ABSTRACT
This study examines the strategic application of information and communication technology for effective delivery of agricultural products/services. The study adopted a survey research design, with a sample size of 55 farmers randomly selected from 13 different farms in Delta State of Nigeria. An instrument titled “Strategic Application of Information and Communication Technology for Effective Delivery in the Agricultural Industries” was used to collect data for the study. Two hypotheses and two research questions were formulated to guide the study. The statistical tool used for analysis was the Pearson Product Moment Correlation Coefficient. The t-tests were carried out at 0.05 level of significance. It was found that the interest as well as the media had significant influence on the yield and delivery of agricultural products. The study recommended among others, that farmers need to put in place appropriate machinery to integrate ICT fully in their farms to increase and improve productivity.

Key words: Information and Communication Technology (ICT), Strategy, sustainable growth.

INTRODUCTION
It is increasingly becoming difficult for countries to penetrate the competitive world of agricultural trade without the use of ICTs. It is therefore imperative for farmers and other players in the agricultural industry to take decisive steps to embrace ICTs as they promote higher productivity and access to markets and sustainable economic growth.

Denni (1996) stresses that every business must bring ICT into its operation and take the advantage it offers. Adoption of ICT is considered to be a means of enabling businesses to compete on a global scale, with improved efficiency, and closer customer and supplier relations (Chong et al., 2001). The use of ICT in agriculture remains a strategic and ambitious way of modernizing the agricultural sector by pushing possibilities into the hands of farmers and ultimately achieving food sufficiency (Faseru 2015).

Literally, ICT means working with computers. In a more technical way, it is a term used to describe technologies that enable us to record, process, retrieve, transmit and receive information. The digital revolution is at the heart of the impending pervasive use of digital ICTs. The ability to store and process numerical, textual, audio and video information in digital form at a very high speeds, in quantities and at costs previously unimaginable, and the ability to transmit the digital objects across time and space quickly and at relatively nominal costs are the strengths of the electronic venue of ICTs (Lans, 1997).
Through formal institutionalization of e-agriculture, which is a global practice where people exchange information, ideas, and resources related to the use of ICT for sustainable agriculture and rural development, Nigeria stands a better chance of using the agricultural sector to achieve sustainable economic growth and development.

ICT in agriculture worldwide, has emerged as a strategic tool, drawing private capital and large-scale investment to projects that benefit small farmers and boost food security. The strength of the approach, according to Faseru and other experts, is its integration of investments, policy frameworks and local institutions and ability to bolster connectivity to improve the functioning of markets, improve agricultural opportunities, create jobs and catalyze improved governance along the value chain. All of these are ingredients needed to spur inclusive and sustainable economic growth. ICT is at the core of most innovations used today by most enterprises to succeed or survive. ICTs are known for strategic management, communication, collaboration work, customers’ access, managerial decision making, data management and knowledge management. With the widespread connectivity to global markets and networks, using the internet and related technologies, there is the need for Nigeria government to establish a comprehensive ICT infrastructure for the agricultural sector.

It is hopeful that Nigeria with over 170 million population should be able to establish a similar net work for farmers to boost their productivity.

Statement of the Problem

ICTs have been a significant contributor to growth and socio-economic development in business sectors, countries and regions where they are well integrated. The large adoption and integration of ICTs have improved service delivery, created new jobs (while making some older ones less relevant), generated new revenue streams and saved money. In fact, a World Bank report from 2009 found that a 10 percent increase in a country’s broadband connections leads on average to 1.38% rise in its GDP (World Bank 2009). This somehow signifies that advancement in information and communication technology has placed information at the fingertips of many farmers.

The paper contends that Nigeria has no ICT platform for farmers and this has slowdown agricultural productivity in Nigeria.

Objectives of study
1. To ascertain the influence of internet on the delivery of agricultural products.
2. To examine the effect of the media on the delivery of agricultural products.

Research Questions
1. To what extent does the internet influence the delivery of agricultural products?
2. What effect does the media have on the delivery of agricultural products?

Hypotheses
1. The internet has no influence on the delivery of agricultural products.
2. The internet has no significant effect on the delivery of agricultural products.

REVIEW OF RELATED LITERATURE

According to Agbamu (2007), with respect to agriculture, ICT involves all aspects of published knowledge in agriculture for example, the use of computer, internets, telephones (mobile and field), television, e-mail, fax, radio etc. Worthy of mention however, is the fact that availability of ICT facilities cannot suffice. Farmers’ ability and willingness to use the said facilities will go a long way to take agriculture to greater heights.

Information and communication technology has contributed immensely to the achievement of organizational effectiveness in many sectors of the economy, agriculture not left out. According to Rao (2007), developing countries are presently connected to developed nations and get the latest information and technologies regarding weather, natural resources and other related information.

