farmers, a check list was provided for them to tick accordingly. Any respondent that scored 50% and above was regarded as those that perceived evidence of climate change while those that scored less than 50% did not perceive evidence of climate change. The respondents were asked to identify the causes of climate change from the list of possible causes. Therefore, the extent to which the identified causes of climate change were perceived by the respondents were measured on five point Likert-type scale of: to a very great extent (5), to a great extent (4), to an extent (3), to a little extent (2) and to no extent (1). These values were summed up to 15 and divided by 5 to give a mean score of 3.0 The items with mean score ≥ 3.0 were regarded as perceived causes of climate change by the respondents while items with mean score < 3.0 were regarded as not perceived as causes of climate change by the respondents. The level of effects of climate change on poultry production was measured on a four point Likert-type scale of: high (4), moderate (3), low (2) and no effect (1). The values were summed up to 10 and divided by 4 to give a mean score of 2.5 The items with mean scores ≥ 2.5 were regarded as having high effect of climate change on poultry production while those with scores < 2.5 were regarded as having low effects.

In order to obtain a quantitative measure of respondents’ agreement on the use of each technique (adaptive measures) in cushioning the effects of climate change, a checklist of various adaptive measures which were obtained from literature and personal interviews, was utilized. Respondents were requested to tick the measures used in adapting to the climate change effects. Any response option (adaptive measure) with score ≥ 50% was regarded as being useful and important while items with scores < 50% was regarded as not being useful and important in cushioning the effects of climate change by farmers. In case of the constraints, a check list of possible constraints was provided and respondents asked to indicate accordingly. Thereafter, items with scores ≥ 50% were regarded as having constraints to the adaptive measures while items with scores < 50% were regarded as having no constraints to the adaptive measures. Descriptive statistics such as percentage, mean score and standard deviation were used to analyse the data. Objective 3 and 4 were analysed by use of mean scores and standard deviation while objective 1, 2, 5 and 6 were analysed using percentage.
Results and Discussion

The result shows that majority (75.0%) of the respondents (Table 1) were within the age range of 30-39 years. The mean age of the respondents was 49 years. This shows that the respondents were in their active age and therefore productive. Majority (66.7%) of the respondents were female. This shows that rural women were more involved in poultry production. Therefore women should be targeted in the event of any climate change programmes on poultry in the study area. About 58% of the respondents were married. This shows that married persons predominated in poultry farming in the study area. Married people are responsible and so may easily find ways of adapting to effects of climate change on poultry as this may increase their productivity and subsequently bring to bear in catering for their family. Thirty three percent of the respondents had primary education while 30% had post primary education. Only 12% had tertiary education while up to 25.0% of the respondents had no form of formal education. Thus majority (75.0%) of the respondents were educated at least up to primary school level. This implies that they are able to harness information on climate change. Adedoyin, Fapojuwo and Torimiro (1999) pointed out that high level of education is a very good springboard for effective extension service. Good educational qualification may impact positively on the respondents' biochemical, social and economic understanding of climate change issues and ability to adapt to it. Greater proportion (40.0%) of the respondents engaged in farming as their major occupation.
Table 1
Distribution of respondents by socioeconomic characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Mean (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-29</td>
<td>10</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td>30-39</td>
<td>20</td>
<td>33.3</td>
<td></td>
</tr>
<tr>
<td>40-49</td>
<td>15</td>
<td>25.0</td>
<td>49</td>
</tr>
<tr>
<td>50-59</td>
<td>6</td>
<td>10.0</td>
<td></td>
</tr>
<tr>
<td>60 and above</td>
<td>5</td>
<td>8.4</td>
<td></td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>20</td>
<td>33.3</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>40</td>
<td>66.7</td>
<td></td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>35</td>
<td>58.3</td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>15</td>
<td>25.0</td>
<td></td>
</tr>
<tr>
<td>Widowed</td>
<td>8</td>
<td>13.4</td>
<td></td>
</tr>
<tr>
<td>Separated/divorced</td>
<td>2</td>
<td>3.3</td>
<td></td>
</tr>
<tr>
<td><strong>Educational attainment:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No formal education</td>
<td>15</td>
<td>25.0</td>
<td></td>
</tr>
<tr>
<td>Primary education</td>
<td>20</td>
<td>33.3</td>
<td></td>
</tr>
<tr>
<td>Post primary education</td>
<td>18</td>
<td>30.0</td>
<td></td>
</tr>
<tr>
<td>Tertiary education</td>
<td>7</td>
<td>11.7</td>
<td></td>
</tr>
<tr>
<td><strong>Household size:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-5</td>
<td>22</td>
<td>36.7</td>
<td></td>
</tr>
<tr>
<td>6-10</td>
<td>30</td>
<td>50.0</td>
<td></td>
</tr>
<tr>
<td>11-15</td>
<td>5</td>
<td>8.3</td>
<td>7</td>
</tr>
<tr>
<td>16-20</td>
<td>3</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td><strong>Major occupation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farming</td>
<td>24</td>
<td>40.0</td>
<td></td>
</tr>
<tr>
<td>Trading</td>
<td>12</td>
<td>20.0</td>
<td></td>
</tr>
<tr>
<td>Civil service</td>
<td>18</td>
<td>30.0</td>
<td></td>
</tr>
<tr>
<td>Artisans</td>
<td>5</td>
<td>8.3</td>
<td></td>
</tr>
<tr>
<td>Nursing</td>
<td>1</td>
<td>1.7</td>
<td></td>
</tr>
</tbody>
</table>

Majority (45.0%) of the respondents had 21-40 birds in their farms (Fig 1). The mean stock size was 36. This implies that poultry production in the study area is on subsistence level. This may be because of constraints (of which climate change effect may be one of them) that may hinder expansion of their farms therefore they can adapt easily as the cost and time spent for adaptation will be low.
Table 1 indicates that 50.0% of the respondents have a household size within the range of 6-10. The mean household size was 7. This implies that the respondents had fairly large household size which could possibly serve as source of farm/family labour. It could also serve as source of information on climate change issues.

**Perceived evidence of climate change**

Excessive sunshine was noted by most (90.0%) of the respondents as a sign for climate change (Fig 2). Also majority (80.0%) of the respondents indicated excessive rainfall as a major evidence of climate change. Others included: short period of hamattan (75.5%) and increased incidence of drought (66.7%). This implies that the respondents have perceive evidence that climate has changed and therefore will be willing to adopt new technologies related to climate change adaptation. Yahaya, (2009) stated that the unusual weather change which brings about rain in different parts of Nigeria in January is an indication of serious negative effects of climate change.
Perceived causes of climate change

The results Table 2 indicate that farmers perceived causes of climate change included: burning of fossil fuel (M=4.2), burning of firewood for cooking (M=4.0), use of generator (M=3.9), bush burning (M=3.8), deforestation (M=3.4), overgrazing (M=3.5), use of fertilizer on farmland (M=3.4), use of pesticides (M=3.4) and decomposition of organic waste (M=3.5). This implies that human activities are to a large extent the major causes of climate change as indicated by respondents in the study area. There is strong evidence that the warming of the earth’s over the last half century has been caused largely by human activity, such as the burning of fossil fuels and changes in land use including agriculture and deforestation (The Rural Society, 2010). Similarly, IPCC (2007) noted that the main cause of climate change has been attributed to anthropogenic (human) activities while Lohnman (2006) opined that climate change is closely associated with burning of oil, coal or gas. However, the respondents perceived to no extent that swamp rice production (M=2.4), gas flaring from oil companies (M=2.4), oil spillage (M=2.5) etc. were causes of climate change. The reason why they did not perceive oil spillage as one of the causes of climate change may be because oil exploration is not yet common in the zone.
Table 2
Perceived causes of climate change

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (M)</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burning of fossil fuel by industries</td>
<td>4.2*</td>
<td>1.22</td>
</tr>
<tr>
<td>Burning of firewood for cooking</td>
<td>4.0*</td>
<td>1.21</td>
</tr>
<tr>
<td>Use of generator to generate electricity</td>
<td>3.9*</td>
<td>1.24</td>
</tr>
<tr>
<td>Bush burning</td>
<td>3.8*</td>
<td>1.20</td>
</tr>
<tr>
<td>Deforestation</td>
<td>3.7*</td>
<td>1.25</td>
</tr>
<tr>
<td>Over-grazing of farm land by livestock</td>
<td>3.5*</td>
<td>1.22</td>
</tr>
<tr>
<td>Use of excess fertilizer on farm land</td>
<td>3.4*</td>
<td>1.23</td>
</tr>
<tr>
<td>Use of pesticides</td>
<td>3.4*</td>
<td>1.45</td>
</tr>
<tr>
<td>Decomposition of organic waste</td>
<td>3.5*</td>
<td>1.48</td>
</tr>
<tr>
<td>Gas flaring from oil companies</td>
<td>2.4</td>
<td>1.5</td>
</tr>
<tr>
<td>Gas releases such as CO2 from industries</td>
<td>2.6</td>
<td>1.4</td>
</tr>
<tr>
<td>Swamp rice production</td>
<td>2.4</td>
<td>1.5</td>
</tr>
<tr>
<td>High rate of irrigation</td>
<td>2.5</td>
<td>1.4</td>
</tr>
<tr>
<td>Oil spillage</td>
<td>2.5</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Perceived effects of climate change

Most farmers in the study area have noticed significant changes in the climatic conditions (see Fig 2) and they claim such climatic conditions have been manifested in several forms. Table 3 summarizes the climatic effects farmers have observed. Almost all the variable except reduced sale of poultry birds (M=1.5) and change in taste of poultry meat (M=2.1) were perceived as high effects of climate change on poultry as their mean scores were greater than 2.5. Data in Table 3 also show that the standard deviations for all the issues considered were less than 1.5. This indicates that farmers’ individual scores as regards their experience of climate change effects/impacts on agriculture did not differ much from their mean scores. These results are not surprising since it is obvious that high heat waves have a negative effect on poultry production and could have serious impact on poultry industry. This finding corroborates the opinion of Gueye, (2003) who reported that climate changes in form of drought, temperature variability, too much sunshine and windstorm have negative effects on agricultural production especially on poultry production. High or low temperatures lead to diseases infection while wind may serve as agent for spread of air-born disease that affects poultry (Guey, 2003). These extreme climatic events could have dramatic effects on the economy of the country. Heat distress suffered by animals will reduce the rate of animal feed intake and result in poor growth performance (Rowlinson, 2008). For rural communities, losing livestock assets could trigger a collapse into chronic poverty and have a lasting effect on livelihoods.
Table 3
Perceived effects of climate change

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (M)</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced body weight</td>
<td>3.1*</td>
<td>1.22</td>
</tr>
<tr>
<td>Increased disease infection</td>
<td>3.0*</td>
<td>1.21</td>
</tr>
<tr>
<td>Reduced egg size</td>
<td>2.8*</td>
<td>1.24</td>
</tr>
<tr>
<td>Reduced feed intake</td>
<td>3.1</td>
<td>1.20</td>
</tr>
<tr>
<td>Reduced fertility</td>
<td>3.3*</td>
<td>1.25</td>
</tr>
<tr>
<td>Decreased activity</td>
<td>3.1*</td>
<td>1.22</td>
</tr>
<tr>
<td>Increased mortality</td>
<td>3.2*</td>
<td>1.23</td>
</tr>
<tr>
<td>Reduced farmers income</td>
<td>2.7*</td>
<td>1.45</td>
</tr>
<tr>
<td>Change in taste of poultry meat</td>
<td>2.1</td>
<td>1.48</td>
</tr>
<tr>
<td>Reduced sale of poultry birds</td>
<td>1.5</td>
<td>1.46</td>
</tr>
</tbody>
</table>

Sources of information about climate change

Respondents’ sources of information (Fig 3) on climate change included: radio (33.3%), film show (30.0%), farmers meeting (28.3%), friends (26.7%) and extension workers (25.0%) . This result corresponds with the report of Christianell, Burger-Scheidlin and Vogl (2009) who opined that in Australia, farmers’ explanations for climate change are dominated by prevailing scientific discourses represented in the media and rarely base on the farmers’ conclusions drawn from their own (local) observations. This shows that extension workers did not perform their duties very well as to supply climate change information to the farmers in the study area. In order to sustain the agricultural sector that plays pivotal roles in human existence in terms of the provision of food, fibre, fun, fuel and income, strategies of change need to be urgently initiated to cope with the changing climate. Agricultural extension has key roles to play in initiating this change. This is because adaptations to climate change impacts require changes in knowledge, attitudes, resilience capacities, and skills of the people and agricultural extension can bring this change. It has been observed that agricultural extension is involved in public information and education programmes that could assist farmers in mitigating/adapting to the effects of climate change (MOE FRN, 2003) such as awareness creation and knowledge brokerage on the issues of climate change; building resilience capacities among vulnerable individuals, communities and regions; encouragement of wide participation of all stakeholders in addressing climate change issues; and developing appropriate frameworks for coping/adapting to climate change effects/impacts.
Adaptation strategies of poultry farmers to climate change

The most significant adaptive measures used by farmers in coping with climate change effects in the study area are presented in Fig 4. The respondents undertook keeping of resistant birds (56.5%), keeping of early maturing birds (53.1%), extensive poultry management system (65.8), keeping different bird varieties (51.4%), keeping of birds and other livestock (53.8%), raising brood and sale (52.3%) etc as adaptive strategies to poultry production. This shows that farmers are already making efforts to cushion the effects of climate change. On the contrary, in Australia, even though farmers are aware of the impact climate change has on agricultural land and local ecosystems, farmers rarely react through adaptive actions or changes in the local agricultural production (Christianell, Burger-Scheidlin and Vogl 2009). On the other hand, Nzuma et al. (2010) stated that in Africa local farmers are already using local adaptation strategies to cope with climate change. Furthermore, ILRI (2008) reported investment in multiple livestock species as one of the adaptive measures for farmers to cope with the effect of climate change. In Enugu State, Nigeria, the most popular adaptive measure used by respondents was the use of resistant crop and animal varieties/species (Ozor and Nnaji, 2008). The use of resistant poultry species provides useful adaptations and resilience to the effects of climate change. Such birds are known to survive and complete their life cycles normally even when the environment will not allow others to thrive. The increased adoption of resistant species may not be unconnected with the fact that farmers encounter serious disease infections, which have been recognized as one of
the most outstanding effects of climate change in the area (see Table 4). Keeping different types of livestock is adopted by farmers for reasons which may be to ensure food security, increased income, reduced incidence of pests and diseases, among others.

**Constraints to adoption or use of climate change adaptive measures**

The analysis of barriers to adaptation to climate change in the study area indicates that there are five constraints to climate change adaptive measures. These are lack of information (92.0%), high cost of adaptation (78.0%), shortage of labour (75.5%), poverty (84.4%) and poor link to input and output markets (61.5%) (Figure 5). Most of these constraints are associated with poverty. Lack of money hinders farmers from getting the necessary resources and technologies. However, lack of information to adaptation options could be attributed to the fact that researches on climate change and adaptation options have not been strengthened in the country hence, information is lacking in this area. The fact that adaptation strategies are costly (Mendelson and Williams, 2004) makes farmers vulnerable to the negative effects of climate change. This cost could be revealed through the need for intensive labour use. Thus, if farmers do not have sufficient family labour or the financial means to hire labour, they cannot adapt easily to climate change. Apata et al, (2009) reported that the most adverse effects of climate change are felt mainly by developing countries, especially those in Africa due to their low level of coping capabilities (Nwafor, 2007; Jagtap, 2007). It is noted by IFAD (2009) that the capacity of local communities to adapt to climate change and mitigate its impacts will also depend on
their socio-economic and environmental conditions, and on the available resources. Farmers need more information and enlightenment on how to curb and mitigate the effect of climate change. The same frontal attack that was and is currently given to HIV/AIDS campaign is needed for climate change issues if we are to ensure food security in the face of unabated urbanization. This circumstance poses great challenge for agricultural extension. Climate change presents new challenges and threats to food security in most countries especially the developing ones. This demands that extension service shall brace up to the development by re-training its staff to acquire the capability (knowledge and skills) in managing the risks that climate change pose especially in rural areas where the greater part of agricultural activities take place.

Conclusion and recommendation

Based on the findings of the study, the following conclusions were drawn: farmers perceived excessive sunshine as evidence of climate change, while anthropogenic causes where the main causes of climate change in the study area; key effect of climate change in the study area was reduced fertility while the key adaptive measure used by farmers was extensive poultry management system; and lack of information on climate change and poverty were the major barriers to climate change adaptation. The study recommended the following: extension has to play a key role in providing information to farmers in the study area; technical innovations (adaptation measures) should be made available to farmers to enable them cope with the challenges of climate change; government should grant loans to poultry farmers to
enable them procure new technologies to meet the protein demands of an ever increasing population; and efficient and affordable adaptation practices need to be developed for the rural poor who are unable to afford expensive adaptation technologies.

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Access and application of climate instruments in the Nigerian South West Zonal Research Extension Farmers Input Linkage System (Refils)

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Abstract

The study assessed the access and use of climate recording facilities by the stakeholders in the Research Extension Farmers Input Linkage System (REFILS) in South West agro-ecological zone of Nigeria. Respondents for the study comprised participants in the REFILS workshop (from research institutes, colleges and faculties of agriculutre, Agricultural Development Programmes (ADPs), National Food Reserve Agency/Federal Ministry of Agriculture and Water Resources (NFRA/FMAWR), input agencies, NGOs and farmers). A structured questionnaire was used to collect data from 74 randomly selected participants out of about 250 participants present in the workshop. All the respondents (100%) believed climate change was real and not a myth and that climate records were relevant to their respective functions. Most of the research institutes and the ADPs had access to some weather/climate recording facilities. Some of the challenges to access and effective usage of instrument/facilities included poor funding, use of obsolete equipment and poor application. ANOVA test showed significant difference in respondents’ of institution categories (research, extension and others) with respect to access (F=8.611; p=0.000) and usage (F=19.048, p=0.000) of climate instruments. The study recommends that all REFILS stakeholders should acquire relevant climate instrument/facilities for their use or source data where available as safeguard against adverse effect of weather or climate change situations.

Key words: Climate change, REFILS, stakeholders

Introduction

Weather is the state of the atmosphere at a place and time as regards heat, cloudiness, dryness, sunshine, wind and rain. Climate is the prevailing weather conditions of an area while climate change is the alteration or modification in the prevailing weather conditions. Climatic factors have not been adequately managed over the years and the effects manifest in various forms such as soil degradation, flooding, reduced rainfall, erosion, global warming/excessive heat, wind and rain storm, cyclones, delayed/short rains etc. Evidences of adverse situations now manifest around the globe to show that climate is changing Atungwu and Odedina, 2010; Nasiru, 2009).

Anuforom (2009) states that climate and agricultural resources are very closely related and as such any crisis situation in the agricultural sector notably food crisis, stands a great risk of becoming escalated by vagaries and extreme weather events like heat wave, drought and flood. Temperature aids biochemical processes and determine crop growth and development and air and soil temperature affect all the
growth and development. Solar radiation/cloud cover and sunshine duration, solar radiation, wind/air motion, soil moisture content and humidity affect crop and animals as well (Wheeler et al., 2000; Deweerdt, 2007)

The instruments used to record weather data include:
- Hydrometer - This is a special type of instrument that measures the humidity by calculating the water vapour in the air.
- Rain Gauge - This is a container that collects precipitation and measured it in millimeters (mm).
- Barometer - These instruments measures the air pressure.
- Sunshine Recorder - The recorder is a chart which has the sun's rays focused onto it using a magnifying glass so it burns a record of the hours the sun shone.
- Maximum and minimum thermometers measure the highest and lowest temperature in degrees Celsius.
- Wind vanes show the direction of the wind.
- Anemometers are used to measure wind speeds, usually in km/h. The wind is caught in small cups and the speed is calculated by measuring how fast the cups rotate.
- Recording cloud type and cloud-cover is done manually, using the naked eye. Meteorologists measure cloud-cover in oktas.

Nigerian Meteorological Agency (NIMET) has the mission to observe Nigerian weather and climate and provide meteorological, hydrological and oceanographic services in support of national needs and international obligations (Anuforom, 2009). NIMET provides various agro-climate information services/products for managing hazards/food crisis which could not be said to be accessible to research and extension institutions let alone farmers. This is partly due to problems associated with ICTs usage as identified by Adebayo and Adedoyin, 2005; Arokoyo, 2005)

The observed variability in weather situation and associated hazards observed in Nigeria include drought, desertification, floods, declining rainfall, increasing frequency of heavy rainfall, and reduction in length of rainy season (Anuforom, 2009). The direct effects on agriculture have been loss of livestock, devastation of farmlands/infrastructures increasing food prices, rottening of food items, poor yields, emergence of new pests and disease vectors.

The basic challenge of climate change to agricultural extension practice is that relevant institutions in the Research Extension Farmers Input Linkage System (REFILS) set up could not be said to possess the relevant climate/weather recording facilities to enhance access and application of climate data/information which will subsequently be disseminated to farmers. If farmers possess the instrument/equipment/facilities they could be used to record weather parameters to guide them in making informed decisions and even give feedback directly to research or through the extension service. The REFILS stakeholders include practitioners in the Agricultural Research Council of Nigeria and the research institutes (ARCN/RIs) under their coordination as well as Agricultural training institutions, National Food Reserve Agency/Federal Ministry of Agriculture and Water Resources and Agricultural Development Programmes (NFRA/FMAWR/ADPs) including other programmes under their coordination, farmers, inputs agencies, non governmental organizations (NGOs), private sector, The research institutes (RIs) and the Monitoring and Evaluation sub programme of the ADPs are expected to have climate/weather recording facilities/instruments, take data and interpret for
subsequent use on the field for researchers and farmers. The information generated could be circulated in the system via various REFILS activities which include annual zonal workshops, zonal steering committee meetings, in-house review meetings, technology review meetings, staff trainings and REFILS stakeholders’ meeting. These activities are for interactions of two or more stakeholders.

Stakeholders require climate recording facilities/equipment to provide data for analysis in order to forecast adverse conditions. This will ensure that mitigation and adaptation measures that are best suited for the different agro-ecological zones/local conditions in the country are sought. This is important because varying climatic conditions have implications for agricultural practices and potentials. It is against this background that the study assessed access and application of climate recording instruments among research and extension personnel in the setup of REFILS in south western Nigeria. The specific objectives included to:

i) identify the climate instruments that are accessed by respondents;
ii) examine the constraints to access and usage of the climate recording facilities

Study hypotheses
Ho (1): There is no significant relationship between respondents’ personal characteristics and access to climate instrument.
Ho (2): there is no significant difference between respondents’ institution types (research, extension, others) with respect to instruments access
Ho (3): There is no significant difference between respondents’ institution types with respect to climate instrument usage/application.

Methodology

South-west agro-ecological zone of Nigeria is made up of eight (8) States- Delta, Edo, Ekiti, Lagos, Ogun, Ondo, Osun and Oyo. All the technical staff of agricultural research and extension institutions, agricultural input agencies, NGOs and about two farmers selected per state who featured in the 2010 Annual Zonal REFILS workshop constituted the population for the study. Sample was drawn through random selection of eighty participants who filled the structured questionnaire. Seventy four (74) copies of the questionnaire were retrieved. The questionnaire addressed personal characteristics access, usage/application and constraints to application of climate recording facilities among the respondents.

Access to nine (9nos) climate recording/measuring instruments was measured on a 3-point Likert type scale. No access (1), occasionally accessed (2), regularly accessed (3). Minimum score= 9, maximum=27 and mean score ≥ 2.00= accessed.
Application/usage of nine (9nos) climate recording/measuring instruments was measured on a 3-point Likert type scale. Not used (1), occasionally used (2), regularly used (3). Minimum score= 9, maximum=27 and mean score ≥ 2.00= used/applied.

Result and Discussion
Personal characteristics of respondents

Majority of the respondents were from extension institutions (70.3%). This is an indication that other stakeholders based in south western Nigeria, do not participate enough in REFILS workshop as much as the extension institutions. Majority were males (73.0%), had HND/B.Sc and higher educational qualifications (94.6%), with work experience of 11-30 years (56.7%). All the respondents (100%) believed climate change was real and climate records were relevant to their functions as agricultural research, extension, farmers, input marketers, NGOs. This is an indication that access and application of the instrument/facilities would be necessary.

Table 1: Personal characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institution type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research (RIs, Univ. etc)</td>
<td>12</td>
<td>16.3</td>
<td></td>
</tr>
<tr>
<td>Extension</td>
<td>52</td>
<td>70.3</td>
<td></td>
</tr>
<tr>
<td>Others (farmers=5, input dealers=3, NGO=2)</td>
<td>10</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>54</td>
<td>73.0</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>20</td>
<td>27.0</td>
<td></td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>10</td>
<td>13.5</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>58</td>
<td>78.4</td>
<td></td>
</tr>
<tr>
<td>Qualification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SSCE/OND</td>
<td>4</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>HND/B.Sc.</td>
<td>32</td>
<td>43.2</td>
<td></td>
</tr>
<tr>
<td>M.Sc</td>
<td>30</td>
<td>40.5</td>
<td></td>
</tr>
<tr>
<td>Ph.D</td>
<td>8</td>
<td>10.8</td>
<td></td>
</tr>
<tr>
<td>Working Experience</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;10</td>
<td>20</td>
<td>26.3</td>
<td></td>
</tr>
<tr>
<td>11-20</td>
<td>22</td>
<td>29.7</td>
<td>19.19yrs</td>
</tr>
<tr>
<td>21-30</td>
<td>20</td>
<td>27.0</td>
<td></td>
</tr>
<tr>
<td>&gt;30</td>
<td>12</td>
<td>16.2</td>
<td></td>
</tr>
<tr>
<td>Experience with REFILS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;5</td>
<td>6</td>
<td>8.1</td>
<td></td>
</tr>
<tr>
<td>6-10</td>
<td>30</td>
<td>40.5</td>
<td></td>
</tr>
<tr>
<td>11-15</td>
<td>16</td>
<td>18.9</td>
<td></td>
</tr>
<tr>
<td>16-20</td>
<td>12</td>
<td>16.2</td>
<td>11.70yrs</td>
</tr>
<tr>
<td>21-25</td>
<td>6</td>
<td>8.1</td>
<td></td>
</tr>
<tr>
<td>No response</td>
<td>4</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>Climate change real</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>74</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Relevance of climate records</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>job/business</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>74</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Respondents’ access to and application of climate recording facilities

Table 2 shows that the respondents had little access to most of the climate recording instruments. Only cloud cover which was physically observed (mean=2.869) and thermometer or temperature-related data (mean=2.211) were regularly accessed by the respondents. The mean for recording cloud cover could have been high due to little or no cost involvement. Other parameters could have also been accessed by non cost involving methods where applicable hence the low mean score.

The overall mean application (1.521) of the instruments (Table 2) was lower than that of access (1.601). Only Temperature (mean=2.198) and cloud (mean=2.976) recording facilities were regularly applied.
Table 2
Mean scores of respondents’ access to and application of climate recording facilities

<table>
<thead>
<tr>
<th>Parameter/Instrument</th>
<th>ACCESS Mean score</th>
<th>ACCESS SD</th>
<th>USAGE Mean</th>
<th>USAGE SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermometer –temperature</td>
<td>2.211</td>
<td>.320</td>
<td>2.198</td>
<td>.524</td>
</tr>
<tr>
<td>Rain gauge – rainfall/precipitation</td>
<td>1.434</td>
<td>.476</td>
<td>1.303</td>
<td>.476</td>
</tr>
<tr>
<td>Hygrometer –humidity</td>
<td>1.275</td>
<td>.273</td>
<td>1.217</td>
<td>.271</td>
</tr>
<tr>
<td>Global Positioning System- various including soil properties</td>
<td>1.346</td>
<td>.203</td>
<td>1.249</td>
<td>.288</td>
</tr>
<tr>
<td>Anaemometer- wind speed</td>
<td>1.387</td>
<td>.169</td>
<td>1.263</td>
<td>.627</td>
</tr>
<tr>
<td>Cloud cover- physical observation</td>
<td>2.869</td>
<td>.204</td>
<td>2.976</td>
<td>.603</td>
</tr>
<tr>
<td>Sunshine- recorder</td>
<td>1.235</td>
<td>.391</td>
<td>1.192</td>
<td>.322</td>
</tr>
<tr>
<td>Wind vane- wind/air motion-direction</td>
<td>1.591</td>
<td>.378</td>
<td>1.259</td>
<td>.153</td>
</tr>
<tr>
<td>Solar radiation-recorder</td>
<td>1.064</td>
<td>.339</td>
<td>1.038</td>
<td>.492</td>
</tr>
<tr>
<td>Overall mean</td>
<td>1.601</td>
<td>1.521</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mean score ≥2.00= regularly accessed/applied

Constraints to effective application of climate instrument

Table 3 shows some of the constraints to effective application of climate instruments. The strongly indicated ones include cannot afford the facilities or cost to access (91.8%), no knowledge of NIMET services and products (89.8%), inadequate funding by government/organization (77.0%), lack of technical know-how in operating equipment (66.2%) and respondent did not have time to access climate information (51.3%) which were indicated by more than 50% of the respondents. Inability to adequately apply the instruments/facilities was due to unavailability of most of them as a result of lack of funds to acquire them. The respondents had poor knowledge of NIMET climate information services which could partly address the data to generate from the instruments. This is an indication that stakeholders might not have optimized their potentials at obtaining weather/climate data. This implies that early warning, mitigation and adaptation information/measures might not be readily available to the client system. This could adversely affect agricultural activities in the zone.
Table 7
Constraints to effective application of climate information and instrument

<table>
<thead>
<tr>
<th>Constraints</th>
<th>Frequency</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequate fund to access facilities by</td>
<td>57</td>
<td>77.0</td>
</tr>
<tr>
<td>Irregular electric power supply</td>
<td>36</td>
<td>48.1</td>
</tr>
<tr>
<td>Obsolete weather recording facilities</td>
<td>4</td>
<td>59.4</td>
</tr>
<tr>
<td>Poor network/reception for electronic media</td>
<td>12</td>
<td>48.1</td>
</tr>
<tr>
<td>Cannot afford the facilities or cost to access</td>
<td>68</td>
<td>91.9</td>
</tr>
<tr>
<td>Wrong timing in climate information</td>
<td>6</td>
<td>8.1</td>
</tr>
<tr>
<td>Facilities were not available in my establishment</td>
<td>32</td>
<td>43.2</td>
</tr>
<tr>
<td>Do not have time to access climate information</td>
<td>38</td>
<td>51.4</td>
</tr>
<tr>
<td>Lack of technical know-how in operating equipment</td>
<td>49</td>
<td>66.2</td>
</tr>
<tr>
<td>No knowledge of NIMET climate services and products</td>
<td>65</td>
<td>89.8</td>
</tr>
<tr>
<td>Not readily available</td>
<td>34</td>
<td>45.9</td>
</tr>
<tr>
<td>No interest</td>
<td>18</td>
<td>24.3</td>
</tr>
</tbody>
</table>

*Multiple responses

Relationship between respondents’ characteristics with access and application of climate instruments

Table 3 shows that only working experience was significant at 5% level to respondents’ access (r=0.362) and application (r=0.283) of climate instrument with positive correlation. This implies that the more experienced the respondents were on their jobs/enterprise the more they accessed and applied climate instruments to obtain climate data/information. Educational qualification showed a negative but very weak and insignificant value with both access (r=-0.006) and application (r=-0.013). This is an indication that the less educated had more access to climate instruments which could be as a result of their roles as field workers. Experience in REFILS set up were strong values but not significant probably because access and application scores were generally low among the respondents.

Table 4
Correlation between personal characteristics and application climate instruments

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>ACCESS Correlation (r)</th>
<th>p-value</th>
<th>APPLICATION Correlation (r)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification</td>
<td>-0.006</td>
<td>0.973</td>
<td>-0.013</td>
<td>0.825</td>
</tr>
<tr>
<td>Working experience</td>
<td>0.362*</td>
<td>0.030</td>
<td>0.283</td>
<td>0.046</td>
</tr>
<tr>
<td>Experience in REFIL</td>
<td>0.312</td>
<td>0.062</td>
<td>0.291</td>
<td>0.066</td>
</tr>
</tbody>
</table>

* Significant at 5% level

Difference in respondents’ access and usage/application of climate instrument to job by institution types

Table 5 shows that the analysis of variance (ANOVA) was significant for access (F=8.611; p=0.000) and application (F=19.048; p=0.000) of instruments in the institution types. This shows that there were significant differences in the means for the access and application of instruments to respondents’ job among the institution
types. This was highest for research, followed by extension and then others. This could be due to the fact that climate parameters are crucial to agricultural research and extension while other stakeholders depend on the outcome of research and information from extension service.

Table 6
Differences in respondents’ equipment access and usage by institution type

<table>
<thead>
<tr>
<th>Institution Type</th>
<th>No of cases</th>
<th>ACCESS</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean Score</td>
<td>F-value</td>
</tr>
<tr>
<td>Research</td>
<td>12</td>
<td>21.18</td>
<td>8.611*</td>
</tr>
<tr>
<td>Extension</td>
<td>52</td>
<td>16.36</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>10</td>
<td>10.67</td>
<td></td>
</tr>
</tbody>
</table>

* Significant at 5% level

Conclusion and Recommendations

The study concludes the following;

- Climate instruments/recording facilities are relevant to stakeholders in south west Research Extension Farmers Input Linkage System (REFILS);
- Access to and application of climate recording instruments/facilities are poor among REFILS stakeholders however the experienced stakeholders access and applied the instruments more;
- Respondents’ constraints to access and apply climate facilities include funding, knowledge and time related factors;
- Respondents from research institutions use climate recording instruments more than other stakeholders;

Based on the findings the following are recommended;

- Research Extension Farmers Input Linkage System (REFILS) activities in south west such as fortnightly trainings, monthly technology reviews and zonal workshops should report on weather/climate situation from as capture at different locations for the review period and relate such information to production/value Chain activities for the area covered;
- Adequate funding support should be given to institutions to acquire relevant facilities and NIMET agro-climatic information services should be widely publicized;
- Capacity building should be carried out to enhance ability of REFILS stakeholders to access and utilize relevant climate facilities and information.
References


Artisanal Fishers’ Use of Sustainable Fisheries Management Practices in the Jebba Lake Basin, Nigeria

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Abstract
The study attempts to characterise artisanal fishers’ use of sustainable fisheries management practices in the Jebba Lake Basin, Nigeria. Stratified sampling technique was used to select 402 respondents. Data were collected using semi-structured interview schedule. Data were analysed using frequency counts, percentages, mean and standard deviation. The result showed fishing in the study area was dominated by male fishers (97.0%) with the mean age of 43 years. Attitude of fishers’ towards formal fishing regulations were below average (mean=3.00). Over half (57%) of the respondents never used any sustainable fishing practices, while only 39.1% used only one form of sustainable fishing practice. About 60% and 50% of the respondents reported using gill net and hook and line, respectively. The study recommended that artisanal fishers should be strengthened as key stakeholders in fisheries policy formulation, implementation and evaluation. This will entrust commitment and ownership on the part of the fishers towards the realization of fisheries policy objectives.

Keywords: Fisheries, Policy, Environment and Management

Introduction

Globally, inland artisanal fisheries have provided an important source of food for sustaining human well-being over the years. Fish plays an important role in improving food security and nutritional status; and is a critical source of dietary protein and macronutrient for many isolated communities in rural areas (Bene and Heck, 2005). Therefore, fish is of great importance as a direct source of protein and micronutrients lacking in plants for millions of people (LSMAC, 2003). In Nigeria, inland fisheries do not only provide an important alternative source of animal protein but is also crucial to the economy contributing 5% of agricultural gross domestic product (FAO, 2007). The inland fisheries accounted for 85% of domestic fish production between 1991 and 2003 with total annual fish production of 615,507 metric tons in 2007 (FDF, 2008). Despite this current contribution of inland fisheries and its potential in national economic development, its sustainability is being threatened due to the overexploitation of natural fish stock, which is getting to its limit (Mutume, 2002).

Also, inspite of the overwhelming potential of abundance fisheries resources, Nigeria remains a very large importer of fish. Reasons for this has been attributed to the subsistence nature of those engaged in fishing, the remoteness of fishing
communities and the difficulty in accessing and use of outdated fishing gears and craft (Ohen et al., 2009) including low adoption of improved fisheries technology and poor management practices adopted by fishers. Domestic fish production (in metric tons) from 1995 to 2007 has been virtually flat (FDF, 2008), reflecting both a stagnant aquaculture production and a stressed and overfished capture fisheries that can no longer sustain increased harvesting. The important issue for management of artisanal fisheries resources in Nigeria is hinged on increased fishing pressure, irresponsible fishing and pollution among others.

The need to reverse declining trend in capture fisheries resources compelled government to formulate sustainable management strategies, which incorporates a combination of management measures, mainly, technical and input controls, and, to some extent, output controls and economic incentives. These management measures are backed up by enactment of laws at Federal level and edicts at State level. The subsisting laws are: Niger and Kebbi States that formed parts of the Jebba Lake, which this study focuses on, have adopted legislation (fisheries edict) aimed at regulating fishing activities over past years. Despite this effort the fishery sector is yet to improve its performance significantly. Domestic fish production has not been able to bridge the gap. Fish supply is put at about 0.4 million tons in comparison to 0.8 million tons of demand (FAO, 2006) and supply of 0.7 million metric tons and demand of 1.7 millions tons of demand in year 2010 (FDF, 2010). This makes Nigeria one of the largest importers of fish in the developing world, importing between 600-700 metric tons annually at a cost of US$ 0.4 billion, resulting in significant loss of domestic jobs (Moehl, 2003 and USAID/Nigeria/SPDC, undated). This has been partly blamed on the fishers’ lack of adoption of sustainable fishing practices. Hence, the aim of this study to examine the fishers’ use of sustainable fishing practices and its implication for effective fisheries extension delivery geared towards the attainment of the objectives of the Federal Government of Nigeria Agricultural Transformation Agenda in food security, employment generation, wealth creation and the overall economic development of the rural communities. Hilborn (2007) asserted that for fisheries management to be successful, associated human factors, such as the reactions of fishermen to management measures are of key importance, need to be understood.

Objectives of the study

The overall aim of the study was to examine artisanal fishers' use of sustainable fisheries management practices in the Jebba Lake Basin, Nigeria and its implication for effective fisheries extension delivery. The specific objectives were to:

i. describe the socio-economic characteristics of fishers in the study area;
ii. ascertain the extent to which fishers have adopted sustainable fishery management practices; and
iii. examine the fishers’ practice of and attitude towards fishing regulations in the study area.

Methodology

The study was carried out in fishing communities in the Jebba Lake Basin, Nigeria. Jebba Lake is situated between Latitude 9° 10’ and 9° 55’ north and longitude 4° 30’ and 5° 00’ east and was formed in August 1983 as an impoundment of River Niger.
Multi-stage sampling technique was used for the study. The first stage was the stratification of communities within the lake basin into local government areas (LGAs). Niger state has 3 LGAs (Borgu, Magama and Mokwa) and Kwara state has 1 LGA (Moro) making a total of 4 LGAs. The second stage was the stratification of the communities around the Lake into 3 strata to have a representation of fishing communities within the Northern, Southern and Central part of the lake across the 4 LGAs of the states. Identification of active fishing communities around the Lake Basin and purposive selection of 30% of total number of identified fishing villages by stratum formed the third stage. Thus; stratum 1 included the following communities: Fakun, Bakoshi, Faransawa, Sabo Leaba and New Awuru; stratum 2 comprised Sabo Niger, Tungan Lanti, Kwaiifawa, Rimaye, Tsofo Gbajibo and Tungan Maje while stratum 3 comprised Tungan Alhaji Audu, Saminaka, Tungan Dukia, Tungan Kwakwari, Ngagi 1, Gungu Zaki and Tungan Garba Bichi. The fourth step was the purposive selection of 18 percent of fishers in each of the selected fishing communities from the 3 strata. Thus, 134 fishers were sampled from stratum 1, 130 from stratum 2 and 138 from stratum 3, making a total of 402 fishers sampled for the study (Table 1).
Table 1
Sample of artisanal fishers by stratum

<table>
<thead>
<tr>
<th>Stratum</th>
<th>Total No. of Fishing villages by stratum</th>
<th>Sampled fishing villages by stratum (30%)</th>
<th>Selected fishing Communities</th>
<th>Fishers population</th>
<th>Sampled fishers (18%)</th>
<th>Sampled fishers by stratum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>5</td>
<td>Fakun Bakoshi Faransawa Sabo Leaba New Awuru</td>
<td>289 105 120 90 140</td>
<td>52 19 22 16 25</td>
<td>134</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>6</td>
<td>Sabo Niger Tungan Lanti Kwaifawa Rimaye Tsofo Gbajibo Tungan Maje</td>
<td>135 95 130 100 200 63</td>
<td>24 17 24 18 36 11</td>
<td>130</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>7</td>
<td>Tungan Alhaji Audu Saminaka Tungan Dukia Tungan Kwakwari Ngagi 1 Gungu Zaki Tungan Garba Bichi</td>
<td>80 180 95 115 81 130 86</td>
<td>14 33 17 21 15 23 15</td>
<td>138</td>
</tr>
<tr>
<td>Total</td>
<td>59</td>
<td>18</td>
<td></td>
<td>2,234</td>
<td>402</td>
<td>402</td>
</tr>
</tbody>
</table>

Relevant data were collected from the respondents through semi-structured interview schedule containing both open and closed-ended questions. Data collected were subjected to descriptive. The descriptive statistical tools included frequencies, graphs, mean, standard deviation and percentages.

**Sustainable fisheries management practices**

Fishing practices the fishers have practiced in sustaining or improving fisheries were identified. Respondent practice of any of the identified practice was measured as dummy viz; Yes = 1, No = 0.

Taking a cue from Fakoaya (2006), the degree of use of sustainable fisheries management practices was measured as a percentage of the overall score.

Thus:

\[ Z = \frac{X}{Y} \times 100 \]

Where,

- \( Z \) = Degree of use of sustainable fisheries management practices of the fishers.
- \( X \) = Number of sustainable fisheries management practices engaged in.
- \( Y \) = Total number of sustainable fisheries management practices available.
Based on the number of fisheries management practices engaged in, respondents were characterized as follows: number of practices, percentage score (z), frequency, percentage

Results and Discussion
Socio-economic characteristics of the artisanal fishers

Majority (66.1%) of the respondents fell within the age range of 40 years and above, with a mean age of 43 years. The finding suggests that fishers in the study area are ageing and fishing activities is becoming unattractive to the teeming youths. Confirming the result, Nwabeze et al., (2011) reported 44-66 years as the dominant age among fisherfolk in Niger State, Nigeria (Table 2). Fishing was practiced by both sexes in the study area with most (97.0%) being males, revealing the preponderance of the male sex in fishing business (Table 2). Only few females of Ijaw origin were found to be actively involved in fishing. They either support their husband or pair with other women in fishing using lift net (Atala net). Most (82.1%) of the respondents were married.