The relevance of ICT in agriculture cannot be over emphasized. Radio, mobile phones, televisions, and the internet provide farmers with the much required information. Information and communication technologies have potential to disseminate the agricultural systematic information among small holder farmers.

Similarly the mobile phones, television, internet and radio have the facility to transfer related and timely information that help to make decisions to use resources in the most productive and profitable way. (Ekbia
According to Murthy (2009) farmers use SMS services for obtaining situation reports on weather as well as proper use of pesticides in their farms. Television is a very effective medium for reaching thousands of farmers, both literates and illiterates in a very short time. Viewers see and understand immediately, and can commence implementation without delay. Fara (2009) maintains that television is one of the most effective media for agricultural information among farmers in developing countries.

“Television has created awareness and knowledge among farmers about use of technologies in farming (Age, 2012)”. The contribution of radio in the dissemination of agricultural information cannot be ignored. Inadequate power supply is a national problem. This limits the use of television to only those rural farmers who can own them and also provide generators for their use. Thus radio seems more readily affordable to rural farmers. Sadaqath and Mariswamy (2007), cited in Chhachhar (2014) argued that the credibility of radio information is a very essential element in the communication process, as it will certainly enhance listenership if the transmitted messages are authentic.

Akinola (2007) emphasized that 79% of the rural women farmers in Zaria local government area preferred radio as the main source of information.

EMPIRICAL REVIEW

A study was conducted in India by Shaik, Jhamtani & Rao (2004) on the use of ICT to meet the needs of farmers. It was found that 90% of farmers perceived the ICT information as most appropriate, since it permitted them to discover and sell at the markets where they had comparative advantage. In the same study, 82.5% of the farmers maintained that access to land records (made available by ICT) was a very welcome idea.

Muto and Yamano (2011) conducted a study on the use of mobile phones by farmers for the sale of their products. By connecting farmers to buyers without much waste of time and energy, farmers were able to sell at satisfactory prices.

In a study conducted by Abbas and Hassan (2009) on the dissemination of agriculture information among farmers in Nigeria, radio was found to provide suitable livestock and fisheries information. It was also found to be the most acceptable medium of communication.

On the effectiveness of radio on agriculture, a study by Okwu et al (2007) revealed that most farmers love to listen to agronomic and plant production programmes.

Murty & Albino (2012) conducted a study on electronic media in rural agricultural business, and discovered that shortage/lack of electricity in rural areas has compelled farmers therein to rely on radio for education, health and agricultural news.

In a study conducted in Malasia by Hassan et al (2010), 85% of the farmers were found to be inclined to the internet as a source of agriculture information.

Methodology

The research adopted a survey research design. The choice of this research design method is informed by the fact that it suits the study of the respondents who are basically farmers with varying knowledge and opinions. The method also enables respondents to respond to issues relative to the topic when they are alone; it has the ability to cover a wide range of information as well as representative samples. This permits inferences and generalization to the study population (Yomere and Agbonifo, 1999). The population consists of farmers located in Delta and Edo states of Nigeria. A sample size of 55 farmers selected randomly from 6 agricultural sectors in the states under study, accounting for 58% of the approved sectors, was considered quite adequate. Our decision is justified by the studies of Peretomode (1996); Yomere and Agbonifo (1999), and Owojori (2005) where both recommended 10% sample size to be adequate for scientific studies. A total of 58 copies of the questionnaire were distributed to our respondents, out of which 55 were returned and used for the study. The farmers in each of the sectors were however randomly selected by administering the questionnaire to one out of every ten customers that comes into the farm.

To test the reliability of the instrument, a pilot study was carried out with the instruments on two agricultural firms not included in the research sample size in order to establish their reliabilities and internal consistencies of the items with them. Twelve farmers were selected from each of the sectors respectively for this purpose, and the designed instruments were administered on them. At the end of the exercise, the completed copies of the questionnaire were collected and coded for statistical analysis. The 13th edition of the Statistical Package for the Social Science (SPSS) was used in analyzing the data. Among the options chosen to determine the reliability and internal consistency of the instrument were the Split Half method and the Spearman Brown Method. The instrument indicated a reliability coefficient of 0.8167 for the Spearman
Brown option while the Guttman Split-half yielded a reliability coefficient of 0.72. The observed Average measure intraclass correlation coefficient for the items within the instrument was 0.75. These observed coefficients for the instruments implied that they were highly reliable and internally consistent for the study (Tuckman, 1975). As pointed out by Anastasi (1968), the closer to 1 the reliability coefficient of an instrument, the more reliable the instrument.