Table 2 shows that majority (83.1%) of the respondents had no formal education. The finding confirms the general assertion that fishing communities are characterized by persons with low level of education (Onemolease and Erie, 2006). The mean household size was 9 persons (Table 2). The large family size was largely attributed to the extended family system in the area whereby parents, children and other relations live together as a household. Respondents mean annual fishing income of ₦81,123.11 implies low income. The mean fishing experience was 29 years.
Table 2  
Socio-economic characteristics of the artisanal fishers

<table>
<thead>
<tr>
<th>Variable</th>
<th>Categories</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>&lt; 20</td>
<td>7</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 - 29</td>
<td>57</td>
<td>14.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30 - 39</td>
<td>68</td>
<td>16.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>40 - 49</td>
<td>119</td>
<td>29.6</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>50 - 59</td>
<td>128</td>
<td>31.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>60 - 69</td>
<td>19</td>
<td>4.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>70 – 79</td>
<td>4</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>390</td>
<td>97</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>12</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td>Single</td>
<td>51</td>
<td>12.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Married</td>
<td>330</td>
<td>82.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Divorced/separated</td>
<td>7</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Widowed</td>
<td>14</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>Annual income from fishing (₦)</td>
<td>&lt; 25,000</td>
<td>7</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>25,001 - 50,000</td>
<td>82</td>
<td>20.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50,001 - 75,000</td>
<td>88</td>
<td>21.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>75,001 - 100,000</td>
<td>114</td>
<td>28.4</td>
<td>81,123.</td>
</tr>
<tr>
<td></td>
<td>100,001 - 125,000</td>
<td>75</td>
<td>18.7</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>125,001 - 150,000</td>
<td>10</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 150,000</td>
<td>26</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>Fishing experience</td>
<td>&lt; 11</td>
<td>37</td>
<td>9.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11 - 20</td>
<td>65</td>
<td>16.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>21 - 30</td>
<td>107</td>
<td>26.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>31 - 40</td>
<td>157</td>
<td>39.1</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>41 - 50</td>
<td>33</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 50</td>
<td>3</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>Household size</td>
<td>&lt; 5</td>
<td>29</td>
<td>7.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 - 10</td>
<td>258</td>
<td>64.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 10</td>
<td>115</td>
<td>28.6</td>
<td></td>
</tr>
</tbody>
</table>

Respondents’ adherence to fishing regulation

The fishing regulation was promulgated by the apex fisheries body in Nigeria (Federal Department of Fisheries) to check the excesses of fishers' fishing practices for continued sustainable yield of fishery resources. Non use of explosive was the most practiced fishing regulation by the respondents (100%) as shown in Table 3, followed by non use of poison (87.8%) and fish fence (63.7%). Only few respondents complied with regulation of gear control (49.3%), declaration of fish catch (29.1%), effort control (14.2%) and closed area and closed season (11.4%). The result suggests a low conformity to the formal fishing regulation in the study area. Reasons for this could be attributed to poor implementation of formal sanctions by law enforcement agents. The emergence of the inland fisheries decree ushered the taking over of fishing activities by the government. This could be responsible for the
breakdown of social control mechanism inherent in fishing communities. Ekong (2003) reported that centralization of the law of the land has accounted for reducing the authority of the local institutions.

A discussant, Mr George of Fakun, has this to say; “People are fond of using under size gear mesh to fish on the Lake especially the beach seine net. They use the beach seine nets at night and often a time when caught, they bribe their way. We the Ijaw ethnic group has reported the case of beach seine use on the lake to the Emir of Borgu Kingdom through our traditional chief”.

This has not fully changed the attitude of some of the fishers on the use of beach seine net. The use of beach seine net could be inimical to the sustainable fishery production of the lake and subsequent negative adverse effect to those who depend on it for survival. This is attributed to the fact that intensive use of beach seine net has implication in extinction of the fish stock. The beach seine nets are undersize mesh size net of less than 0.5mm and length of 100 metre and above. It is operated by no fewer than 10 fishers depending on the length and has the capacity to crop fish eggs, frys and juveniles of all fish species.

<table>
<thead>
<tr>
<th>Fishing regulations</th>
<th>Frequency *</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ban on the use of explosives</td>
<td>402</td>
<td>100.0</td>
</tr>
<tr>
<td>Ban on the use of poisons</td>
<td>353</td>
<td>87.8</td>
</tr>
<tr>
<td>Prohibition of fish fence</td>
<td>256</td>
<td>63.7</td>
</tr>
<tr>
<td>Gear control</td>
<td>198</td>
<td>49.3</td>
</tr>
<tr>
<td>Declaration of fish catch</td>
<td>117</td>
<td>29.1</td>
</tr>
<tr>
<td>Effort control</td>
<td>57</td>
<td>14.2</td>
</tr>
<tr>
<td>Closed areas and closed seasons</td>
<td>46</td>
<td>11.4</td>
</tr>
</tbody>
</table>

*Multiple responses

Respondents’ attitudes towards formal fishing regulation

The mean results (Table 4) show that respondents were positively disposed to formal fishing regulations. The leading attitudes were ban on the use of explosive (mean=4.47, SD=0.7), ban on the use of poison (mean=4.41, SD=0.7), prohibition of fish fence (mean=4.25, SD=0.7) and gear control (mean=4.10, SD=0.7). In terms of percentages, over 52.0% of the respondents considered as very good the ban on the use of poison and ban on the use explosive. Almost 51.0% agreed that policy on prohibition on fence and gear control were good. More than 30.0% supported government effort control (37.8%) and declaration of catch (31.3%). However, less than 30.0% was in support of closed area and closed seasons.
Table 4
Respondents attitudes toward formal fishing regulations

<table>
<thead>
<tr>
<th>Regulations</th>
<th>Percentages</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very good</td>
<td>Good</td>
</tr>
<tr>
<td>Ban on the use of explosives</td>
<td>58.0</td>
<td>31.1</td>
</tr>
<tr>
<td>Ban on the use of poisons</td>
<td>52.0</td>
<td>36.8</td>
</tr>
<tr>
<td>Prohibition of fish fence</td>
<td>37.6</td>
<td>51.0</td>
</tr>
<tr>
<td>Gear Control</td>
<td>30.3</td>
<td>50.7</td>
</tr>
<tr>
<td>Effort control</td>
<td>15.9</td>
<td>37.8</td>
</tr>
<tr>
<td>Declaration of catch</td>
<td>12.7</td>
<td>31.1</td>
</tr>
<tr>
<td>Closed areas and closed seasons</td>
<td>16.9</td>
<td>23.1</td>
</tr>
</tbody>
</table>

*Good (mean≥ 3.00)
SD = Standard deviation

Effectiveness of fishing master to control fishing livelihood

Respondents rated the effectiveness of fishing master in enforcing compliance to fishing regulation in the community as good (53.7%), very good (27.1%), poor (8.5%) and very poor (0.2%) (Fig 1). The result implies that at community level fishing master is effective to controlling issues related to fishery.

Characterisation of fishers participatory score based on sustainable fishing practices used

Table 5 revealed that fishers were characterised on the basis of their use of sustainable fishing practices. The Z value qualified fishers’ on the degree of sustainable fishing practices used. More than half (57.0%) of the respondents never used any sustainable fishing practices. About 39.1% adopted only one form of sustainable fishing practice and degree of use (Z) was 17.0%, 3.7% used two forms of sustainable fishing practices with 33.0% level of usage while only 0.2% adopted
three forms of sustainable fishing practices at 50.0% degree of use. The result implies that large proportion of the fishers in the area do not use fishing practices that will enhance the sustainability of the fisheries resource.

Table 5
Characterization of fishers’ participatory score based on sustainable fishing practices adopted

<table>
<thead>
<tr>
<th>No. of practices</th>
<th>Percentage score (z)</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>0</td>
<td>229</td>
<td>57.0</td>
</tr>
<tr>
<td>One</td>
<td>17.0</td>
<td>157</td>
<td>39.1</td>
</tr>
<tr>
<td>Two</td>
<td>33.0</td>
<td>15</td>
<td>3.7</td>
</tr>
<tr>
<td>Three</td>
<td>50.0</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>402</td>
<td>100.0</td>
</tr>
</tbody>
</table>

4.4.2 Characterization of fishers on fishing practices adopted

Table 6 shows that respondents fishing practices based on whether they are sustainable, unfriendly and damaging taking a cue from Binyotubo (2011) and FAO (1994). The most prominent sustainable fishing practices adopted by the respondents include gill net of size 76.2 mm and above (59.7%), hook and line (49.3%) and drift net (37.1%). The result revealed low adoption of most of the sustainable fishing practices by the respondents. Landing net (11.0%) and fish fence trap (4.2%) dominated the unfriendly fishing practices being practiced by the respondents. Damaging fishing practices such as the beach seine net (1.5%) and poison (gamalin) (1.5%) were hardly practiced by the respondents. The unfriendly and damaging fishing practice on the lake has a lasting effect in depleting the fish stock. This has overall negative effect in sustaining the welfare of fishers’ households (Nwabeze et al., 2011; Deka, Goswami, and Kakati, 2005). When asked on why fishers chose to adopt destructive fishing practices, most of the respondents said, “Fish species vary greatly in terms of habits and habitants, and as they change according to seasons, we equally have to change our gear and method of fishing so that we and our families can survive”.

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Table 6
Characterization of fishers on fishing practices used

<table>
<thead>
<tr>
<th>Fishing practices</th>
<th>Frequency*</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Sustainable</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gill net (size 76.2 mm and above)</td>
<td>240</td>
<td>59.7</td>
</tr>
<tr>
<td>Hook and line</td>
<td>198</td>
<td>49.3</td>
</tr>
<tr>
<td>Drift net (76.2 mm and above)</td>
<td>149</td>
<td>37.1</td>
</tr>
<tr>
<td><em>Goura</em> (Malian) trap</td>
<td>70</td>
<td>17.4</td>
</tr>
<tr>
<td>Lift nets <em>(Atala)</em></td>
<td>47</td>
<td>11.7</td>
</tr>
<tr>
<td>Cast net</td>
<td>47</td>
<td>11.7</td>
</tr>
<tr>
<td>Long line</td>
<td>27</td>
<td>6.7</td>
</tr>
<tr>
<td>Double chamber trap</td>
<td>16</td>
<td>0.4</td>
</tr>
<tr>
<td>Fyke net</td>
<td>12</td>
<td>3.0</td>
</tr>
<tr>
<td>Open water seine</td>
<td>10</td>
<td>24.9</td>
</tr>
<tr>
<td>Pound trap</td>
<td>9</td>
<td>2.2</td>
</tr>
<tr>
<td>Spring loaded set line</td>
<td>9</td>
<td>2.2</td>
</tr>
<tr>
<td>Skimming net</td>
<td>8</td>
<td>2.0</td>
</tr>
<tr>
<td>Push net</td>
<td>6</td>
<td>1.5</td>
</tr>
<tr>
<td>Scoop net</td>
<td>4</td>
<td>1.0</td>
</tr>
<tr>
<td>Pole and line</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>B. Unfriendly</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landing net</td>
<td>44</td>
<td>11.0</td>
</tr>
<tr>
<td>Fence trap</td>
<td>17</td>
<td>4.2</td>
</tr>
<tr>
<td>Dragged bag nets with Fixed mount</td>
<td>12</td>
<td>3.0</td>
</tr>
<tr>
<td><strong>C. Damaging</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beach seine net</td>
<td>6</td>
<td>1.5</td>
</tr>
<tr>
<td>Poison</td>
<td>1</td>
<td>0.2</td>
</tr>
</tbody>
</table>

*Multiple responses

Implication for Effective Fisheries Extension Delivery

In all the fishing communities studied, informal institutional structures were put in place by the local people to take charge of issues relating to fishing livelihood. The traditional institution operates through the *Sarkin Ruwa* (Fishing Master) that is well respected and recognized by both communities and formal institutions. They formulate and enforced local fishing regulations and also, represented the informal link between the communities and government. Local fishing regulations observed in the area are ban on beach seine net and also moral vices (unauthorized supervision of fishing gear, fishing gear and craft theft) related to fishing livelihood. Sanction and sanction mechanism on the use of beach seine net was adopted. These were confiscation of gear, arrest of culprit and reports to formal authority for prosecution whereas, fishing gear theft are liable to forfeit their gears and banished from community. Therefore, the informal institution enhances effective extension strategy
in implementing and enforcing fisheries policy that will drive Agricultural Extension Transformation Agenda component of Agricultural Transformation Agenda of the Federal Government of Nigeria.

**Conclusion and Recommendations**

Based on the analysis of the data and findings of the study, the following conclusions are drawn: Low compliance of fishers with formal fishing regulations that encouraged sustainable fisheries connote weak participation of fishers at the initial stages of fisheries policy formulation.

Traditional Institution of fishing master (*Sarkin Ruwa*) are important aspect of change agents in implementation of local and formal fishing regulation that will enhance the sustainability of inland fisheries resource.

Based on the conclusions of the study, the following recommendations are made:

1. Enlightenment campaign on the use of sustainable fishing practices for continued sustenance of the fishing ground provided with the lake to the fishers. This will not only sustain the maximum production yield of the lake but also encourage the youth to invest in fishing livelihood.
2. There is need to strengthen artisanal fishers as key stakeholders in fisheries policy formulation, implementation and evaluation. This will entrust commitment and ownership on the part of the fishers towards the realization of formal fisheries policy objectives.
3. Recognition of the Traditional Institution by government in enforcing formal fishing regulations is step towards controlling obnoxious fishing practices. Their effort will complement that of the formal law enforcement agents whose manpower are grossly inadequate coupled with the challenges in reaching the scattered inland fishing terrain within the lake basin.

**References**


Capabilities of Universities in Achieving the Agricultural Transformation Agenda in Nigeria: Evidence from Climate Change Study in Southeast, Nigeria.

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Abstract
The study examined the capabilities of universities in combating the problems of climate change towards increased food production. A total sample size of 79 respondents selected from universities in Southeast, Nigeria was used. Data were collected with the use of questionnaire and analyzed using descriptive and inferential statistics including percentage and factor analysis. All (100\%) the respondents had no capability in acquiring machines and equipment needed for teaching and conducting researches on climate change. Majority (85\%) of the respondents had no capability in terms of human resource development with regards to climate change. Funding/manpower (0.657), organizational (0.575) and weak policy (0.565) related factors influenced the development of the capabilities of the respondents. For a successful agricultural transformation that will not be marred by the negative impact of climate change, the study recommends that the Federal Government of Nigeria should provide adequate funding to the universities in order to enhance the development of their capabilities in acquiring machines and other things needed for the teaching and research in climate change related issues. Also, bodies concerned should provide regular in-service training for respondents in other to promote human resource needed for tackling climate change issues.

Keywords: capabilities, agricultural transformation agenda, climate change, universities

Introduction
The vision of the present Agricultural Transformation Agenda (ATA) is to achieve a hunger-free Nigeria through an agricultural sector that drives income growth, accelerates achievement of food and nutritional security, generates employment and transforms Nigeria into a leading player in global food markets to grow wealth for millions of farmers. This vision if not tread with caution could be marred by the negative impacts of climate change. This is because agricultural production in many African countries including Nigeria is projected to be severely compromised by climate variability and change (Ajetomobi and Abiodun 2010; Harris, 2009; Cribb, 2008; Glantz and Cullen 2003). To achieve ATA that will not be marred by climate change, researches, training and innovation in the area of climate change is needed. University education provides leadership in research, training/innovation and development of human resource often responsible for sustainable development of which climate change is a component. This implies that universities have responsibility for generating knowledge, advancing teaching and learning in climate...
change issues and injecting same into the economy to create opportunity for innovation to thrive. Such innovations could include those that will help to combat the challenges posed by climate change, especially through the promotion of adaptation strategies; and the production of crop/animals that can withstand changes in the climate and invariably helping to achieve food security. If universities will achieve this feat, they must have the necessary human resource in the field of climate change and also possess relevant equipment needed for teaching/learning and research in climate change issues.

In Nigeria, especially in the Southeast, climate change is occurring and is already affecting lives. It therefore becomes pertinent to determine the capabilities of the universities in Southeast, Nigeria in tackling climate change towards increased food production which will invariably help in achieving the proposed ATA in Nigeria. Hence, the following questions become imperative: In terms of human resource development, what capabilities do the universities in the southeast have and which is lacking? What capacities do they have with regards to acquisition of equipment/machineries needed for the teaching and conducting researches in climate change related issues? What factors impede the capabilities of the respondents? The paper therefore aims at:

1) determine the capabilities (in terms of machine/equipment acquisition and human resource development) of universities in tackling climate change;
2) identify factors that impede the capabilities of the respondents.

Methodology

Area of study
The study was carried out in Southeast Nigeria. The Zone is located between Latitudes 04° 30′ N and 07°30′ N and Longitudes 06° 45′ E and 08°45′ E. It covers an area of 29,908 square kilometres with a population of about 16,381,729 (Federal Republic of Nigeria, 2007). The area comprises the geographical location of the following states: Abia, Anambra, Ebonyi, Enugu, and Imo.

Economically, it is primarily an agricultural zone. The soils of the region are largely sandy, mostly loose and porous. The commonest crops grown in the zone include cassava, yam, cocoyam, maize, Fluted Pumpkin “ugu” (Telferia occidentalis), plantain/banana, oil palm and coconut while major animals reared include goat, sheep, poultry etc. The region is experiencing devastating impact of climate change which is well represented in the frequent cases of flooding and increased number of gully erosion sites on farmlands.

All academic staff in the universities in the Southeast formed the population. Three states (Abia, Anambra and Enugu) were purposively selected based on the high incidences of climate change related disaster. Both state and federal universities/faculties of Agriculture in the three States, namely: Abia State University, Uturu and Micheal Okpara University of Agriculture, Umudike for Abia State; Anambra State University, Uli and Nnamdi Azikiwe University Awka for Anambra State; Enugu State University of Science and Technology and University of Nigeria, Nsukka for Enugu State. Simple random sampling was used to select three (3) academic staff on the rank of senior lecturer and above across the departments in the faculty/college of agriculture of each university with the exception of UNIZIK
where four (4) old staff of the University who are the pioneer staff of the new faculty of Agriculture were purposively selected. A grand total sample size of 79 was used for the study.

Structured questionnaire was used for data collection. The questionnaire was divided into two sections. Section 1 was devoted to information on capabilities of the respondents while section 2 investigated factors that impeded the capabilities of the respondents.

Objective 1: sought information on the capabilities of the respondents. Capabilities were accessed based on acquisition of machines and other equipment needed for teaching/researching on climate change issues. It was also based on human resource development of the respondents. Respondents were asked to indicate if as a faculty/college they have capability in terms of acquisition of necessary equipment needed for teaching and conducting researches on climate change issues. If they do, they should itemise the equipment, state the function of the equipment, when was it purchased, who purchased them and what the cost was. For human resource development, the respondent specified the number of staff with their qualifications, the type of training on climate change the staff have embarked on, the duration of such training and amount invested into such trainings, new lessons learnt etc.

Objective 2: factors that impede the capabilities of the respondents. The respondents were asked to respond to possible factors using a four-point Likert-type scale of “to a great extent (4), “to some extent (3), “to a little extent (2)” and “to no extent (1)”. The mean value of 2.5 was used to determine the factors. Variables that have a mean value of 2.5 and above were considered as factors that impede the capability development and those below 2.5 were not. Data were further subjected to exploratory factor analysis procedure using the principal factor model with varimax in grouping the impeding factors. Only variables with loadings of 0.4 and above (10% overlapping variance) were used in naming the factors while variables that loaded high in more than one factor were discarded (Comrey, 1962).

Information on the capabilities of the respondents (objectives 1) was analysed using percentage. Information on factors that impede the capabilities of the respondents (objective 2) was analysed with exploratory factor analysis. Version 16.0 of the Statistical Package for the Social Science (SPSS) software was used for the analysis.

Results and Discussion

The capabilities of respondents

Figure 1 shows that all (100%) the respondents had no capability in terms of acquiring equipment/machines needed for teaching and conducting researches on climate change issues. The Figure also shows that 85.0% have no capability in human resource development. This result shows that the respondents lack the needed equipment needed for teaching and conducting researches anchoring on climate change. It also shows that human resource development with regards to climate change issues is poor.
University education usually provides leadership in research, training and innovation, often responsible for sustainable development of which climate change adaptation is a component (Committee on Building Trans-disciplinary Capability at the University of Nigeria, UNN_ATPS, OSF Project, 2011). Yanda (2010) also noted that one of the goals of university education globally is to provide solutions to the development challenges such as climate change. With the increase in the challenges that climate change pose on agricultural production, it is expected that universities/faculties of agriculture should massively embark on researches that will help provide scientific adaptive strategies that would be taught/impacted on students and other stakeholders; unfortunately, this result implies that with regards to climate change issues, the university which is supposed to be the place where solutions about climate change should emanate are lacking the needed equipment and human resource capacity. Lack of expertise/human resource capability among university teaching staff has being attributed to the fact that most of this category of staff were trained before climate change became a recognised problem (Achike and Okpara, 2011); consequently, there is need for regular in-service training for these staff.

Fig 1: Chart showing percentage distribution of respondents based on their capabilities

Factors that impede the capabilities of the respondents

Table 1 shows varimax rotated factor on factors that impede the capabilities of the respondents. Based on variable loading, three factors were identified and named. Factor one was named funding/manpower related factors, factor two was named organizational related factors while factor three was named weak policy related factors.

Entries in the Table show that factors that loaded high under funding/manpower related factors (factor 1) were poor funding to research (0.657), poor funding to teaching (0.651), lack of manpower (0.471), unavailability of technology (0.495), unavailability of equipment (0.650), lack of training opportunity, (-0.650), lack of competent staff i.e. climate change experts (0.650). Poor funding will not allow the
respondents to invest in training, research and development, or state-of-the-art technology acquisition. Also, unavailability of equipment needed for teaching and research among the respondents imply that they are incapable of transferring needed climate change adaptation skills to their students and other stakeholder. With adequate funding into teaching/research, teachers/researchers will have enough equipment and other technology needed for their researches and this will bring technological change. Technological change itself stimulates capability accumulation and will directly and indirectly enhance teachers/researchers capabilities.

Poor motivation (0.575), culture of firm (0.482), bureaucracy (0.550), poor remuneration (-0.541), and lack of interaction between actors i.e. poor linkage (0.565) loaded high under organizational related factors (factor 2) (Table 2). Interaction among the respondents will allow them swap information and enhance learning (Dominguez and Brown, 2004). Such learning will permit the respondents to accumulate capabilities in adapting to the challenges of climate change. Lack of interaction hence implies there will be no opportunity of learning and development of climate change capabilities. This inability to learn or link could retard efforts towards addressing the problems of climate change.

Table 1 equally shows the factors that loaded high under weak policy related factors (factor 3) as poor fiscal government policies (0.565), policy dynamics (0.521), poor access to knowledge and information on new technologies (0.475), poor government commitment to climate change issues (0.545) and lack/weak legal framework (-0.470). Government can be instrumental in stimulating capability enhancement through a number of fiscal incentives (Porter, 1980). Aderemi, Oyebisi and Adeniyi (2009), maintained that government has the roles of setting priorities, participating and enacting laws that could enhance capabilities’ development and accumulation. Capabilities of the respondents could be enhanced if government makes and enacts polices that allow funds to be adequately provided to the universities and also monitor the utilization of such funds.
### Table 1
Factors that impede the capabilities of the respondents

<table>
<thead>
<tr>
<th>Impeding factors</th>
<th>Funding/manpower</th>
<th>Organizational weak policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor funding to research</td>
<td>0.657</td>
<td>0.367</td>
</tr>
<tr>
<td>Poor funding to teaching</td>
<td>0.651</td>
<td>0.280</td>
</tr>
<tr>
<td>Lack of manpower</td>
<td>0.471</td>
<td>-0.344</td>
</tr>
<tr>
<td>Unavailability of technology</td>
<td>0.495</td>
<td>0.319</td>
</tr>
<tr>
<td>Unavailability of equipment</td>
<td>0.650</td>
<td>0.123</td>
</tr>
<tr>
<td>Size of firm</td>
<td>-0.329</td>
<td>0.026</td>
</tr>
<tr>
<td>Culture of firm</td>
<td>0.390</td>
<td>0.482</td>
</tr>
<tr>
<td>Firm organisation strategy</td>
<td>0.215</td>
<td>-0.191</td>
</tr>
<tr>
<td>Lack of training opportunity</td>
<td>-0.650</td>
<td>0.254</td>
</tr>
<tr>
<td>Lack of competent staff (climate change experts)</td>
<td>0.650</td>
<td>0.297</td>
</tr>
<tr>
<td>Bureaucracy/organisational bottleneck</td>
<td>0.351</td>
<td>0.550</td>
</tr>
<tr>
<td>Poor fiscal government policies</td>
<td>0.252</td>
<td>0.362</td>
</tr>
<tr>
<td>Policy dynamics</td>
<td>0.344</td>
<td>0.289</td>
</tr>
<tr>
<td>Farmer’s conservatism</td>
<td>0.301</td>
<td>0.233</td>
</tr>
<tr>
<td>Market forces</td>
<td>0.312</td>
<td>0.375</td>
</tr>
<tr>
<td>Poor access to knowledge and information on new technologies</td>
<td>0.008</td>
<td>0.321</td>
</tr>
<tr>
<td>Poor remuneration</td>
<td>0.371</td>
<td>0.541</td>
</tr>
<tr>
<td>Influence of donor agencies</td>
<td>0.364</td>
<td>0.254</td>
</tr>
<tr>
<td>Poor government commitment to climate change issues</td>
<td>0.258</td>
<td>-0.098</td>
</tr>
<tr>
<td>Poor motivation/poor working environment</td>
<td>0.208</td>
<td>0.575</td>
</tr>
<tr>
<td>Lack of interactions among actors/poor linkage with other actors</td>
<td>0.287</td>
<td>0.565</td>
</tr>
<tr>
<td>Inadequate finance/credit</td>
<td>0.521</td>
<td>0.470</td>
</tr>
<tr>
<td>Lack/weak legal framework</td>
<td>0.367</td>
<td>0.319</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization (loading at .4 and above)
Bold type is used to highlight high factor loads.

### Conclusion and Recommendation

Agricultural transformation agenda among other things aims at making Nigeria food secured. This mission stands to be threatened by the negative impact of climate change, hence, innovations that will help overcome the threats is paramount. Such innovations could be developed in the universities if the needed enabling environment is provided. The study showed that the respondents lacked both machines and human resource needed for teaching and conducting climate change researches. This unfortunate situation implies that the universities are not capable in combating the problems of climate change which will negatively affect food production and invariably threatening the transformation agenda.
It is recommended that bodies responsible for the funding of the universities should financially support them so that they can acquire equipment needed for teaching/researching with regards to climate change. The bodies should also provide in-service training to the universities so that they can build human capacity needed for teaching/researching on climate and climate change related issues.

References


Empowering Small-Scale Farmers through Improved Technology Adoption: A case study of Soybean Farmers in Borno State, Nigeria

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Abstract

The study examined factors that influenced the adoption of improved soybean seed as production technology in Borno State, Nigeria. Data for the study were collected from 360 small-scale farmers spread across nine farming communities in three local government areas. Respondents were selected through multi-stage sampling technique while the data were collected with the aid of structured questionnaire. Data were analyzed using descriptive statistics such as frequency count, percentage and rank while correlation coefficient was used to establish relationship between variables. Results of the study showed that 74.99% of the respondents were below 51 years of age; 52.51% attained at least the Junior Secondary School level of education; 32.50% of the respondents had income between ₦400,000.00k - ₦1,600,000.00k from the sales of soybean during the period under study. This led to the empowerment of the respondents mainly in catering for their household needs, expanding their agricultural production and purchase of landed property. Socio-economic characteristics such as age (-0.78), level of education (0.68), and farm size (0.62) had significant influence on the adoption of soybean production technology. The main constraints faced by the respondents in the adoption of improved soybean production technologies included the complex technicality of agronomic practices and limited access to extension services. It was therefore recommended that government should put in place definitive policy to encourage young people to venture into agriculture/farming and small-scale farmers should be given more agricultural extension educational opportunities.

Introduction

Small-scale farming is the most dominant mode of agriculture in most developing countries, Nigeria inclusive. Approximately, 3 billion people live in rural areas of developing countries with over 2 billion of them involved in agriculture as small-scale farmers or farm workers (World Bank, 2007). Nagoyetes (2005) also observes that at least 75% of farms in majority of African and Asian countries are only two hectares or less in size. It is for this reasons that any attempt at transforming agriculture should aim at transforming the small-scale farming. Small-scale farming is significant in many ways. In agriculture-based economies, such as in Nigeria, farming generates 34% of the Gross Domestic Products (GDPs) and 65% of employment (Jazairy et al., 1992), with the farm owners mainly self-employed.
Small-scale farming therefore merits support for many reasons. For instance, Morton (2007) recognizes that the small-scale farmers can be efficient than the large-scale farmers in utilizing production resources, especially purchased inputs and labour. Other researchers (Thirtle et al., 2005; de Janvry and Sadoulet, 2010) also report that small-scale farming has great capacity to reduce poverty if the small-scale farmers are connected to market and extension services. According to them, for each percentage growth in agricultural yield, there is 0.6% to 1.2% reduction in poverty. This therefore implies that empowerment of small-scale farmers through provision of appropriate agricultural technologies can go a long way in reducing poverty and food security in farming community. These benefits result from the direct effects of agricultural improvement on the small-scale farmers themselves and from strong agricultural linkages with other sectors of the economy, promoted by agricultural extension.

One way of transforming agriculture is by exposing small-scale farmers to improved agricultural production technologies, such as high yielding seed varieties. According to Sunding and Zilberman (2000), technological change has been a major factor shaping agriculture in the recent past. For instance, a comparison of agricultural production pattern in the United States in 1920 and 1995 shows that harvested cropland has declined (from 350 to 320 million acres), the number of people employed in agriculture has declined (from 9.5 million in 1920 to 3.3 million in 1995). Yet agricultural production in 1995 was 330% greater than its figure in 1920. This suggests that agricultural productivity has increased. The main explanation for such increase is change in agricultural production methods, chief among which is the use of improved/high yielding seed varieties.

The International Institute of Tropical Agriculture (IITA) has championed the course of developing improved agricultural technologies for possible adoption by farmers in Africa. One of such technologies developed and delivered to farmers is the improved soybean seeds. This technology was introduced into Borno State with the hope that, if adopted by farmers, it will lead to improvement in the nutritional status and food security of the small-scale farmers in the adopting communities. It was also hoped that the production of soybean will stimulate economic activities in the study area owing to its wide application locally and industrially.

The use of modern farming technologies such as improved seeds enhance crop yield and income of farmers generally (Bamire, et al 2002; Ouma, et al 2006; Onu, 2006). It is also expected that living conditions of the farmers would significantly improve as a result of the benefits of adopting this technology. This study was therefore conducted mainly to examine the effect of adoption of improved soybean seed on the livelihood of small-scale farmers in Borno State. The specific objectives of the study were to:

i. determine the income generated from soybean production;  
ii. examine the utilization of income generated from soybean production by the respondents; and  
iii. determine the constraints militating against the adoption of improved soybean seeds by farmers in the study area.
Methodology
The study was conducted in Borno State, Nigeria. Multi-stage sampling technique was used in selecting the respondents for the study. The three local government areas (LGAs) where IITA promoted soybean production were purposively selected out of the 27 LGAs in Borno state. The three LGAs included Biu, Hawul and Kwaya-Kusar. Four soybean producing communities each were selected from Biu and Hawul LGAs, while one soybean producing community was selected from Kwaya-Kusar LGA. This was done in proportion to the soybean producing communities in the LGAs. A total of 360 respondents were selected proportionately from the soybean producing communities. The numbers of respondents selected from each LGA were: Biu, 158 (43.89%); Hawul, 176 (48.89%); and Kwaya-Kusar, 26 (07.22%). The 360 respondents were administered structured questionnaire. The key dependent variables for the study are: adoption, which was measured in terms of the total land area devoted to improved soybean seed production, as used by Ojiako (2007); output of soybean, which was measured in quantity of soybean obtained by a farmer. This was multiplied by the market price of soybean to get the income farmers earn from soybean. The independent variables are: age, measured in years, educational qualification, measured in terms of the highest educational qualification attained; and farm size, measured in hectares. Descriptive statistics, namely the frequency count, percentage and ranks were used to categorize the respondents based on their socio-economic characteristics while the inferential statistics were used to establish relationship between certain socio-economic characteristics of the respondents and various parameters of the study.

Results and Discussion
Socio-economic characteristics of respondents

The results in Table 1 reveal that 53.03% of the respondents were within the active age group of 31-50 years. Only 25.10% of them were above 50 years of age, with the mean age being 42 years. This age range has some advantage for the adoption of improved technologies as Bamire et al., (2002); Sheik et al., (2003) found that the age of individuals affects their mental attitude toward new ideas and hence influence adoption in several ways. Consequently, the high proportion of young farmers in the study area spells bright future for adoption of improved agricultural technologies in the study area. The study also reveal that more than half (52.51%) of the respondents attained at least the Junior Secondary School level of education and above, while about 22. % of the respondents had no formal education at all (Table 1). Education affects agricultural productivity by increasing the ability of farmers to produce more output from given resources. Earlier, Idrisa et. al. (2010) found that education was positive and significant in influencing the adoption of improved soybean seed among farmers in Borno State, Nigeria. As shown in Table 1, majority (67.50%) of the respondents devoted 0.5ha or less to soybean cultivation during the 2007 cropping season while only a dismal (0.28%) of them devoted more than 2.6ha to the cultivation of improved soybean. In fact, a vast majority (95%) of the respondents devoted the maximum of 1.5ha to soybean production during the study period. Farmers who cultivate large farm holdings are more resource-endowed and therefore are more likely to adequately have the required resources for the acquisition of farm inputs (Ajibefun, 2006). This puts them in an advantage position to adopt improved technologies compared with farmers who have small farm holdings. The small family size, which translates into small labour supply forms
another possible explanation for the small farm size recorded among respondents in the study area.

Table 1

<table>
<thead>
<tr>
<th>Socio-economic variable</th>
<th>Frequency</th>
<th>Percentage</th>
<th>Standard Deviation</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (in years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 20</td>
<td>21</td>
<td>5.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21 – 30</td>
<td>58</td>
<td>16.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 – 40</td>
<td>97</td>
<td>26.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41 – 50</td>
<td>94</td>
<td>26.11</td>
<td></td>
<td>42</td>
</tr>
<tr>
<td>51 – 60</td>
<td>50</td>
<td>13.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above 60</td>
<td>40</td>
<td>11.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational qualification</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tertiary education</td>
<td>72</td>
<td>20.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Senior secondary education</td>
<td>80</td>
<td>22.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junior secondary education</td>
<td>37</td>
<td>10.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary education</td>
<td>61</td>
<td>16.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult education</td>
<td>30</td>
<td>08.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No formal education</td>
<td>80</td>
<td>22.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farm size (ha)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤0.5</td>
<td>243</td>
<td>67.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.6-1.0</td>
<td>89</td>
<td>24.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1-1.5</td>
<td>10</td>
<td>02.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.6-2.0</td>
<td>00</td>
<td>00.00</td>
<td></td>
<td>0.59</td>
</tr>
<tr>
<td>2.1-2.5</td>
<td>17</td>
<td>04.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.6 and above</td>
<td>01</td>
<td>00.28</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field Survey, 2008

Adoption of improved Soybean seed by respondents

Results in Table 2 reveal that majority (96.93%) of the respondents have adopted improved soybean seed as production technology in the study area having devoted at least 10% of their total land area to soybean production. The mean adoption among farmers in the study area was 39.34%. This indicates that soybean had high level of acceptability among the small-scale farmers in the study area, being that on the average, every respondent has devoted 39.34% of his total land to improved soybean seed. Ojiako (2007) opined that a farmer that devoted at least 10% of his total land area to improved seed production is considered as an adopter for that technology. With regards to intensity of adoption, 24.51% of the respondents devoted 50% or more of their land to improved soybean production during the study.
period while more than half (54.87%) of the respondents devoted at least 30% of their land to improved soybean seed.

Table 2
Distribution of respondents based on adoption of improved soybean seeds

<table>
<thead>
<tr>
<th>Intensity of use (%) (given that adoption has occurred)</th>
<th>Frequency</th>
<th>Percentage</th>
<th>mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0% - 29.9</td>
<td>151</td>
<td>42.06</td>
<td></td>
</tr>
<tr>
<td>30.0% - 49.9</td>
<td>109</td>
<td>30.36</td>
<td>39.34%</td>
</tr>
<tr>
<td>50.0% - 69.9</td>
<td>56</td>
<td>15.60</td>
<td></td>
</tr>
<tr>
<td>70.0% - 89.9%</td>
<td>06</td>
<td>7.24</td>
<td></td>
</tr>
<tr>
<td>90.0 and above</td>
<td>26</td>
<td>01.67</td>
<td></td>
</tr>
</tbody>
</table>

Source: Field Survey, 2008

Yield of Soybean and income from Soybean

Table 3 reveals that majority (67.50%) of the respondents had 1000kg or less of soybean during the study period. About one-quarter (23.89%) of the respondents had from 1001kg to 2000kg; 05.83% of them had between 2001kg and 3000kg while a dismal (2.78%) had more than 3000kg of soybean during the study period. This depicts that the yield of soybean in the study more than 2000kg of soybean during the study period, about the same proportion (92.22%) also operated at small-scale level (≤ 1ha).

When the physical output was converted into its monetary value (Table 3), it was found that majority (67.50%) of the respondents got up to N 400,000.00k from the sale of soybeans, while additional 29.72% of the respondents got up to N 1,200,000.00k from the sale of soybeans. Each 100kg bag of soybean sells for N 40,000.00k. Mean income from sale of soybean among the respondents was N 380,000.00k which is equivalent to $2,420.38. This helps to bring cash income into the soybean farming communities. de Janvry and Sadoulet (2009) found that introduction of cash crop into farming community has the capacity to empower the cash-trapped farmers in the rural communities. The World Bank (2007) also reported that Ghana reduced rural poverty by 24% between 1990 and 2005, principally as a result of empowering small-scale farmers through adoption of improved technologies.
Table 3
Distribution of respondents based on yield of Soybean obtained in 2007 production season and income from Soybean (n = 360)

<table>
<thead>
<tr>
<th>Yield in kg (Naira Value)</th>
<th>Frequency</th>
<th>Percentage annual income</th>
<th>Mean annual income</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 1000kg (≤ ₦ 400,000.00k)</td>
<td>243</td>
<td>67.50</td>
<td>₦ 380,000.00k</td>
</tr>
<tr>
<td>1001kg – 2000 (≤ ₦ 400,400 – ₦ 800,000k)</td>
<td>86</td>
<td>23.89</td>
<td>($2, 420.38)</td>
</tr>
<tr>
<td>2001kg – 3000 (≤ ₦ 800,400 – ₦ 1,200,000k)</td>
<td>21</td>
<td>05.83</td>
<td></td>
</tr>
<tr>
<td>3001kg – 4000 (≤ ₦ 1,200,400 – ₦ 1,600,000k)</td>
<td>06</td>
<td>01.67</td>
<td></td>
</tr>
<tr>
<td>4001kg and above (₦1,600,400 and above)</td>
<td>04</td>
<td>01.11</td>
<td></td>
</tr>
</tbody>
</table>

Source: Field Survey, 2008

Utilization of Income from Soybean sales

Entries in Table 4 show the uses to which the respondents put the income they got from soybean production. Majority (94.44%) of the respondents used part of the income to attend to their family needs. These routine or day-to-day family problems included providing for the family during festivals, paying hospital bills of family members and other needs that may arise in the family. Also, majority (79.72%) of the respondents re-invested the income they got from the sales of soybean in farming business. This, they did through increasing their farm size (i.e expanding their farm size) and buying inputs that will help them expand production such as work bull/farm implements. About half (49.44%) of the respondents also used the proceeds to buy landed property, while 45.55% of them used the income to sponsor their children in school either at secondary school level or tertiary education including their university education. About 25% of the respondents used the income to start other forms of business, notably trading and livestock fattening. These show that the small-scale soybean farmers in these communities have been empowered through the introduction of improved soybean seed to them. Idrisa et. Al. (2012) in a study of the effect of adoption of improved maize varieties on food security in Gwoza local government of Borno State, Nigeria found that adoption of improved maize varieties significantly enhanced food security in the study area. One measure of empowerment is the ability of an individual to solve his/her felt needs which was impossible prior to the empowerment intervention. Farmers now produce soybean, which they readily sell through the well established market linkages and earn money to solve their household problems.
Table 4
Distribution of respondents based on their utilization of income obtained from Soybean production

<table>
<thead>
<tr>
<th>Area for which money was used</th>
<th>Frequency</th>
<th>Percentage*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re-investment in farming</td>
<td>287</td>
<td>79.72</td>
</tr>
<tr>
<td>Purchase of landed property</td>
<td>178</td>
<td>49.44</td>
</tr>
<tr>
<td>Invested in other form of business</td>
<td>89</td>
<td>24.72</td>
</tr>
<tr>
<td>Children’s education</td>
<td>164</td>
<td>45.55</td>
</tr>
<tr>
<td>Attending to routine household needs</td>
<td>340</td>
<td>94.44</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2008
*Multiple responses

Analysis of relationships between respondents’ adoption and socio-economic factors.

The study looked at the relationships between some socio-economic characteristics of the respondents and their level of adoption of soybean production technology. Correlation analysis was used to achieve this. The correlation analysis revealed that there was a significant but negative (-0.78) relationship between adoption and age of respondents in the study area (Table 5). This finding corroborates earlier findings (Adesina and Zinna, 1993; Bamire et al., 2002; Sheik et al., 2003) which showed that young people are more likely to be better agents of technology adoption and transfer. Table 5 also reveals a significant and positive (0.68) relationship between educational level of the respondents and their adoption of technology. Education is essential for farmers to gather, process and interpret information needed for agricultural production. Availability of necessary information enables farmers to produce more output from a given input. Table 5 further shows that 95.00% of the respondents in the study area cultivate between 0.5ha and 1.5ha of land. This puts the effects of farm size to hibernating and asymptomatic to analysis.

Table 5
Correlation analysis between socio-economic characteristics of respondent and adoption of soybean production technology

<table>
<thead>
<tr>
<th>Socio-economic Characteristic</th>
<th>Coefficient of Correlation</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.78***</td>
<td>1</td>
</tr>
<tr>
<td>Level of Education</td>
<td>0.68**</td>
<td>2</td>
</tr>
<tr>
<td>Farm Size</td>
<td>0.48*</td>
<td>4</td>
</tr>
</tbody>
</table>

Source: Synthesis from 2008 Field Survey Data

Constraints to respondents’ adoption of improved Soybean seed technology

Only 87 respondents, representing 24.17% of the sample size reported having problems associated with the adoption of improved soybean seed in the study area. Table 6 shows the distribution of the problems encountered by the respondents. The technicality of the agronomic practices associated with soybean production ranked highest among the problems, as reported by 42.53% of the respondents. This is not surprising because the soybean crop was introduced into the study area only about four years ago. The agronomy of the crop is still complex to the respondents
especially that the crop requires a great deal of precision in terms of depth of sowing, spacing, weeding requirement and the need to harvest on time so as to escape pod shattering. The study also revealed that inadequate access to extension services as reported by 37.93% of the respondents ranked second among the problems. Access to extension service is important in popularizing technologies among farmers. Previous studies (Bamire et al., 2002; Omolehin et al., 2007) indicated that in Africa, low level of contact between extension workers and farmers form one of the main reasons for low level of adoption of improved technologies. Farmers in the study area depend on extension agents for information on improved agricultural technologies as well as knowledge of how to use the technologies. A situation of low level of interaction between extension agents and farmers will retard the spread of innovations in the farming communities. It will also negatively affect the likelihood of adoption of innovations and the intensity of use of the technologies. A small proportion (19.50%) of the respondents reported untimely access to improved soybean seed as their problem. Alimi (1991) earlier recognized that accessibility to production resources is perhaps a more serious problem in African countries than inefficiency of use of the resources.

Table 6

Distribution of respondents based on problems encountered in the adoption of improved soybean seeds (n = 87)

<table>
<thead>
<tr>
<th>Variable (Nature of problem)</th>
<th>Frequency</th>
<th>Percentage* (%)</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technicality of agronomic practices</td>
<td>37</td>
<td>10.28 (42.53)</td>
<td>1</td>
</tr>
<tr>
<td>Inadequate access to extension service</td>
<td>33</td>
<td>09.17 (37.93)</td>
<td>2</td>
</tr>
<tr>
<td>Untimely access to improved seed</td>
<td>17</td>
<td>04.72 (19.54)</td>
<td>3</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2008

*Percentages in parentheses were derived from respondents who encountered problems in the course of adoption of improved soybean seed: n=87

Conclusion and Recommendations

It can be concluded from the findings of the study that majority (62%) of the respondents adopted improved soybean seed as production technology. It was also concluded that adoption of improved soybean seed has significantly empowered the small-scale farmers in the soybean producing areas in many ways, notably: solving their day-to-day family problems; investing in their farming business; and buying landed property. The study also concludes that age of respondents, their level of education, farming experience and farm size significantly influenced the adoption of soybean production technology by the respondents. Based on the findings of the study, it is recommended that: Policy should be put in place to encourage young people to venture into agriculture/farming; and farmers should be given more agricultural extension educational opportunities.
References


Capacity Building Needs of Farmers for Safe Agro-chemical Use/Application in Niger State, Nigeria

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Abstract

In order to determine the capacity building needs of farmers for safe agro-chemical use in Niger State, the study examined awareness of safety measures for agro-chemical usage, sources of awareness, practice of safety measures and training needs of farmers. One hundred and twenty farmers were randomly selected from three local government areas in the state. Validated interview schedule with reliability coefficient of 0.89 was used to collect data. Data collected were analyzed using descriptive statistics and correlation analysis. All the respondents were aware of wearing of protective clothing and avoiding drinking/eating during spraying, safety measure such as avoiding off label use (7.50%) had low awareness level. The major sources of awareness were friend/relatives (55.00%). The most widely practised safety measure was avoiding ingesting or inhaling chemicals (91.67%), while the least practised safety measure was avoiding off label use (2.50%). Reasons given for not practicing some safety measures include heaviness of protective clothing (17.50%) and unreadable nature of instruction labels (14.17%). Major areas of training needs of the respondents were application (61.67%) and handling (52.50%) of agro-chemicals. A positive significant correlation existed between education (r = 0.461), farming experience (r = 0.337), farm income (r = 0.307) and practice of safety measures. It was therefore recommended that enlightenment campaign should be carried out in the State to raise awareness level for safe use of agro-chemicals in the agricultural transformation programme, while the characters of the instruction labels should be boldly written to facilitate reading and practice of safety measures.