Data Presentation and Analysis
The responses from the farmers on their strategy application of information and communication technology to enable effective delivery of agricultural production in their respective firms are statistically analyzed in line with the related objective and research question which they were intended to address. The responses are presented in tables of frequencies and percentages based on the various options used in the 5 point Likert scale questionnaire for the study. In the course of the discussion of the items especially on the options in the Likert Scale, after presenting the separate percentages, a summation of the ‘strongly agree’ and ‘agree’ was effected while ‘disagree’ and ‘strongly disagree’ were also added to enable conclusive statement to be made on the items. Since they added up to either agree or disagree. Most discussions are however presented in the analysis along the Likert Scale System.

Table 1 below presents the opinions of the farmers on the adoption of the media on their farm businesses. Though the five-point scale was used in the assessment, the responses were re-categorized into five options. In the table, the percentages of the frequency counts are enclosed in brackets.

<table>
<thead>
<tr>
<th>S/N</th>
<th>Questions</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>My farm always uses ICT to monitor growth of plants</td>
<td>25 (45)</td>
<td>20 (37)</td>
<td>4 (7)</td>
<td>3 (5)</td>
<td>3 (5)</td>
</tr>
<tr>
<td>2.</td>
<td>I use computer simulation to hybrid my poultry birds</td>
<td>20 (37)</td>
<td>23 (42)</td>
<td>8 (14)</td>
<td>1 (2)</td>
<td>3 (5)</td>
</tr>
<tr>
<td>3.</td>
<td>As a result of radio information, my sales has improved</td>
<td>22 (40)</td>
<td>22 (40)</td>
<td>5 (9)</td>
<td>2 (4)</td>
<td>4 (7)</td>
</tr>
<tr>
<td>4.</td>
<td>I have challenges of inadequate electricity supply so I would not use ICT effectively.</td>
<td>3 (5)</td>
<td>4 (7)</td>
<td>8 (14)</td>
<td>18 (34)</td>
<td>22 (40)</td>
</tr>
<tr>
<td>5.</td>
<td>My farm has used the internet to launch into global markets.</td>
<td>6 (10)</td>
<td>4 (7)</td>
<td>9 (17)</td>
<td>20 (37)</td>
<td>16 (28)</td>
</tr>
<tr>
<td>6.</td>
<td>The internet has helped to boost my yield.</td>
<td>10 (18)</td>
<td>11 (21)</td>
<td>6 (11)</td>
<td>14 (25)</td>
<td>14 (25)</td>
</tr>
<tr>
<td>7.</td>
<td>The cost of ICT equipment is high so I could not adopt it.</td>
<td>8 (14)</td>
<td>6 (11)</td>
<td>12 (22)</td>
<td>19 (35)</td>
<td>10 (18)</td>
</tr>
<tr>
<td>8.</td>
<td>We still use our traditional farming system despite the presence of ICT.</td>
<td>18 (34)</td>
<td>17 (31)</td>
<td>14 (25)</td>
<td>3 (5)</td>
<td>3 (5)</td>
</tr>
<tr>
<td>9.</td>
<td>ICT has aided agricultural sector in other countries.</td>
<td>10 (18)</td>
<td>12 (22)</td>
<td>17 (31)</td>
<td>10 (18)</td>
<td>6 (11)</td>
</tr>
<tr>
<td>10.</td>
<td>Agricultural sector has more potential to grow if ICT is employed.</td>
<td>24 (43)</td>
<td>20 (37)</td>
<td>6 (9)</td>
<td>2 (4)</td>
<td>4 (7)</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>146</td>
<td>139</td>
<td>88</td>
<td>92</td>
<td>85</td>
</tr>
</tbody>
</table>

Looking at the summarized table 1, one is left with the impression that the farmers were really in favour of adoption of information and communication technology in their farms. This is not without some problems as indicated by the percentages of disagreement on some of the items in the table. For example not all the farmers agreed that they use ICT to monitor growth of their animals or plants. It could also be observed that not all the farmers agreed that the use of information and communication technology has boosted their yield. On the issue that the farmers still used their traditional farming system irrespective of ICT, the farmers were divided. While 65% agreed, 10% of them did not agree.
A sample of 10 farmers who claimed to be conversant with the internet was drawn. The Pearson product moment correlation coefficient was used to determine the degree of relationship between the use of internet and delivery of agricultural products. This was found to be 0.92, indicating a high degree of relationship.

FINDINGS
Sequel to the hypotheses formulated and tested, farmers were understood to be satisfied with the application of information and communication technology in their farms. These findings are in line with the following opinions expressed by customers in Table 1.

1) Farmers have used it to improve their yields.
2) Information and communication technology has exposed farmers to international markets.
3) Farmers have been denied access to information and communication technology because of lack of power supply.
4) That agricultural sector has more potential to grow if information and communication technology is employed.