Introduction

Agriculture is classified as one of the most hazardous sectors both in industrialized and developing countries with an estimated number of 170,000 agricultural workers being killed yearly (International Labor Organization ILO, 2004). This implies that agricultural workers are twice at risk of dying on the job when compared with workers in other sectors. For quit sometimes now there has been public concern about the crop protection and pest control chemicals, deliberately developed to be toxic to some living organisms which is the reason for their commercials utilization (Sajo and Mustapha, 2007). Accidental ingestion of agro-chemicals by humans and animals might produce adverse effect because they are very poisonous. Thus, there are a lot of health risks to the farmers and others handling and spraying agro-chemicals.

The negative human health and environment consequences arising from misuses of agro-chemicals is of great concern as farmers, farm workers and rural population experience both acute and chronic health effects from agro-chemical exposure. The
World Health Organization (WHO) estimates that globally, exposure to pesticide caused an annual 20,000 death and at least 3 million cases of poisoning are recorded annually with over 70% occurring in Africa (WHO, 2001). Other estimates suggest that annual figure for pesticide poisoning is as high as 20 million in developing countries alone (Jenyaratnam, 1990). Ajayi (2006) disputed these figures suggesting that those cases should be as much as even treble, since many cases are not reported in rural areas of developing countries. According to Sajo and Mustapha (2007) most human health and environment hazards are caused by mishandling of agrochemicals from their purchases, storage, application and disposal of pesticide waste and containers. The author further stressed that hazards can be minimized if stakeholders abide by the guideline on safe use of agrochemicals.

World Health Organization (2001) in agricultural census reported that most of the agro-chemical operators are hired farm workers that lack agricultural background and use employment in the agricultural sector as an entry level job. The report also reveals that language barrier also exists which can impede following safety information on labels. All of those may increase health safety hazard in the agricultural work place (ILO, 2004). Training workshop on safe use of agrochemicals organized by Daimina Project (2004) recommended precautionary measures by farmers when applying the various agrochemicals such as wearing of nose shield to avoid inhalation, protective clothing, rubber gloves and boots, restraining from smoking, eating and drinking during chemical applications, covering of food and water to avoid contamination among others. This study is significant in that the identification of capacity building needs of farmers for safe agro-chemical use and application will inform decision makers and instruct policy to reduce the negative effect of agro-chemicals in the agricultural transformation programme.

Objectives of the study

The broad objective of the study is to examine the capacity building needs of farmers for safe agro-chemical use in Niger State: the specific objectives are to:
1. determine the awareness of safety measures of agrochemicals use;
2. determine sources of awareness of safety measures;
3. determine the extent of practice of safety measures; and
4. identify areas of training needs of the respondents.

Hypothesis of the study

There is no correlation between the socio-economic characteristics of the respondents and practice of safety measures of agro-chemicals.

Methodology

Niger State falls within latitudes 8°-10°N and longitudes 3°-8° East. The State is located in the Southern Guinea Savanna ecological zone of Nigeria. The climate of the state is characterized by distinct wet and dry seasons. Some of the rains fed crops produced are maize, millet, sorghum, yam, groundnut, rice, cowpea, cassava and melon. Economic trees grown include; mango, oil palm shea butter trees, locust beans, orange and guava. Vegetable crops such as pepper tomatoes spinach and
okra are grown during the dry season along the banks of state’s major rivers through irrigation. Animals reared include cattle, goat, sheep, camel, donkey and poultry (Niger State Agricultural Development Project, 2002).

Three local government areas (Mokwa, Paikoro and Wushishi LGAs) one from each of the 3 agricultural zones in the state were randomly selected for the study. A total of 12 villages were randomly selected from the LGAs. Based on the population of farmers in each of the selected village, a total of 120 respondents were sampled for the study from established sampling frame of 1,200 farmers. A validated interview schedule which was subjected to Cronbach’s Alpha reliability test (r= 0.89) was used for data collection. Data were collected on the farmer’s socio-economic characteristics and awareness of safety measures as well as on the practices of the safety measures and training needs. Age, educational level and farming experience were measured in years; while income, farm size and marital status were measured in naira, hectare and dummy respectively. Awareness, sources of awareness and areas of training needs were measured by asking the respondents to indicate the awareness of any safety measure, their sources of awareness and areas of training needs. Extent of practice of safety measures was measured by asking the respondents to indicate the number of safety measures they practised regularly. The maximum score for extent of practice of safety measures was 16 while the minimum score was 1. Field survey for data collection was conducted between January and March, 2012. Data were analyzed using descriptive statistics (frequency and percentage) and correlation analysis.

Results and Discussion
Socio-economic characteristics of respondents

Result in Table 1 indicates that 12.50% of the respondents were less than 20 years, while 31.70% and 30.00% of the respondents were in the ranges of 20-29 years and 30-39 years, respectively. These findings suggest that majority of the respondents were in their active age ranges of 20-39 years and Hamidu et al. (2006) reported that young active farmers are more willing to adopt and practice new agricultural technologies than the older farmers. Table 1 further reveals that majority (94.20%) of the respondents were married. Findings on educational status of the respondents shows that (54.20% did not acquire formal education, while only (9.20%) have tertiary education. This result reveals that more than half of the respondents did not acquire formal education. Majority (62.50%) of the respondents had more than 15 years of farming experience, which implies that the majority of the respondents have long years of experience. Most of the respondents (68.30%) realized income of between ₦151, 000 - ₦250,000. Only 27.50% of the respondents realized above ₦250, 000 as farm income. Similarly, Table 1 shows that (35.00%) of the respondents cultivated less than 1 hectare, while (45.80%) cultivated between 1-2 hectares. The mean farm size of the respondents was 1.3 hectare.
Table 1
Socio-economic characteristics of the respondents.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;20years</td>
<td>15</td>
<td>12.50</td>
</tr>
<tr>
<td>20-29years</td>
<td>38</td>
<td>31.70</td>
</tr>
<tr>
<td>30-39 years</td>
<td>36</td>
<td>30.00</td>
</tr>
<tr>
<td>40-49years</td>
<td>15</td>
<td>12.50</td>
</tr>
<tr>
<td>50-59</td>
<td>10</td>
<td>8.30</td>
</tr>
<tr>
<td>60 and above</td>
<td>6</td>
<td>5.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>120</td>
<td>100.00</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>7</td>
<td>5.80</td>
</tr>
<tr>
<td>Married</td>
<td>113</td>
<td>94.20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>120</td>
<td>100.00</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No formal education</td>
<td>65</td>
<td>54.20</td>
</tr>
<tr>
<td>Primary education</td>
<td>24</td>
<td>20.00</td>
</tr>
<tr>
<td>Secondary education</td>
<td>20</td>
<td>16.60</td>
</tr>
<tr>
<td>Tertiary education</td>
<td>11</td>
<td>9.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>120</td>
<td>100.00</td>
</tr>
<tr>
<td><strong>Farming experience</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;5years</td>
<td>6</td>
<td>5.00</td>
</tr>
<tr>
<td>6-10years</td>
<td>19</td>
<td>15.80</td>
</tr>
<tr>
<td>11-15years</td>
<td>20</td>
<td>16.70</td>
</tr>
<tr>
<td>Above 15years</td>
<td>75</td>
<td>62.50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>120</td>
<td>100.00</td>
</tr>
<tr>
<td><strong>Farm Income</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>₦50,000- ₦100,000</td>
<td>2</td>
<td>1.70</td>
</tr>
<tr>
<td>₦101,000- ₦150,000</td>
<td>3</td>
<td>2.50</td>
</tr>
<tr>
<td>₦151,000- ₦200,000</td>
<td>45</td>
<td>37.50</td>
</tr>
<tr>
<td>₦201,000- ₦250,000</td>
<td>37</td>
<td>30.80</td>
</tr>
<tr>
<td>Above ₦250,000</td>
<td>33</td>
<td>27.50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>120</td>
<td>100.00</td>
</tr>
<tr>
<td><strong>Farm size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;1ha.</td>
<td>42</td>
<td>35.00</td>
</tr>
<tr>
<td>1.1ha-2ha</td>
<td>55</td>
<td>45.80</td>
</tr>
<tr>
<td>2.1ha-3ha</td>
<td>23</td>
<td>19.20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>120</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: Field survey, 2012

Awareness of safety measures

Data in Table 2 show that hundred percent each of the respondents were aware of wearing protective clothing, wearing of rubber gloves/boots and avoiding drinking, eating or smoking during spraying, respectively. Similarly, 92.50% of the respondent were aware of wearing of nose shield to prevent inhalation, while 91.67% of the respondents knew about avoiding ingesting or inhaling of chemicals. Others included no spraying of chemical during windy periods (81.67%), covering of food and water
during spraying to avoid contamination (73.33%), avoiding skin contact with chemical (61.66%), no pouring of unused chemicals into drinking, irrigation or running water (54.17%), reading of instruction on label before using (45.83%), puncturing and burying of used agro-chemical containers in the soil (35.00%), bathing with soap and water after spraying chemical (30.00%), keeping of chemical under lock and key away from children (21.67%), washing of spraying cloth separately from other cloths (15.83%), buying of chemical from a reputable sources (13.33%) and avoiding off label use (7.50%). The findings reveal that there is low level of awareness on the last four safety measures listed above in the state. Thus, the extension agents should take special cognizance of those safety measures for appropriate information dissemination to farmers.

### Table 2
Awareness of safety measure by the respondents

<table>
<thead>
<tr>
<th>Awareness of safety measure*</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buying of chemical from reputable sources</td>
<td>16</td>
<td>13.33</td>
</tr>
<tr>
<td>Reading of instruction on label before using</td>
<td>55</td>
<td>45.83</td>
</tr>
<tr>
<td>Do not spray during windy period</td>
<td>98</td>
<td>81.67</td>
</tr>
<tr>
<td>Wearing of protective clothing, wearing of nose shield to avoid inhalation</td>
<td>120</td>
<td>100.00</td>
</tr>
<tr>
<td>Wearing of rubber gloves and boots</td>
<td>120</td>
<td>100.00</td>
</tr>
<tr>
<td>Do not drink, eat or smoke while spraying</td>
<td>120</td>
<td>100.00</td>
</tr>
<tr>
<td>Avoid skin contact with chemicals</td>
<td>74</td>
<td>61.66</td>
</tr>
<tr>
<td>Do not ingest or inhale chemicals</td>
<td>110</td>
<td>91.67</td>
</tr>
<tr>
<td>Covering of food and water during spraying to avoid contamination</td>
<td>88</td>
<td>73.33</td>
</tr>
<tr>
<td>Do not pour unused chemical in to drinking, irrigation or running water</td>
<td>65</td>
<td>54.17</td>
</tr>
<tr>
<td>Puncture used chemical containers and bury in the soil</td>
<td>42</td>
<td>35.00</td>
</tr>
<tr>
<td>Avoid off-label use</td>
<td>9</td>
<td>7.50</td>
</tr>
<tr>
<td>Both with soap and water after spraying chemicals</td>
<td>36</td>
<td>30.00</td>
</tr>
<tr>
<td>Wash spraying cloths separately from other cloths</td>
<td>19</td>
<td>15.83</td>
</tr>
<tr>
<td>Keep chemicals under lock and key away from children</td>
<td>26</td>
<td>21.67</td>
</tr>
</tbody>
</table>

Source: Field survey, 2012
* Multiple responses

### Sources of awareness

Majority (55.00%) of the respondents got information on safety measures from friends and relatives through conversation. This was followed by cooperative societies (35.00%) and radio jingles (25.00%), while extension agents (20.83%) ranked fourth as a source of information on safety measures. The implication of the findings is that the majority of respondents had more interaction with non professionals (friends and relatives) than the extension agents who are supposed to be a reliable and better source of awareness on safety measures.
Table 3
Distribution of respondents according to their sources of awareness of safety measures.

<table>
<thead>
<tr>
<th>Sources of awareness of safety measure*</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extension agents</td>
<td>25</td>
<td>20.83</td>
</tr>
<tr>
<td>Television</td>
<td>18</td>
<td>15.00</td>
</tr>
<tr>
<td>Radio jingles</td>
<td>30</td>
<td>25.00</td>
</tr>
<tr>
<td>Friends/relatives</td>
<td>66</td>
<td>55.00</td>
</tr>
<tr>
<td>Posters</td>
<td>8</td>
<td>6.67</td>
</tr>
<tr>
<td>Cooperative societies</td>
<td>42</td>
<td>35.00</td>
</tr>
<tr>
<td>Extension bulletins</td>
<td>11</td>
<td>9.17</td>
</tr>
<tr>
<td>Newspaper/magazines</td>
<td>7</td>
<td>5.83</td>
</tr>
<tr>
<td>Neighbours</td>
<td>5</td>
<td>4.17</td>
</tr>
<tr>
<td>Instruction labels on containers</td>
<td>2</td>
<td>1.67</td>
</tr>
</tbody>
</table>

Source: Field survey, 2012
* Multiple responses

Practice of safety measures

Table 4 shows practice of safety measures by the respondents. Only one quarter of the respondents (25.83%) read instructions on the label before using the chemicals. Also, only 23.33% avoided pouring of unused chemicals into drinking, irrigation or running water. It is pertinent to note that the practice of wearing rubber gloves/boot, protective cloth and nose shield had low responses with 22.50%, 18.33% and 15.83% response rate, respectively. Other safety measures that were not well practised included keeping of chemicals under lock and key away from the children (10.83%), puncturing and burying of used agro-chemical containers in the soil (7.50%), washing of spraying cloth separately from other cloths (6.67%) and avoiding off label use (2.50%). This could be attributed to the low level of awareness and knowledge of the respondents on the devastating effect of the agro-chemicals. This poses a possible threat to farming families, animals, food and agriculture in the state.
Table 4
Practice of safety measures by the respondents.

<table>
<thead>
<tr>
<th>Practice of safety measure*</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buying of chemical from reputable source</td>
<td>6</td>
<td>5.00</td>
</tr>
<tr>
<td>Reading of instruction on label before using</td>
<td>31</td>
<td>25.83</td>
</tr>
<tr>
<td>Avoiding spray during windy period</td>
<td>94</td>
<td>78.33</td>
</tr>
<tr>
<td>Wearing of protective clothing</td>
<td>22</td>
<td>18.33</td>
</tr>
<tr>
<td>Wearing of nose shield to avoid inhalation</td>
<td>19</td>
<td>15.83</td>
</tr>
<tr>
<td>Wearing of rubber gloves and boots</td>
<td>27</td>
<td>22.50</td>
</tr>
<tr>
<td>Avoiding drinking, eating or smoking while spraying</td>
<td>103</td>
<td>85.83</td>
</tr>
<tr>
<td>Avoiding skin contact with chemicals</td>
<td>65</td>
<td>54.17</td>
</tr>
<tr>
<td>Avoiding ingestion or inhaling chemicals</td>
<td>110</td>
<td>91.67</td>
</tr>
<tr>
<td>Covering of food and water during spraying to avoid contamination</td>
<td>76</td>
<td>63.33</td>
</tr>
<tr>
<td>Avoiding pouring unused chemical in to drinking, irrigation or running water</td>
<td>28</td>
<td>23.33</td>
</tr>
<tr>
<td>Puncture used agro-chemical containers and bury in the soil</td>
<td>9</td>
<td>7.50</td>
</tr>
<tr>
<td>Avoiding off-label use</td>
<td>3</td>
<td>2.50</td>
</tr>
<tr>
<td>Bathing with soap and water after spraying</td>
<td>34</td>
<td>28.33</td>
</tr>
<tr>
<td>Washing of spraying cloth separately from other cloths</td>
<td>8</td>
<td>6.67</td>
</tr>
<tr>
<td>Keep chemicals under lock and key away from children</td>
<td>13</td>
<td>10.83</td>
</tr>
</tbody>
</table>

Source: Field survey, 2012
* Multiple responses

Reasons for not practising safety measures

When asked to give reasons for not practicing some safety measures, 8.33% of the respondents in Table 5 indicated that they did not know the reputable dealers of the agro-chemicals in their area, while 17.50% of respondents indicated that they are not practicing wearing of protective cloth and rubber glove/boots because they are too heavy to wear. On the other hand, some of the respondents (14.17%) reported that they are not practicing reading of instructions before using agro-chemicals because character of some instruction labels are too small or tiny to read. Other respondents constituting 15.00% indicated that they did not take some safety measure such as avoiding skin contact with chemicals, washing spraying cloth separately from other cloths and keeping chemicals under lock and key away from children very serious. This point to the problem of information provided by non-professionals (friends and relatives). This implies that a considerable awareness campaign is needed to promote the practice of some safety measures.
Table 5
Reasons for not practicing safety measures

<table>
<thead>
<tr>
<th>Reasons for not practice safety measures*</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did not know the reputable dealers</td>
<td>10</td>
<td>8.33</td>
</tr>
<tr>
<td>Protective cloths and rubber gloves/boots are heavy to wear</td>
<td>21</td>
<td>17.50</td>
</tr>
<tr>
<td>Character of instruction labels too small to read</td>
<td>17</td>
<td>14.17</td>
</tr>
<tr>
<td>Did not take safety measures very serious</td>
<td>18</td>
<td>15.00</td>
</tr>
</tbody>
</table>

Source: Field survey 2012
* Multiple responses

Training needs of farmers

Table 6 reveals that 61.7% of the respondents were in need of training on application of agro-chemicals on how to use knapsack sprayer, type of agro-chemical to apply under different environment, how to apply it and when it should be applied. Similarly, 52.5% of the respondents were in need of training on handling of agro-chemicals such as mixing and cleaning of agro-chemical. Other areas of training needs were disposal of waste/containers (49.2%), storage (38.3%) and transportation (10.0%) of agro-chemicals. This result highlights the areas of capacity building needs of farmers; which suggest that most of the respondents were in need of training on application, handling and disposal of waste/container of agro-chemicals. Attending to those areas of needs will go a long way in building farmers’ capacity for safe use and application of agro-chemicals, thereby minimizing pest resistance, damage to pollinating insects, phytotoxicity, agro-chemical drift, air pollution as well as hazards to human and wildlife species.

Table 6
Training needs of the respondents

<table>
<thead>
<tr>
<th>Training needs*</th>
<th>Percentage</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation of agro-chemicals</td>
<td>12</td>
<td>10.00</td>
</tr>
<tr>
<td>Storage of agro-chemicals</td>
<td>46</td>
<td>38.33</td>
</tr>
<tr>
<td>Handling of agro-chemicals</td>
<td>63</td>
<td>52.50</td>
</tr>
<tr>
<td>Application of agro-chemicals</td>
<td>74</td>
<td>61.67</td>
</tr>
<tr>
<td>Disposal of waste/containers of agro-chemicals</td>
<td>59</td>
<td>49.17</td>
</tr>
</tbody>
</table>

Source: Field survey, 2012
* Multiple responses

Correlation between socio-economic characteristics and practice of safety measures.

Data in Table 7 shows a negative correlation between age and practice of safety measures. This implies that as farmers get older, they become more conservative and tend to abandon safety measures. In a related study, Hamidu et al. (2006) reported that old farmers often tend to be more conservative in relation to adoption of innovation and practices. However, educational level, farming experience and farm income of the respondents had positive correlation with the practice of safety measures.
measures, indicating that a unit increase in those variables will ensure constant practice of the safety measures by the respondents.

Table 7
Correlation between socio-economic characteristics of the respondents and practice of safety measures

<table>
<thead>
<tr>
<th>Description of variables</th>
<th>Practice of safety measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>-0.290</td>
</tr>
<tr>
<td>Marital status (dummy)</td>
<td>0.183&lt;sup&gt;NS&lt;/sup&gt;</td>
</tr>
<tr>
<td>Education (years)</td>
<td>0.461&lt;sup&gt;*&lt;/sup&gt;</td>
</tr>
<tr>
<td>Farming experience (years)</td>
<td>0.337&lt;sup&gt;*&lt;/sup&gt;</td>
</tr>
<tr>
<td>Farm income (naira)</td>
<td>0.307&lt;sup&gt;*&lt;/sup&gt;</td>
</tr>
<tr>
<td>Farm size (hectare)</td>
<td>0.190&lt;sup&gt;NS&lt;/sup&gt;</td>
</tr>
<tr>
<td>Practice of safety measures (number)</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Source: Computed from field survey, 2012

*correlation is significant at 0.05 levels

r-values at 0.05=0.232

NS= Not significant

Conclusion

Most of the respondents were in need of training on application and handling of agro-chemicals. Education, farming experience and farm income had positive correlation with practice of safety measures by the respondents.

Recommendations

Extension awareness campaign should be carried out in the state to raise the level of awareness on the safety measures of agro-chemicals and for farmers to take the safety measures very serious.
List of reputable agro-chemical dealers in the state should be compiled by extension agent and made known to the farmers for patronage.
Lighter protective clothing and rubber boots should be designed by their manufacturers for farmers’ conveniences, while the character of the instruction labels on the containers of agro-chemicals should be boldly written for ease of reading.
To build farmers’ capacity for safe use and application of agro-chemicals in the state, extension education should pay particular attention to training the farmers on agro-chemical safety issues such as application, handling and disposal of waste/containers of agro-chemicals. This is necessary to prevent both human and animal health hazards as well as environmental hazards.
References


Use of Information and Communication Technologies among Extension Agents In Kano State, Nigeria


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Abstract
The study assessed the use of ICTs among extension agents in Kano State Nigeria. Two hundred and twenty-one (221) extension agents were randomly selected from the 44 local government areas. Data for the study were obtained with the aid of structured questionnaire administered to extension agents. Majority of extension agents were in the age range of 41-50 years. Majority (87.3%) of them were males and married (100%), with family sizes of 5-14 (53.95%). The entire extension agents had formal education including HND (35.8%), OND (33.3%) and secondary school certificate (27.2%). Most of the extension agents had an annual income of ₦100,000-₦300,000, with ₦376,984 as mean. They were aware and had access to radio, television, telephone, DVD, video, camera, computer, satellite and printer. They however recorded a low usage of the Web, satellite, e-mail, CD-ROM, search engines, scanner, fax and Web publishing. The result also indicates a positive correlation between ICT use and socio-economic characteristics of the agents; including age, work experience, membership of agricultural associations (p<0.05). It was concluded that the benefits of the ICTs were not fully utilized by extension workers in the state due to some factors associated with low income, ICTs training, awareness and access.

Keywords: Information, Communication, Technologies, Extension Agents

Introduction
The main purpose of agricultural extension activities is to communicate relevant and useful information to the end users in order to persuade them to adopt that which will eventually lead to increase in agricultural production. To achieve this, extension workers and their trainers should be knowledgeable and skilful in communication (Okunade and Oladosu 2006).

The use of Information and Communication Technologies (ICTs) in agriculture, just like in the other fields of knowledge, has been gaining popularity in Africa and Nigeria in particular. During the last two decades, the world witnessed an unprecedented growth in the area of ICT (Hosseini et. al., 2009). The use of conventional communication channels such as farm/home visit, personal letters, and use of contact farmers, for disseminating agricultural information is counterproductive (Arokoyo, 2005). This calls for the adoption of ICTs by both
researchers and extension workers to transmit relevant information to farmers in a most efficient way (FAO, 1993; Salau and Saingbe, 2008).

ICTs can be broadly interpreted as technologies that facilitate communication and the processing and transition of information by electronic means. This definition encompasses the full range of ICTs from radio and television to telephones (fixed and mobile), computers and the internet (CTA, 2003). Food and Agriculture Organization (FAO, 1993) defines ICT as technologies involved in collecting, processing, storing, retrieving, disseminating and implementing data and information using microelectronics, optics and telecommunications and computers.

ICTs have the potentials of bridging the existing communication gap among the extension workers on one hand and between the extension workers and the farmers on the other. According to CTA (2003), ICTs have the potentials to enhance farmers’ ability to collate demands; collaborative learning; exchange of time sensitive information e.g. market prices, disease outbreaks, etc. make extension systems and structures more efficient; engage farmers in assessing own needs, solutions; facilitating multi-stakeholder brainstorming; exploring alternative production technologies; facilitating access to markets and credits; training and demonstration; community learning; search, select and compile information for individual clients; early warning for disasters etc. and weather forecast; and peer to peer sharing and exchange among extension.

If modern ICT facilities are not adequately built into the mainstream of Nigerian agricultural system, there is likely to be stagnation in the dissemination, utilization and application of scientific agricultural information for purposeful development of the system (Adebayo and Adesope, 2007). Modern agricultural extension system encourages the development of positive attitude in the scientists to appreciate the knowledge, experience and capacities of the local people in the research development process (Amalu, 1998).

It has therefore become necessary for all stakeholders to join hands in developing ICT world in Nigeria since it has the potential of transforming agriculture through agricultural extension in the country. An agricultural extension worker can learn new technologies, rainfall forecasts, commodity prices, etc and use that information to advice farmers in villages. The importance of ICTs in development process was long recognized and access to ICTs was even made one of the targets of the Millennium Development Goal No. 8 (MDG 8), which emphasizes the benefits of new technologies, especially ICTs in the fight against poverty. “With 10 percent increase in high-speed internet connections, economic growth increases by 1.3 percent” observed a World Bank report on Information and Communication for Development (World Bank, 2009). The same report also observed “connectivity – whether the Internet or mobile phones -- is increasingly bringing market information, financial services, and health services to remote areas, and is helping to change people’s lives in unprecedented ways” (Asenso-Okyere and Mekonnen, 2012). ICT is therefore a veritable tool for transformation of Nigerian agriculture.

Agriculture is still the main stay of Nigerian economy, employing over 70% of the population. This is more so in the north and Kano state in particular. Agricultural extension system has the responsibility to develop the country’s agriculture. Such
development is often measured through the performance of the extension agents, whose main responsibility is to communicate innovations to the end users. However, there is no adequate information on whether the extension agents utilize the necessary ICTs in contacting the farmers, especially in Kano state.

The study was therefore designed to assess the use of ICTs among extension workers in Kano state.

**Objectives of the study**

The broad objective of the study was to assess the use of ICTs among extension agents in Kano state, Nigeria. The specific objectives were to examine the awareness, access and use of ICTs by the extension agents; and determine the relationship between some selected socio-economic characteristics of extension agents and ICT-use.

**Methodology**

The study was conducted in Kano state, northern Nigeria. The state has 44 local government areas, lies between latitudes 10° 33' N and 12° 37' N and longitudes 7° 34' E and 9° 29' E (Yakubu, 2011). The total land area is estimated at 20,760 square kilometres while the population is 9, 383,682 inhabitants who are mainly Hausa/Fulani and 80% of them engaged in farming (NPC, 2006). Most part of the state lies within the Sudan Savannah vegetation zone. On some parts of the western and southern boundaries, some traces of Guinea Savannah exists (KNSG, 2004).

The target population for the study was the entire extension agents under the Kano Agricultural and Rural Development Authority (KNARDA). Simple random sampling technique was used to proportionately select extension agents from each of the 3 zones of KNARDA in the state. A total of 221 extension agents were selected.

Structured questionnaire was administered to the extension agents to obtain data on socio-economic characteristics of the extension agents and awareness, access and use of ICTs.

Data were subjected to descriptive and inferential statistical analyses. Objectives one and two were analyzed using frequency and percentage while objective three was analysed using Pearson product-moment correlation to determine the relationship between the selected socio-economic characteristics and level of ICT-use.

**Measurement of Variables**

The study considered two sets of variables; dependent and independent variables. The dependent variable Y is ICT use. The study referred to the following ICTs: Radio, Television, Telephone (fixed and mobile), The Web, Search Engines, Packet digital Assistants, Cameras, Videos, E-mail, Computer, Scanner, CD-ROM, DVD, Satellite, Fax, Printer and Web Publishing.
Depending on the number of ICTs used by extension workers, ICT use was trichotomized into low (when < 9 ICTs were used), medium (when 9-12 ICTs were used) and high (when >12 ICTs were used).

The most important independent variables were measured as follows:
- Age: In years.
- Education: Measured according to the level of formal education attained (2= secondary; 3= OND; 4 = HND; 5 =B. Sc./B.A; 6 = M. Sc./M.A and 7 = PhD).
- Work experience: Measured in the number of years spent working.
- Annual income: Measured in N/year.
- Membership of agricultural associations: Dichotomized into members and non-members.
- Training on ICT Received: Categorized into no training and received training.
- Awareness of ICTs: Measured in the number of ICTs extension worker is aware of.
- Access to the ICTs: Also measured in the number of ICTs extension worker had access to.

**Results and discussion**

**Socio-economic Characteristics of the Extension agents**

Result on Table 1 shows that 49.8% of the respondents were within the ages of 41-50 years and only 16.3% were within 21-30 years. The mean age was 40.6 years. This indicates that most of the extension agents were in their middle ages and are therefore old enough to take decision on the use of ICTs.

Majority (87.3%) of the extension agents were males (Table 1). This indicates that the extension agents in were predominantly males. This may be connected with gender disparity found in the public service in Nigeria. It also agrees with Adedoyin et al (1999) who reported that males dominated the agricultural workforce in Nigeria. It further implies that technology development and transfer will be gender biased (Salau and Saingbe, 2008).

Table 1 also shows that the entire (100%) extension agents were married. It further shows that majority (53.9%) of them had family sizes in the range of 5-14. This implies that the extension agents have family responsibilities which might negatively affect their ability to purchase or employ the services of the ICTs.

Table 1 reveals that 35.8% of the extension agents had Higher National Diploma (HND), 33% had Ordinary National Diploma (OND), 27.2% had Secondary School Certificate and 3.6% had a Bachelor Degree (B. Sc or B. A) as their highest educational level attained. This indicates that the entire respondents had one educational qualification or the other. They were therefore literates and could utilize ICTs to improve their work as change agents. Majority (52.9%) of the extension agents had a working experience of 15-20 years. It indicates that most of the extension agents were over 15 years in the service. Such years of experience could enable the extension agent to save enough money to purchase the ICT facilities.

Majority (62.1%) of extension agents had an annual income of N100,000 N300,000 while 20.4% had N301,000 N500,000. The mean annual income was N376,984 ($2,313) that is about N31,415 ($192) per month. This reveals that the extension
workers were not comfortable enough financially to acquire and maintain most of the ICTs, especially computers and their accessories and mobile phones. Salau and Saingbe (2008), discovered that extension workers in Nassarawa state, Nigeria earned below ₦61,000 monthly which led to their lower level of ICTs utilization compared to agricultural researchers in the area. Poverty has also been observed by Arokoyo (2005) as a major constraint to ICT utilization.

Table 1

Socio-economic Characteristics of the Extension agents (n= 221)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-30</td>
<td>36</td>
<td>16.3</td>
</tr>
<tr>
<td>31-40</td>
<td>63</td>
<td>28.5</td>
</tr>
<tr>
<td>41-50</td>
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<tr>
<td>51-60</td>
<td>12</td>
<td>5.4</td>
</tr>
<tr>
<td>Mean age= 40.6 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
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<td></td>
</tr>
<tr>
<td>Male</td>
<td>193</td>
<td>87.3</td>
</tr>
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<td>Female</td>
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<td>12.7</td>
</tr>
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<td>Marital Status</td>
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<tr>
<td>Family Size</td>
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<tr>
<td>&lt;5</td>
<td>53</td>
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</tr>
<tr>
<td>5-14</td>
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<td>53.9</td>
</tr>
<tr>
<td>15-24</td>
<td>39</td>
<td>17.6</td>
</tr>
<tr>
<td>25-34</td>
<td>10</td>
<td>4.5</td>
</tr>
<tr>
<td>Mean Family Size = 9.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Educational Level</td>
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<td></td>
</tr>
<tr>
<td>Secondary Certificate</td>
<td>60</td>
<td>27.2</td>
</tr>
<tr>
<td>OND</td>
<td>73</td>
<td>33.0</td>
</tr>
<tr>
<td>HND</td>
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</tr>
<tr>
<td>B.Sc./B.A.</td>
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<td>3.6</td>
</tr>
<tr>
<td>M.Sc./M.A.</td>
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<td>0.4</td>
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<tr>
<td>Work Experience</td>
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<td></td>
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<tr>
<td>&lt;5</td>
<td>41</td>
<td>18.6</td>
</tr>
<tr>
<td>5-14</td>
<td>20</td>
<td>9.0</td>
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<td>15-24</td>
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<td>52.9</td>
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<td>25-34</td>
<td>43</td>
<td>19.5</td>
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<tr>
<td>Annual Income (₦)</td>
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</tr>
<tr>
<td>&lt;100,000</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>100,000-300,000</td>
<td>135</td>
<td>61.1</td>
</tr>
<tr>
<td>301,000-500,000</td>
<td>45</td>
<td>20.4</td>
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<tr>
<td>501,000-700,000</td>
<td>9</td>
<td>4.1</td>
</tr>
<tr>
<td>701,000-900,000</td>
<td>12</td>
<td>5.4</td>
</tr>
<tr>
<td>901,000-1,100,000</td>
<td>3</td>
<td>1.4</td>
</tr>
<tr>
<td>&gt;1,100,000</td>
<td>16</td>
<td>7.2</td>
</tr>
<tr>
<td>Mean Income = ₦ 376,984</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Field Survey, 2010
Awareness and access to ICTs

The entire (100%) extension agents were aware of radio, television and telephones as ICT tools (Table 2). Majority were also aware of DVD (99.1%), camera (98.6%), video (98.2%), computer (96.4%), printer (95.9%) and the Web (93.2%). Others were aware of satellite (92.8%), e-mail (78.3%), CD-ROM (69.2%) and scanner (53.4%). However, only 7.2% were aware of Web publishing, 25.3% of fax and 33.0% search engines. While Ani, (2007) recognized awareness as the first stage in adoption process, Agwu and Chah, (2007) observed that it is important to recognize that awareness among policy makers on the potentials of ICTs is a critical element for its development.

The entire extension agents (100%) had access to radio while 99.1% had access to television, 98.2% telephone, 94.6% video, and 93.7% camera (Table 2). Others were 88.7% DVD, 85.5% computer, 78.7% printer and 68.8% satellite. The table indicates a low access to Web publishing (3.6%), fax (7.7%), scanner (28.1%) and search engines (29.4%). Others were The Web (37.6%), CD-ROM (41.2%) and E-mail (46.2%). These findings supported the views of Omotayo (2005) that many rural areas of developing countries had no access to the basic telecommunication services that support key ICTs like the telephone and internet.
Table 2
Awareness and access to ICTs

<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequency (n = 221)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ICTs Awareness level</strong></td>
<td></td>
</tr>
<tr>
<td>Radio</td>
<td>221</td>
</tr>
<tr>
<td>Television</td>
<td>221</td>
</tr>
<tr>
<td>Telephone</td>
<td>221</td>
</tr>
<tr>
<td>The Web</td>
<td>206</td>
</tr>
<tr>
<td>DVD</td>
<td>219</td>
</tr>
<tr>
<td>Video</td>
<td>217</td>
</tr>
<tr>
<td>Camera</td>
<td>218</td>
</tr>
<tr>
<td>Computer</td>
<td>213</td>
</tr>
<tr>
<td>Satellite</td>
<td>205</td>
</tr>
<tr>
<td>E-mail</td>
<td>173</td>
</tr>
<tr>
<td>CD-ROM</td>
<td>153</td>
</tr>
<tr>
<td>Printer</td>
<td>212</td>
</tr>
<tr>
<td>Search Engines</td>
<td>73</td>
</tr>
<tr>
<td>Scanner</td>
<td>118</td>
</tr>
<tr>
<td>Fax</td>
<td>56</td>
</tr>
<tr>
<td>Web Publishing</td>
<td>16</td>
</tr>
<tr>
<td><strong>ICTs Access</strong></td>
<td></td>
</tr>
<tr>
<td>Radio</td>
<td>221</td>
</tr>
<tr>
<td>Television</td>
<td>219</td>
</tr>
<tr>
<td>Telephone</td>
<td>217</td>
</tr>
<tr>
<td>The Web</td>
<td>83</td>
</tr>
<tr>
<td>DVD</td>
<td>196</td>
</tr>
<tr>
<td>Video</td>
<td>209</td>
</tr>
<tr>
<td>Camera</td>
<td>207</td>
</tr>
<tr>
<td>Computer</td>
<td>189</td>
</tr>
<tr>
<td>Satellite</td>
<td>152</td>
</tr>
<tr>
<td>E-mail</td>
<td>102</td>
</tr>
<tr>
<td>CD-ROM</td>
<td>91</td>
</tr>
<tr>
<td>Printer</td>
<td>174</td>
</tr>
<tr>
<td>Search Engines</td>
<td>65</td>
</tr>
<tr>
<td>Scanner</td>
<td>62</td>
</tr>
<tr>
<td>Fax</td>
<td>17</td>
</tr>
<tr>
<td>Web Publishing</td>
<td>8</td>
</tr>
</tbody>
</table>

Field Survey, 2010

Information and Communication Technology Use

Table 3 shows that the entire extension agents (100%) use radio while 99.6% use television, 98.2% telephone, 92.3% camera and 90.1% DVD. Others were 80.1% video, 78.3% computer and 67.0% printer. There was however, a low usage of Web publishing (0.5%), fax (4.1%), and scanner (10.9%). Others included CD-ROM (21.3%), search engine (30.8%), the Web (31.2%), email (37.1%) and satellite (45.3%). It implies that majority of the extension agents had adopted one ICT or the other. According to Adeyinka, et al. (2009) since 2002, Nigeria has witnessed a rapid expansion of the internet. For instance, telephone lines in Nigeria prior to the introduction of the Digital Mobile Communications services popularly referred to as GSM in 2001 was mere 450,000 but increased to over 38 million lines by July 2007 thereby boosting teledensity growth from 0.4 to 24. Elijah (2010) also reported that the internet has proved to be an invaluable resource for obtaining information and providing new dimensions to existing areas of business. For example, it enhances marketing of agricultural products through strengthening social networks and
expansion of rural-urban linkages. Gelb et al. (2009) observed that adoption of ICTs as one instance of technological innovation dramatically improved the transfer and management of information, production chain efficiencies and integration within and with the agricultural sector. Lobo (2007) affirmed that multimedia communication campaigns were among the most effective methods of informing, training and diffusing appropriate technologies to farmers. Omotayo (2005) stated that a number of developments in many developing countries were shaping the future of extension services and setting the stage for the adoption of ICTs. According to Kiplang’at (2003) the impact of the use of ICTs in extension delivery still remained minimal as confirmed by a recent study to determine the diffusion of ICTs in communication of agricultural information among researchers and extension workers in Kenya.

Table 3
Information and Communication Technology Use

<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequency</th>
<th>Percentage (n = 221)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio</td>
<td>221</td>
<td>100.0</td>
</tr>
<tr>
<td>Television</td>
<td>220</td>
<td>99.6</td>
</tr>
<tr>
<td>Telephone</td>
<td>217</td>
<td>98.2</td>
</tr>
<tr>
<td>The Web</td>
<td>69</td>
<td>31.2</td>
</tr>
<tr>
<td>DVD</td>
<td>199</td>
<td>90.1</td>
</tr>
<tr>
<td>Video</td>
<td>177</td>
<td>80.1</td>
</tr>
<tr>
<td>Camera</td>
<td>204</td>
<td>92.3</td>
</tr>
<tr>
<td>Computer</td>
<td>173</td>
<td>78.3</td>
</tr>
<tr>
<td>Satellite</td>
<td>100</td>
<td>45.3</td>
</tr>
<tr>
<td>E-mail</td>
<td>82</td>
<td>37.1</td>
</tr>
<tr>
<td>CD-ROM</td>
<td>47</td>
<td>21.3</td>
</tr>
<tr>
<td>Printer</td>
<td>148</td>
<td>67.0</td>
</tr>
<tr>
<td>Search Engines</td>
<td>68</td>
<td>30.8</td>
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<tr>
<td>Scanner</td>
<td>24</td>
<td>10.9</td>
</tr>
<tr>
<td>Fax</td>
<td>9</td>
<td>4.1</td>
</tr>
<tr>
<td>Web Publishing</td>
<td>1</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Field Survey, 2010

Types of Information Obtained and Disseminated Using ICTs

Majority of the extension agents (64.0%) obtained information on improved agricultural production techniques using ICTs (Table 4). Such information involves innovations on scientific production, new varieties of crops and livestock and their production techniques, modern bee keeping, irrigation or dry season farming scheme and fish farming techniques. Others include new fertilizer application technique, food and feed preservation, management of pests and diseases and the use of pesticides. They also obtained information on both improved production techniques, marketing and climate (13.8%). Only 1.6% reported that they obtained information on ‘others’ using the ICTs. ‘Others’, refer to receiving and sending of mails and other messages such as those associated with staff meetings and training schedules, entertainment programmes such as music and drama, maps and results from workshops, seminars and conferences. This indicates that the ICTs were not optimally utilized by the extension agents in the extension activities, particularly concerned with communication. The result also reveals that most of the extension agents (89.4%) disseminated information on improved production techniques to the farmers using ICTs. All the Information disseminated on improved production techniques were similar to those obtained using the ICTs. Similarly, only 1.1% of the extension agents disseminated other information described earlier as ‘others’,
obtained using the ICTs (Table 4). However, they disseminated information on improved production techniques, marketing and climate (10.6%). Marketing information involves the purchase of farm inputs and the prices of farm produce. Climate information entails the expected period of rain onset, planting and harvesting periods.

Table 4
Types of Information Obtained and Disseminated Using ICTs

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Obtained Using ICTs (n=189)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved Production Techniques</td>
<td>121</td>
<td>64.0</td>
</tr>
<tr>
<td>Marketing</td>
<td>10</td>
<td>5.3</td>
</tr>
<tr>
<td>Climate</td>
<td>3</td>
<td>1.6</td>
</tr>
<tr>
<td>Conservation</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td>Govt. Policies</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td>Others</td>
<td>3</td>
<td>1.6</td>
</tr>
<tr>
<td>Improved Production Techniques and Marketing</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td>Improved Production Techniques and Climate</td>
<td>5</td>
<td>2.7</td>
</tr>
<tr>
<td>Improved Production Techniques and Conservation</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td>Improved Production Techniques and Govt. Policies</td>
<td>3</td>
<td>1.6</td>
</tr>
<tr>
<td>Improved Production Techniques,</td>
<td>26</td>
<td>13.8</td>
</tr>
<tr>
<td>Marketing and Climate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved Production Techniques, Marketing and Climate</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td>Conservation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved Production Techniques</td>
<td>8</td>
<td>4.2</td>
</tr>
<tr>
<td>Techniques and Others</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information Disseminated Using ICTs (n = 189)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved Production Techniques</td>
<td>169</td>
<td>89.4</td>
</tr>
<tr>
<td>Marketing</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td>Climate</td>
<td>4</td>
<td>2.2</td>
</tr>
<tr>
<td>Conservation</td>
<td>6</td>
<td>3.2</td>
</tr>
<tr>
<td>Govt. Policies</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td>Improved Production Techniques &amp; Marketing</td>
<td>4</td>
<td>2.2</td>
</tr>
<tr>
<td>Improved Production Techniques &amp; Climate</td>
<td>7</td>
<td>3.7</td>
</tr>
<tr>
<td>Improved Production Techniques &amp; Conservation</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td>Improved Production Techniques &amp; Govt. Policies</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Improved Production Techniques, Marketing &amp; Climate</td>
<td>20</td>
<td>10.6</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2010

Correlation between Socio-economic Characteristics of Extension Agents and ICT Use

Table 5 shows the correlation between the socio-economic characteristics of the extension agents and ICT use. Among the variables, age, years of working experience and membership of agricultural associations showed a positive correlation and therefore significantly (p<0.05) related to ICT use. Similarly, education, annual income, ICTs training, awareness and access correlated positively and also significantly (p<0.01) related to ICT use. The result implies that with age and more years of working experience, an extension agent is expected to acquire more personal capital; hence, more capacity to
purchase and use the ICT facilities. The more educated extension agents are more likely to adopt the ICTs for finding solutions to their professional and other problems. Increase in income improves the ICT purchasing power of the extension agent.

Table 5  
Correlation between Socio-economic characteristics of Extension Agents and ICT use

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Independent Variables</th>
<th>R-values</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICT use</td>
<td>Age</td>
<td>0.156</td>
<td>0.05*</td>
</tr>
<tr>
<td>ICT use</td>
<td>Education</td>
<td>0.350</td>
<td>0.01**</td>
</tr>
<tr>
<td>ICT use</td>
<td>Years of work</td>
<td>0.013</td>
<td>0.05*</td>
</tr>
<tr>
<td>ICT use</td>
<td>Annual Income</td>
<td>0.359</td>
<td>0.01**</td>
</tr>
<tr>
<td>ICT use</td>
<td>Membership of Agric. Associations</td>
<td>0.134</td>
<td>0.05*</td>
</tr>
<tr>
<td>ICT use</td>
<td>ICTs Training</td>
<td>0.190</td>
<td>0.01**</td>
</tr>
<tr>
<td>ICT use</td>
<td>ICTs Awareness</td>
<td>0.604</td>
<td>0.01**</td>
</tr>
<tr>
<td>ICT use</td>
<td>ICTs Access</td>
<td>0.873</td>
<td>0.01**</td>
</tr>
</tbody>
</table>

*Significant at 5%   ** Significant at 1%

Conclusion

ICTs are veritable tools for the formation of the needed linkages among researchers, agricultural extension agents and farmers. The benefits of the ICTs were not fully utilized by the extension agents in Kano State due to some factors associated with low income, ICTs training, awareness and access.

There is therefore the need for the development of ICTs infrastructure; especially in the rural areas to enable the extension agents have access to the key ICTs like telephone, computer and the internet.

References


Alampay, F. R. Heeks and , P.P.A Soliva. (2003). *Bridging the information divide; A Philippine Guidebook on ICTs.*


Meeting the Needs of Small Scale Farmers in Nigeria: The Commodity Price Broadcast Approach

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Abstract

Commodity price is a systematic process of disposing farm produce to give farmers a good remuneration for products. Giwa market from North West Zone was purposively chosen. 120 farmers were randomly selected from market surrounding villages. Information was obtained by the use of structured questionnaires. Data were analyzed by means of descriptive statistics which were used to describe the mean (x) distribution of the prices per commodity; bar charts and tables were used to present the result of the study. Farmers derived more information on market prices of agricultural produce and facilitated decision on what, how, when, and where to market their produce. This would aid farmers to have better earnings. The recommendations included: more market information from other location should be sought and intervention should be intensified to create more awareness on the importance of commodity price for agricultural and national development.

Keywords: Small scale farmers, farmers’ needs, commodity price broadcast.

Introduction

Commodity price as a marketing information system is a systematic process of disposing farm produce to give farmers good remuneration for the product. It plays an important role in the agro-industrialization and food supply value chain and serves as one of the very strategic information needs of vast majority of farmers in Nigeria. It involves a range of strategies and techniques to raise awareness of farm commodity and get more people to purchase the produce or services.

This is in line with the current Federal Government Agricultural Transformation Agenda (ATA) as a new beginning of a revolution for the agricultural sector to improve the livelihood of Nigerians (Arokoyo, 2012). According to Ozowa (1995) and Leroux et al. (2001) market information are farmers needs that enabled them to make rational and relevant decisions whose services have the function of collecting and processing market data systematically and continuously thereby making it available to all relevant stakeholders. It provides farmers with information on how, when, what, and where about of agricultural commodities in order to meet clients needs. This corroborates the position of the Food and Agricultural Organization (FAO, 2005) which asserts that, market information enables farmers to make an informed decisions about what to grow how, to grow, and as well as which markets produce should be sent for consumers to buy for onward utilization.
There are a number of factors which influence prices such as supply and demand, location, time of the year, quality of the product, and available market information (Sernow, 2004; NAERLS, 2012). Good marketing activities would enhance farmers' opportunity of gaining more advantages over the sale of their produce as well as providing adequate protection for small holder farmers from exploitation from middlemen who patronises small scale farmers at the farm gate.

The Programme (ACPB)

The commodity market price broadcast (ACPB) sponsored by the National Agricultural Extension and Research Liaison Services (NAERLS), Ahmadu Bello University, Zaria (A.B.U) is one of the programme aimed at providing a grassroots extension delivery to Nigerian farmers as a strategy of satisfying farmers need via marketing information.

The programme started with a pilot project in 2008 covering six (6) Agroecological zones based on Geo-political Zones of Nigeria viz: North west (Giwa market, Kaduna State), North East (Monday market, Borno State), North Central (Bida market, Niger state), south west (Bodija market, Oyo State), and South East (Umuahia market, Abia State). The effort is in line with satisfying one of its mandates of providing market information to the diverse target users among which are the small scale farmers, producers, marchants, commodity agents, processors, industrialists, and consumers alike. Thirteen selected agricultural commodities identified were Maize, Cowpea, Soybean, Groundnut, Rice, Sorghum, Gari, Tomatoes, Egusi, Dry Fish, Eggs, Ginger, and Palm oil through the use of standard and familiar measures. In line with this, the project comprises of:-

a) Commodity price collection from rural market by enumerators.

b) Collation, compilation, processing of National table of commodity market prices and.

c) Weekly broadcasting of the programme across the country. (NAERLS, 2012)

The information from these markets are tabulated capturing price variation across the country and are aired on a weekly basis on FRCN and some states radio stations in English and native language of where the market is located. The programmer is broadcasted for 15 minutes on Monday from 9:30am – 9:45am in Hausa and Tuesday from 9:45am – 10am in English as the case with North West Zone listeners.

Therefore, the study investigated perceived effectiveness and benefits derivable from the agricultural commodity market price broadcast among farmers in Giwa Local Government Area. Specifically, the study sought to:

- assess farmers perception on commodity market price broadcast;
- determine the farmers' benefit, derivable from the programme; and
- identify problems associated with commodity market price programme.

Methodology

Sample/Sampling Procedure

Giwa market from North West Zone was purposively selected due to proximity to NAERLS Headquarter for easily collation, monitoring and evaluation and also minimize expenses attached to project. One Hundred and twenty farmers were randomly selected from Shika (30), Giwa (20), Marabar Guga (20), Mahuta (10),
Gangara (10), Tashar Zomo (10), and Yakawada (10). Information obtained were on farmers socio-economic characteristic, their perception on commodity price broadcast, benefit derivable from the programme as well as problems associated with the programme in the North-West Zone of Nigeria.

Data Analysis
Data were analysed using descriptive statistics and percentages and illustrated with bar charts.

Result and Discussion
The socio-economic parameters considered in the study include: age, sex, education, house hold size, farm size and marketing experience.

Respondent’s age ranged between 20-69 years, with an average of 35 years. (Table 1) However majority (45.9%) fell within age bracket of 40-49 years, 23.3% within 50-59 years, 16.7% between 60-69 and only 14.1% were between the range of 30-39 years. The Table further indicates that majority were male (82.5%). Quite a majority of the farmers were educated with about 33.3% having had primary education, 16.7% had secondary level, while 25.0% were each had tertiary institutions and Islamic education. The respondents cropped an average of 6ha per farmer with an average household sizes of 12.5 people per family. On the average, respondents had marketing experiences of about 22 years, with 35.0% ranging between 10-19 years, and 29.2% falling within 20-29 years while about 23.3% within 30-39 years and only 12.5% had 5-9 years respectively.

Middle age implies active, hence may influence resource allocation, reasoning and managerial abilities (Jabil, 2009; Haruna, 2002), while sex and household size were economic indicators of labour availability for the production of enough with an excess for marketing (Jabil, 2009). On the other hand, education and marketing experiences were expected to have direct positive relationship with proficiency, and hence helps farmers to observe critically the market price trends for participation in policy matters and generally in developmental responsibilities (Jabil, 2009; Haruna, 2002), while also the average farm size was an indicator of small nature of farm operations.
### Table 1

**Socio-economic characteristics of the respondents**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage (n=120)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (Years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-39</td>
<td>17</td>
<td>14.1</td>
</tr>
<tr>
<td>40-49</td>
<td>55</td>
<td>45.9</td>
</tr>
<tr>
<td>50-59</td>
<td>28</td>
<td>23.3</td>
</tr>
<tr>
<td>60-69</td>
<td>20</td>
<td>16.7</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>99</td>
<td>82.5</td>
</tr>
<tr>
<td>Female</td>
<td>21</td>
<td>17.5</td>
</tr>
<tr>
<td><strong>Educational qualifications</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>40</td>
<td>33.3</td>
</tr>
<tr>
<td>Secondary</td>
<td>20</td>
<td>16.7</td>
</tr>
<tr>
<td>Tertiary</td>
<td>30</td>
<td>25.0</td>
</tr>
<tr>
<td>Islamic education</td>
<td>30</td>
<td>25.0</td>
</tr>
<tr>
<td><strong>Marketing experiences (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-9</td>
<td>15</td>
<td>12.5</td>
</tr>
<tr>
<td>10-19 Average = 22 years</td>
<td>42</td>
<td>35.0</td>
</tr>
<tr>
<td>20-29</td>
<td>35</td>
<td>29.2</td>
</tr>
<tr>
<td>30-39</td>
<td>28</td>
<td>23.3</td>
</tr>
<tr>
<td><strong>Farm size (ha) plots</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>16.7</td>
</tr>
<tr>
<td>4</td>
<td>40</td>
<td>33.3</td>
</tr>
<tr>
<td>6 Average = 6ha/person</td>
<td>20</td>
<td>16.7</td>
</tr>
<tr>
<td>8</td>
<td>30</td>
<td>25.6</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>8.3</td>
</tr>
</tbody>
</table>

**Source:** Field Survey, 2013

### Farmers Perception on Commodity Price Broadcast

Table 2 shows farmers perception of the commodity price broadcast, ranging from awareness, interest, sources of information, reason for choosing a market, appropriateness/adequacy of time and frequency of the programme as well as the relevance of the programme in agricultural development.

The result of the survey revealed that 75.7% were aware of the programme and majority (73.3%) were interested. Also 75.0% reported that, radio serve as a main source of market information eventhough about 25.0% revealed to have gotten market information through extension agents. Farmers advanced reasons for choosing Giwa market as closeness, attractive prices, potential buyers with 46.7%, 32.5% and 20.8% respectively. Both the broadcasting timing and programme
frequency were reported inadequate, as majority (84.0%) were agitating for increase in timing to 30 minutes, while about 50.9% opined to the fact that the programme should be aired twice per week for effective dissemination of market information. All the respondent reported that, the price broadcast radio programme is relevant and is in line with ATA value chain for all the zonal offices on both state and national broadcasting stations; for transformation of Nigeria through agriculture.

The trend observed in these result were attributed to broadcast of the programme in official and native language of the area (English and Hausa) even though the broadcasting hour in the morning is not suitable for most of the farmers in the region. This negates the findings of Olajide et. al (2012) who showed that the programme is aired in the evening at Oyo which remains a leisure time for most farmers in the area.

The possible explanation on inadequate broadcasting timing and frequency may be attributed to poor sponsorship as well as the exorbitant prices paid for airing the programme per week (₦54,000.00) for only a programme in English and Hausa which translate to ₦702,000.00 per quarter. That seems to be a major challenge with the Institute, eventhough, the programme is gaining wider acceptance nationwide through promoting economic development.
### Table 2

**Respondents perception on the commodity price programme.**

<table>
<thead>
<tr>
<th>Remark (positive/negative)</th>
<th>Perception statement</th>
<th>Frequency</th>
<th>Percentage (n=120)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1+</td>
<td>Awareness of the programme</td>
<td>92</td>
<td>76.7</td>
</tr>
<tr>
<td>2+</td>
<td>interest in the programme</td>
<td>88</td>
<td>73.3</td>
</tr>
<tr>
<td></td>
<td>Sources of information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3+</td>
<td>Radio</td>
<td>90</td>
<td>75.0</td>
</tr>
<tr>
<td></td>
<td>Extension Agents</td>
<td>30</td>
<td>25.0</td>
</tr>
<tr>
<td></td>
<td>Reason for choosing Giwa Market</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Closeness</td>
<td>56</td>
<td>46.7</td>
</tr>
<tr>
<td></td>
<td>Attractive prices</td>
<td>39</td>
<td>32.5</td>
</tr>
<tr>
<td></td>
<td>Potential buyers</td>
<td>25</td>
<td>20.8</td>
</tr>
<tr>
<td>4-</td>
<td>The broadcasting timing is appropriate</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Suggest an appropriate timing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>60 minutes</td>
<td>14</td>
<td>11.7</td>
</tr>
<tr>
<td></td>
<td>30 &quot;</td>
<td>84</td>
<td>70.0</td>
</tr>
<tr>
<td></td>
<td>15 &quot;</td>
<td>22</td>
<td>18.3</td>
</tr>
<tr>
<td>5-</td>
<td>The programme frequency is adequate</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Suggest No. of appropriate frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 times</td>
<td>61</td>
<td>50.9</td>
</tr>
<tr>
<td></td>
<td>3 &quot;</td>
<td>42</td>
<td>35.0</td>
</tr>
<tr>
<td></td>
<td>4 &quot;</td>
<td>10</td>
<td>8.3</td>
</tr>
<tr>
<td></td>
<td>5 &quot;</td>
<td>7</td>
<td>5.8</td>
</tr>
</tbody>
</table>

**Source:** Field survey, 2013

**Average price of some selected commodity in North West Zone**

Information on the bar charts indicated average prices of some major selected Commodity covered by NWZ markets.
Figure 1: Average price of some selected Commodity (NWZ)

Source: NAERLS 2012

The chart, presented an average prices of dominant Commodity in the zone (Maize, Sorghum, Rice and Beans) across a Cropping Season of January, 2012 – December, 2012.

Respondents perceived benefit on the Commodity Price Broadcast (ACPB)

Table 3 result indicated that, 32.5% of the respondents claimed to have benefitted with the programme as a source of commodity prices information, and also about 23.3% were facilitated with decision making on where or which market to dispose up their produce. Others were 22.5 who opined to increase in their income from inception of the programme, while 8.3% claimed to have experienced increased in marketability of their produce, and those who benefitted with an informed decision of what to produce constituted 7.5% respectively.
Table 3 Respondents perceived benefit on the ACPB

<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequency</th>
<th>Percentage (n=120)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source of market information</td>
<td>39</td>
<td>32.5</td>
</tr>
<tr>
<td>Information on where to dispose</td>
<td>28</td>
<td>23.3</td>
</tr>
<tr>
<td>their product</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase in income</td>
<td>27</td>
<td>22.5</td>
</tr>
<tr>
<td>Marketability of produce</td>
<td>10</td>
<td>8.3</td>
</tr>
<tr>
<td>Decision on what to produce</td>
<td>9</td>
<td>7.5</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2013

Prices broadcast is a marketing information system that help farmers to obtain good prices for their product, hence obtain profit from their production with which to increase their income and earn good living, and make an informed decision on when and where to sell their Crops (Isiaku 2012).

Problems Associated with ACPB
The institute mandate was to cover as many rural markets and agricultural commodities as possible to provide key information required by producers, processors, marketers as well as consumers, for informed decision making. However, due to financial constraints, technical rehabilitation on some Radio Corporation, coupled with that, is the exorbitant charges per air time which has made the institution unable to respond to several demands for the expansion of the broadcast to cover more commodities and markets.

Conclusion and Recommendations
Evidently the study revealed that overall farmers positive disposition to commodity price programme was high. Farmers perceive efficacy was positive. However, programme timing and frequency was rated low. Farmers benefited most from the programme as a source of market information for agricultural commodities and least from an informed decision on what to produce. It is therefore recommended that:

- More market information on commodity prices from other location should be sought and effort should be intensified for more awareness on the programme for national and agricultural development.
- Government and non-governmental organization should put more effort in funding the programme in order to cover more locations and commodities.
- A review of timing and frequency per week is necessary in order to meet small scale farmers needs who form the majority of Nigerian farmers.
- Other media such as television and newspapers could be employed to air the programme for listeners across the country.
References


Soil conservation practices among Arable Crop Farmers In Enugu – North Agricultural Zone, Nigeria: Implications for Climate Change

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Abstract

The study examined soil conservation practices used by arable crop farmers in Enugu – North agricultural zone of Enugu State. One hundred and twenty randomly selected arable crop farmers were interviewed. Data were analysed by use of percentage and mean score. The study revealed that respondents used organic manure (87.5%), planting of cover crops (87.5%), crop rotation (86.7%), mulching (85.8%), inorganic manure (76.7%), contour bonds(75.8%), liming (61.7%), and terracing (60.8%) for soil conservation in the zone. However, organic manure (M=3.32), use of inorganic manure (M= 3.08), crop rotation(M=2.86), and mulching (M=2.82) were most preferred by the respondents The major reasons indicated for use of most soil conservation practices included enhanced productivity, high quality products, long term nutrient value and others. While most of the preferred conservation practices hold great potential for increased production, income for farmers and enhanced food security for the nation, some are implicated as causes of climate change. The more environment friendly and climate change sensitive practices are less popular among the farmers. The paper recommends concerted efforts to promote among farmers the conservation practices that aid mitigation and adaptation to climate change and at the same time enhance production. Researches and a corresponding creation of awareness on the most efficient and environmentally safe way of using practices that contribute to climate change should be intensified, since the pressure on ensuring food security remains a formidable challenge in the nation.

Key words: soil conservation, climate change, farmer, potential, threat.

Introduction

Achieving food security in its totality continues to be a challenge not only to developing nations but also to the developed world (Angela, nd). According to FAO (2006) an estimated 854 million people worldwide are still undernourished and almost 33% or close to 200 million people in Africa are chronically undernourished. The situation in Sub-Saharan Africa is particularly dire with the number of hungry people increasing by 20 percent since 1990 (Braun, 2005). In Nigeria the situation is not different. Kumolu (2010) reported that about 40 million people in Nigeria are believed to be hungry and a large percentage of the population lack access to adequate food.
Land degradation is one of the biggest threats to sustainable development of agriculture, food security and poverty reduction in the world and Nigeria in particular. According to Barbier, (2003), land degradation is the result of a combination of social, economic, cultural, political and biophysical forces operating across a broad spectrum of temporal and spatial scales but essentially arises from bad land management that encourages soil erosion by wind and water, bad irrigation management leading to salinization, excessive use of fertilizer that leads to soil acidification and formation of acid sulfate soil resulting in barren soil, over grazing of rangeland and more widely and insidiously through loss of soil organic matter and loss of biodiversity.

World Watch (2012) reports that according to a study conducted for the International Food Policy Research Institute, each year an estimated 10 million hectares of cropland worldwide are abandoned due to soil erosion and diminished production caused by erosion. Another 10 million hectares are critically damaged each year by salinization, in large part as a result of irrigation and/or improper drainage methods. This loss amounts to more than 1.3 percent of total cropland annually. Primarily, farmers depend on rich topsoil for production of crops but about 1.9 billion tons of topsoil washes or blows away each year with 1.3 billion tons of excessive erosion (www.planetwire.org/files.fcgi/291.agricult.pdf). Consequently, most of the additional cropland needed to replace yearly losses comes from the world's forest areas.

According to World Bank report of 1990, the long term loss to Nigeria from environmental degradation was estimated to be about $5 million annually (Ezeaku, 2012). With gully erosion widespread in southern Nigeria, the federal government spent almost 91.0 billion naira on the periodic rehabilitation aid and replacement project of the Bar Beach in Lagos (UNCSD, 1997) .World Bank reported that in 1990, gullies occupied 4% of the land area of Anambra, Imo, Abia, and Enugu States. Ogbonna, Onyenweaku and Mbanasor (2007) remarked that the situation of soil degradation that requires immediate soil conservation attention is more precarious in the southeastern states of Nigeria especially in Enugu State. Therefore, use of sustainable soil conservation techniques is of paramount importance to achieving increased production and food security of the country.

Soil conservation according to Ezeaku (2012) is a set of management strategies for prevention of soil being eroded from the earth’s surface or becoming chemically altered by over use, salinization, acidification, or other chemical soil contamination. It comprises the combination of all methods of management and land use to guard against soil depletion or deterioration by natural or man-induced factors. In the opinion of Dumaski, Peiretti, Benitis, McCarry et. al., (2006), soil conservation efforts of farmers promote minimum disturbance of the soil by tillage, balance application of chemical inputs which are only required for improved soil quality for healthy crop and animal production with careful management. Thus, effective soil conservation practices reduce land and water pollution; reduce long-term dependency on external inputs which often times led to increased cost of production, enhance environmental management, improved water quality and water use efficiency, reduced emission of green house gases through lessened use of fossil fuel and finally improved agricultural productivity with minimum cost (Smith and Smithers, 2006).
Traditionally, farmers employ several soil conservation practices ranging from simple agronomic practices, soil management and use of mechanical methods of soil management. Though the use of these practices has considerably sustained production at least on subsistence level, but their impacts (long and short term) in relation to adapting, mitigating or exacerbating the problems of climate variability should be of concern. It is generally believed that agriculture ranks high as one of the major contributors to climate change and a sector most vulnerable to climate change (IPCC, 2007). Organic Agriculture Association (2008) states that agricultural land use is responsible for approximately 15% of all green house gas (GHG) emission. Specifically, agricultural processes comprise of 54% of methane emissions, roughly 80% of nitrous oxide emission, and virtually all carbon dioxide emissions tied to land use (Niggli, Fliessbach, and Hepperly, 2008). On another hand, agriculture stands as the most vulnerable sector because of its heavy reliance on sustainable use of natural resources. Another paradox is the notion that it has potential for mitigating to climate change. This calls for a rethinking on the current soil conservation practices employed by farmers for agricultural production. Therefore examining the current soil conservation practices employed by arable crop farmers in relation to climate change phenomenon is an imperative. The study aimed to:

- ascertain and examine soil conservation practices used by farmers;
- examine farmers’ preference of soil conservation practices and reasons for the preference; and
- identify constraints to the use of soil conservation practices.

Methodology

The study was conducted in Enugu – North Agricultural Zone of Enugu State, Nigeria. Enugu North Agricultural Zone consists of eight (8) blocks which includes: Nsukka 1, Nsukka II, Igbo-Eze I, Igbo-Eze II, Udenu, Igbo-Etit, Uzo-Uwani I, and Uzo-Uwani II. Arable crop farmers in the zone constituted the population. Multistage random selection technique was used. The first stage involved random selection of six blocks from the zone by simple random technique. The second stage was the selection of two cells from each block using simple random selection techniques, giving a total of twelve cells for the study. Lastly, ten arable crop farmers were selected from list of arable crop farmers provided by extension agents using simple random selection technique. A total sample size of 120 respondents was used. Data were collected by the use of structured interview schedule. Respondents were asked to indicate the methods of soil conservation employed in the farm (example mulching, planting of cover crops, conservation-tillage crop rotation, organic manures, inorganic manure and others), their preference and reasons for preference of soil conservation used. The respondents indicated their preference on a four point Likert type scale of highly preferred (4), preferred (3), less preferred (2), and least preferred (1). Respondents were also asked to indicate among listed variables, problems encountered while using a particular soil conservation practice. Data collected were analyzed using descriptive statistics. (frequency distribution, percentage, mean and standard deviation). Preference was determined using the mean cut off point ≥ 2.5 as most preferred and < 2.5 as less preferred.

Results and Discussion

Soil conservation practices used
Table 1 shows that respondents employed organic manure (87.5%), cover crops (87.5%), crop rotation (86.7%), mulching (85.8%), inorganic manure (76.7%), and terracing (60.8%) to conserve the soil. Only 30% and 0.8% of the respondents practiced planting of windbreak and conservation-tillage in their farms, respectively. Generally, respondents used both agronomic, soil management and mechanical strategies of soil conservation. Either practices are important because they variously affect chemical, physical and biological properties of soil. For instance, agronomic soil conservation practices (cover crops, mulching, crop rotation, fallowing and others) use the effect of surface covers to reduce erosion by water and wind in order to conserve the soil, protect the soil from direct sun rays and enrich soil by the decay of their fallen leaves (Olaitan and Omamia, 2006) and some reduces the risk of serious pest and disease outbreaks. Also highlighting on its importance, Agele, Iremiren, and Ojeniye (2000) pointed out that the crop residues released reduce the soil temperature by some degree in the upper centimeters of the top soil and provide better moisture conservation by reducing the intensity of radiation, wind velocity and evaporation. It is these attributes that enhanced its potential for climate change adaptation and mitigation. Infact, Enete, Madu, Onwubuya, Onyekuru et al. (2011) identified some of the practices as indigenous adaptation practices used by farmers in south east Nigeria. It boosts adaptation to erosion, effect of direct sun rays on the soil, increase pest and diseases, loss of soil biomass and reduce soil fertility associated with climate change. The mitigation potential is provided by its ability to significantly contribute to soil carbon sequestration (carbon uptake from the atmosphere) through increase organic matter content of the soil.

In the same manner, soil management practices which include conservation tillage, the use of organic and inorganic manure holds great potentials for climate change adaptation and mitigation. Specifically, conservation tillage (zero tillage, minimum tillage, ridge tillage etc.) particularly zero tillage mitigate against release of CO$_2$ and N$_2$O caused by intensive tillage and burning of fossil fuel. It only becomes a threat where farmers use slash and burn for zero tillage. Similarly, the use of inorganic (fertilizer) and organic manure (animal dung/droppings) increases vulnerability (threat) by release of nitrous oxide and methane into the atmosphere. According to Organic consumer Association (2008) they are the two main sources of nitrous oxide. Nevertheless, these soil conservation practices are highly recommended by climate change scholars with emphaisis on appropriate management that depend less on use of inorganic manure and that enhance mitigation against release of nitrous oxide. (Ozor, Madukwe, Onokala, Enete et al., 2010; and Nzeh and Eboh, 2011)

Mechanical soil conservation practices namely the use of terrace, vegetative barriers/planting for wind break, contour bonds etc. are not very popular among the farmers. According to Junge, Deji Abaidoo, et al. (2009) they are effective soil conservation technologies as they reduce soil loss, but because the installation and maintenance is usually labour intensive, they are not likely to be adopted by farmers. However, they are both adaptive and mitigation measures to climate variability. When used, excessive soil and wind erosion, loss of degraded lands, and silting up of the field are reduced. The mitigation potentials are achieved through carbon sequestration (absorption of carbon from the atmosphere) by tree planting or vegetative barrier.
Table 1
Precentage distribution of respondents by soil conservation practices used

<table>
<thead>
<tr>
<th>Conservation practices</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>conservation tillage</td>
<td>0.8</td>
</tr>
<tr>
<td>Organic manure</td>
<td>87.7</td>
</tr>
<tr>
<td>Mulching</td>
<td>85.8</td>
</tr>
<tr>
<td>Inorganic manure</td>
<td>76.7</td>
</tr>
<tr>
<td>Planting cover crops</td>
<td>87.5</td>
</tr>
<tr>
<td>Crop rotation</td>
<td>86.7</td>
</tr>
<tr>
<td>Contours bonds</td>
<td>85.8</td>
</tr>
<tr>
<td>Terracing</td>
<td>60.8</td>
</tr>
<tr>
<td>Planting windbreak</td>
<td>30.0</td>
</tr>
</tbody>
</table>

Multiple response

Preferences of soil conservation practices

The mean scores in Table 2 show that organic manure (M= 3.32; S.D= 1.13), inorganic manure (M= 3.08; S.D= 1.16), Planting of cover crops (M= 3.05; S.D= 1.15) and mulching (M=2.82; S.D= 1.08) were the most preferred soil conservative practices. The less preferred soil conservative practices included terracing (M= 2.39; S.D= 1.37), Contour bond (M= 1.88; S.D= 1.18), planting windbreak (M= 1.68; S.D= 0.74), and conservation tillage (M= 1.39; S.D= 0.82). The high standard deviation of responses of the most preferred practices portrays varying opinion and probably the frequency of use by the respondents. Respondents are more homogenous in the perception of less preferred conservation practices and this suggests that these practices are yet to be welcomed and adopted as one of the effective soil conservation practices, perhaps due to location specificity of some of the practices. The integration of these practices especially in erosion prone areas is expedient in the present reality of climate change and the call for effective adaptation and mitigation measures. However, respondents’ reasons for the preference are discuss as follows:

Table 2
Mean score based on respondents’ preference of the soil conservation practices

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>S.D</th>
</tr>
</thead>
<tbody>
<tr>
<td>conservation tillage</td>
<td>1.39</td>
<td>0.82</td>
</tr>
<tr>
<td>Organic manure</td>
<td>3.32*</td>
<td>1.13</td>
</tr>
<tr>
<td>Mulching</td>
<td>2.82*</td>
<td>1.08</td>
</tr>
<tr>
<td>Inorganic manure</td>
<td>3.08*</td>
<td>1.16</td>
</tr>
<tr>
<td>Planting cover crops</td>
<td>3.05*</td>
<td>1.15</td>
</tr>
<tr>
<td>Crop rotation</td>
<td>2.86*</td>
<td>1.42</td>
</tr>
<tr>
<td>Contours bonds</td>
<td>1.88</td>
<td>1.18</td>
</tr>
<tr>
<td>Terracing</td>
<td>2.39</td>
<td>1.37</td>
</tr>
<tr>
<td>Planting windbreak</td>
<td>1.68</td>
<td>0.74</td>
</tr>
</tbody>
</table>

*Most preferred soil conservative practices

Reasons for using soil conservation practices

Conservation tillage
Table 3 shows that respondents used conservation tillage because it reduces production cost (50.4%), is less labour intensive (20.9%), and that it is less expensive (19.4%). About 11%, 8%, and 6% stated that it has no environmental pollution, it is easily accessible, conserve soil moisture and controls erosions, respectively. The results show that reduced cost of production is the major factor influencing use of conservation-tillage. The respondents seem to be unaware of other benefits. For example Nalewaje, (2001) reported that avoiding tillage averts disruption of soil aggregate, protect soil organic matter from accelerated decomposition and restore several soil biological processes. Above all, it is an emergent crop production technique which can increase the amount of water in the soil and decrease erosion. Thus, Bellarly, Foereid, Hasting and Smith (2008) and Niggli, Fliessbach and Hepperly. (2008) identified it as one of the sustainable agricultural practices beneficial to reducing the effect of climate change.

**Organic manure**

The respondents preferred organic manure because it enhances productivity (90.7%), high quality products (83.7%), long term nutrient value (80.6%), increase water filtration (72.1%), availability and accessibility (64.3%), increase soil biological activities (59.7%), aid soil aeration (57.4%), and control erosion (55.9%) (Table 3). Other reasons include less environmental pollution (48.1%), conserve soil moisture (45.0%) and less expensive (45.0%). This is in agreement with the conservation properties of organic manure. Hence, it’s importance for carbon sequestration and improvement of ecosystem resilience. However, appropriate management particularly during fermentation and/or when animal waste comes in contact with water and slurry (decomposition) is necessary to reduce potential threats to the climate.

**Mulching**

Table 3 shows that the respondents practiced mulching because it reduces the effect of heat from the sun (87.6%), conserve soil moisture (86.8%), has no environmental pollution (63.6%), and enhances productivity (53.5%), while 48.8%, 37.2%, 31.8% and 30.2% practiced mulching because of ease of accessibility, less expensive, increase soil microbial activities and increases water infiltration, respectively. This agrees with FAO (2006) that mulching protects against erosion, suppresses weeds, increase water infiltration and promotes soil biological activities. Also crop residues reduces the soil temperature by some degrees in the upper centimeters of the topsoil and provide better moisture conservation by reducing the intensity of radiation, wind velocity, and evaporation (Agele, et al., 2000). These characteristics effect of mulching constitute its potential for adaptation to climate change indicators such as increased temperature, erosion etc.

**Inorganic manure**
Majority (86.8%) of the respondents used inorganic manure because it enhances productivity, while 55.8% and 55.0%, used it for higher quality product and long term nutrient values; respectively (Table 3). Other reasons namely less labour intensive (18.6%), accessibility and availability (16.3%), aid aeration (14.0%), others were lowly perceived as reasons for use of inorganic manure. The result revealed that economic benefit is the key driver for application of inorganic soil conservation practice. The low perception of other reasons seem to suggest that the respondents are aware of its limitation in engendering long term improved physical, chemical and biological property of the soil. Frequent use of inorganic manure (fertilizer) has been associated with land degradation, increase in soil acidification and the formation of acid sulfate soil resulting in barren soil which eventually leads to decrease in agricultural productivity (Barbier, 2003)). Above all, the doubling of greenhouse gas (GHGs) production during the last 35 years was associated with a 6.9 fold increase in nitrogen fertilizer, a 3.5 fold increase in phosphorus fertilizer and a 1.7 fold increase in irrigated land (FAO, 2008). This makes it a threat instead of resource in adapting or mitigating climate change, especially where application is highly intensive.

**Cover crop**

Table 3 shows that (89.9%) of the respondents practiced cover cropping because it suppresses weeds (89.9%), conserves soil moisture (86.0%), reduces heat from the sun (84.5%), and had no environmental pollution (53.5%), A significant proportion used it for enhanced productivity (45.0%), control erosion (45.0%), aid soil aeration (39.5%), increases soil biological activities (34.9%) and increases water infiltration (31.0%). Relatively, the reasons are in line with FAO (2006) which maintained that permanent soil cover protects against erosion, suppresses weeds, increase water infiltration and promotes soil biological activities. This is further substantiated by Olaitan and Omomia (2006) who stated that cover crops are mainly planted to protect the soil from direct sun rays, reduce erosion, and enrich the soil by the decay of fallen leaves. These attributes makes it potentially a resource for both adaptation and mitigation against climate variability and global warming.

**Crop rotation**

The respondents indicated that the reasons for practicing crop rotation were to enhance production (79.1%), had no environmental pollution (72.9%), gives higher quality products (65.9%), and control erosion (60.5%) (Table 3). About 46%, 43%, and 21% applied crop rotation because it increases water infiltration, conserve soil moisture and it is less expensive, respectively. Characteristically, soil rotation reduces the risk of serious pest and disease outbreak, check erosion, improve soil fertility, and balance nutrient removal from the soil among others. In this way it increases resilience and reduces vulnerability of production system to climate change.

**Contour bond**
Majority (59.7%) of the respondents practiced contour bond because it enhanced productivity, while 44.2%, 38.0% and 30.2% indicated that it has no environmental pollution, controls erosion and conserves soil moisture, respectively (Table 3). A lesser proportion (22.5%) used it to increase water infiltration. Other reasons indicated by the respondents were because contour bond is less expensive (10.9%), availability/accessibility (10.9%), give higher quality products (9.3%) and others. The low perception expressed over reason for use confirms low preference and use of contour bond as indicated in the previous results. It could be that the respondents either have constraints to its use or they are not very knowledgeable of its application/benefits. Unfortunately it is supposed to be a common erosion control measure particularly in erosion prone areas. Thus, it is relevant for adaptation to climate associated problems like erosion.

**Terracing**

The respondents indicated that terracing was practiced in their farm to enhance productivity (39.5%), control erosion (29.5%), conserve soil moisture (26.4%), has no environmental pollution (24.0%), and increases water infiltration (21.7%) (Table 3). Relatively, the reasons expressed agree with Conservation Technology Information (2002) report that terrace prevent gully erosion and decrease sediment pollution in water. However, the perception of the respondents suggests that use of terracing for soil conservation is not a common practice. This is not surprising because according to Igbokwe (1996) high labor intensity, time-consuming regular inspection, high consumption of scarce farmland, and the large amounts of construction material required stop farmers from installing or maintaining terracing. Nevertheless, it is important for adapting to changes caused by climate variability (erosion).

**Planting of Wind break**

Table 3 shows that respondents plant Windbreak because it controls erosion (67.4%), reduce the effect of heat from the sun (44.2%), suppresses weeds (41.9%) and has no environmental pollution (39.5%). Other reasons for planting windbreak include; it enhanced productivity (23.3%), increase water infiltration (12.5%), and others. This is true of tree planting but it is surprising that is still not a common practice among farmers. Rather indiscriminate felling of trees seems to be more widespread in communities. Planting of trees in farms, and surroundings is essential for adaptation (against heat from sun, wind erosion etc) and mitigation (carbon sequestration and ecosystem resilience).

Table 3
Percentage distribution of respondents by reasons for preference of soil conservation practices

<table>
<thead>
<tr>
<th>Reasons</th>
<th>Conservation tillage</th>
<th>Organic manure</th>
<th>Mulching</th>
<th>Inorganic manure</th>
<th>Cover crop</th>
<th>Crop rotations</th>
<th>Contour bunds</th>
<th>Terracing</th>
<th>Planting wind break</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less expensive</td>
<td>19.5</td>
<td>45.0</td>
<td>37.2</td>
<td>8.5</td>
<td>9.3</td>
<td>20.9</td>
<td>10.9</td>
<td>3.9</td>
<td>-</td>
</tr>
<tr>
<td>Availability/accessibility</td>
<td>7.8</td>
<td>64.3</td>
<td>48.8</td>
<td>16.3</td>
<td>8.5</td>
<td>5.4</td>
<td>10.9</td>
<td>10.9</td>
<td>3.1</td>
</tr>
<tr>
<td>Long term nutrient value</td>
<td>-</td>
<td>80.6</td>
<td>6.2</td>
<td>55.0</td>
<td>7.8</td>
<td>8.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Aid soil aeration</td>
<td>-</td>
<td>57.4</td>
<td>14.0</td>
<td>14.0</td>
<td>39.5</td>
<td>7.0</td>
<td>-</td>
<td>10.9</td>
<td>-</td>
</tr>
<tr>
<td>conserve moisture</td>
<td>6.2</td>
<td>45.0</td>
<td>86.8</td>
<td>6.2</td>
<td>86.0</td>
<td>43.4</td>
<td>30.2</td>
<td>26.4</td>
<td>9.3</td>
</tr>
<tr>
<td>higher quality product</td>
<td>-</td>
<td>83.7</td>
<td>5.4</td>
<td>55.8</td>
<td>16.3</td>
<td>65.9</td>
<td>9.3</td>
<td>18.6</td>
<td>-</td>
</tr>
<tr>
<td>Less labour intensive</td>
<td>-</td>
<td>8.5</td>
<td>4.7</td>
<td>18.6</td>
<td>8.5</td>
<td>2.3</td>
<td>2.3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Has no environmental pollution</td>
<td>10.9</td>
<td>48.1</td>
<td>63.3</td>
<td>11.6</td>
<td>53.5</td>
<td>72.9</td>
<td>44.2</td>
<td>24.0</td>
<td>39.5</td>
</tr>
<tr>
<td>Increase water infiltration</td>
<td>-</td>
<td>72.1</td>
<td>30.2</td>
<td>5.4</td>
<td>31.0</td>
<td>45.7</td>
<td>22.5</td>
<td>21.7</td>
<td>12.5</td>
</tr>
<tr>
<td>Increase soil biological activities</td>
<td>-</td>
<td>59.7</td>
<td>31.8</td>
<td>8.5</td>
<td>34.9</td>
<td>5.4</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Control erosion</td>
<td>6.2</td>
<td>55.8</td>
<td>17.1</td>
<td>7.0</td>
<td>45.0</td>
<td>60.5</td>
<td>38.0</td>
<td>29.5</td>
<td>67.4</td>
</tr>
<tr>
<td>Reduce effect of heat</td>
<td>-</td>
<td>6.2</td>
<td>87.6</td>
<td>7.0</td>
<td>84.5</td>
<td>3.9</td>
<td>-</td>
<td>-</td>
<td>44.2</td>
</tr>
<tr>
<td>Suppress weeds</td>
<td>-</td>
<td>2.3</td>
<td>24.0</td>
<td>2.3</td>
<td>89.9</td>
<td>8.5</td>
<td>-</td>
<td>7.8</td>
<td>41.9</td>
</tr>
<tr>
<td>Reduce production cost</td>
<td>50.4</td>
<td>14.0</td>
<td>13.3</td>
<td>1.6</td>
<td>8.5</td>
<td>9.3</td>
<td>3.9</td>
<td>7.0</td>
<td>-</td>
</tr>
<tr>
<td>Enhanced productivity</td>
<td>-</td>
<td>90.7</td>
<td>53.5</td>
<td>86.8</td>
<td>45.0</td>
<td>79.1</td>
<td>59.7</td>
<td>39.5</td>
<td>23.3</td>
</tr>
</tbody>
</table>

Multiple response

Constraints to use of soil conservation practices

Conservation tillage

Results show that use of soil conservation practices are constrained by several factors. Majority (70.8%) of the respondents perceived that conservation tillage method encourages weed growth, while 15.0% and 10.0% indicated that it increases pest infestation and inhibits soil microbial activities (Table 4). Similarly, greater proportion (55.8%, 41.7% and 40.8%) of the respondents perceived that bulkiness of material, encouragement of weed growth and environmental pollution limit the use of organic manure for soil conservation, respectively. Other constraints perceived by the farmers were that organic manure increases pest infestation (32.5%), high cost of material (21.7%), requires multiple applications (20.8%), inadequate capital (16.7%) and others. Also use of inorganic manure was largely constrained by inaccessibility (87.5%), inadequate capital (79.2%), high cost of material (68.3%), unavailability (62.5%), multiple application (49.2%), causes environmental pollution (41.7%) and others, while inadequate capital (53.3%), and size of farm land (23%) were indentified as major limiting factors to use of crop rotation for soil conservation.
Furthermore, Table 4 shows that high labour involvement constrained use of cover crops (51.7%), contour bonds (62.5%), and terracing (39.2%). About 52% and 42% of the respondents expressed that bulky nature of material and poor access constrained use of mulching as soil conservation practice. Only 30.0% of the respondents perceived that planting windbreaks constitute nuisance during cultivation. Largely concern on the cost of use is more outstanding as constraint than environmental issues related to application of some practices. The perceptions suggest that while some practices have gained popularity (inorganic manure, organic manure etc.), others like planting of wind break, crop rotation, contour bonds and others are less commonly used. Unfortunately, some of these practices constitute adaptation/mitigation measures recommended against climate-related land degradation and problems. (FAO, 2008 and Ozor, Madukwe, Onokala, 2010). Above all, lack of information, knowledge of application and benefits; and location specificity that characterized some soil conservation practices may have influenced the low perception of the constraints.

Table 4
Percentage distribution of respondents by constraints to use of soil conservation practices

<table>
<thead>
<tr>
<th>Constraints</th>
<th>Conservation tillage</th>
<th>Organic Manure</th>
<th>Mulching</th>
<th>Inorganic Manure</th>
<th>Cover Crops</th>
<th>Crop rotation</th>
<th>Contour bunds</th>
<th>Terracing</th>
<th>Planting of Wind break</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase pest infection</td>
<td>15.0</td>
<td>32.5</td>
<td>-</td>
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Multiple response

Conclusion
The study shows that arable crop farmers used different soil conservation practices namely conservation tillage, organic manure, inorganic manure, mulching, use of cover crops, crop rotation, contour bond, and others. However, the respondents preferred organic manure, planting of cover crops, inorganic manure, and mulching. Economic benefits in terms of the cost, labour, timely access, and productivity were central to the reason for preference of the practices. Relatively the respondents were less concern about the environmental implications and long term impact on the soil. Overall, because of the chemical, biological and physical effect on the soil, most of the practices hold great potential for adaptation and mitigation to climate change except the use of inorganic manure which characteristically exacerbates the problem of climate change and increases vulnerability of production system.

On another hand some of the practices which hitherto provide adaptation/mitigation benefits, example use of organic manure could aid climate change especially when it is not appropriately managed. Above all the use of these practices are constrained by several factors such as cost, logistics, and others. The study therefore recommends that extension and stakeholders should intensify efforts on creation of awareness on climate change in farming communities and re-orientate farmers on climate implications of the soil conservation practices used. Farmers should be trained and encouraged to increase dependance on practices that present high potentials for adaptation/mitigation to climate change. Regulatory measures should be put in place to regulate use of some of the practices such as inorganic manure which are detrimental to climate, increase vulnerability and reduce resilience of farming system and communities. Researches and training on the best management practices for soil conservation that has dual effects on the climate is expedient.

**Reference**