DISCUSSIONS OF FINDINGS
The observations from the data collected for this study revealed some significant factors in the perceptions of farmers in the adoption of information technology in their farms. Information and communication technology has evolved as an indispensable tool in farms. It requires that farmers adapt to the new systems of farming.

Findings from the study revealed that a high degree of relationship exists between adoption of the internet and delivery of agricultural products. This is in line with the views of Hassan et al (2010) wherein a majority of farmers in Malaysia were found to have vested interest in the internet. The views of Okwu et al (2007) Akinola (2007) and Sadaqath (2007) are not in consonance with the above finding, as they firmly maintain that radio is the most effective source of agriculture information for farmers.

CONCLUSION
Information technology is changing the agricultural sector from traditional farming to digitized and networked farming activities. It is now fundamentally changing the delivery systems used by farmers to interact with their customers. Farmers with the ability to invest and integrate information technology will become dominant in farmers retention of businesses. Farmers are convinced that investing in IT is imperative.

The increasingly declining costs in telecommunications and information technology are opening up new possibilities for farmers in the developing countries to leapfrog the stages of technological development and thus making farming businesses to shift away from traditional centre to ICT. This generates better farming activities, growth opportunities, attracts new customers and expands market shares. Thus, ICT, if properly managed by the government authorities, can facilitate the process of laying the foundation of a sound and resilient agricultural sector. An overt fact that necessitated the adoption of information and communication technology is that farm businesses have become globalized, and fund transfers are now done through the electronic fund transfer via online computer system. Coupled with the above is the globalization of online commercial activities by most international firms as well as individuals who require the services of farmers. In spite of the seeming problems, the use of information and communication technology has actually contributed to the acceleration of farming.

RECOMMENDATIONS
1. Internet facilities should be made available to farmers by the government. This brings them closer to the sophisticated agricultural methods applied by their counterparts in developed countries.
2. The provision of internet facilities needs to be backed up with adequate training.
3. Farmers need to put in place appropriate machinery to integrate ICT fully in their farms to increase and improve productivity.
REFERENCES


Chikezie Austin, (2015). Commissioner for Agriculture and Natural Resources; *Pointer Newspaper*, July 19, p.20


APPENDIX I

Computation of correlation coefficient, r.

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>XY</th>
<th>X²</th>
<th>Y²</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>18</td>
<td>306</td>
<td>289</td>
<td>324</td>
</tr>
<tr>
<td>18</td>
<td>19</td>
<td>342</td>
<td>324</td>
<td>361</td>
</tr>
<tr>
<td>20</td>
<td>21</td>
<td>420</td>
<td>400</td>
<td>441</td>
</tr>
<tr>
<td>17</td>
<td>18</td>
<td>306</td>
<td>289</td>
<td>324</td>
</tr>
<tr>
<td>16</td>
<td>17</td>
<td>272</td>
<td>256</td>
<td>289</td>
</tr>
<tr>
<td>19</td>
<td>19</td>
<td>361</td>
<td>361</td>
<td>361</td>
</tr>
<tr>
<td>20</td>
<td>21</td>
<td>420</td>
<td>400</td>
<td>441</td>
</tr>
<tr>
<td>20</td>
<td>22</td>
<td>440</td>
<td>400</td>
<td>484</td>
</tr>
<tr>
<td>16</td>
<td>17</td>
<td>289</td>
<td>289</td>
<td>289</td>
</tr>
<tr>
<td>18</td>
<td>19</td>
<td>344</td>
<td>326</td>
<td>363</td>
</tr>
<tr>
<td>180</td>
<td>190</td>
<td>3444</td>
<td>3264</td>
<td>3638</td>
</tr>
</tbody>
</table>

\[
r = \frac{10(3444) - 34200}{\sqrt{(32640 - 32400)(36380 - 36100)}}
\]

\[
\sqrt{240 \times 280} = \frac{240}{\sqrt{67200}}
\]

\[
r = \frac{10}{259} = 0.92
\]

To test for the significance of r, we convert t-statistic as follows:

\[
t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}
\]

\[
= \frac{0.92 \sqrt{8}}{0.85}
\]

\[
t = 6.67
\]

Since the computed value of t (6.67) is greater than the critical value (1.86), we reject Ho and accept H1, and conclude that there is correlation among the variables.

APPENDIX II

Computation of Correlation Coefficient r

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>XY</th>
<th>X²</th>
<th>Y²</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>146</td>
<td>730</td>
<td>25</td>
<td>21316</td>
</tr>
<tr>
<td>4</td>
<td>139</td>
<td>556</td>
<td>16</td>
<td>19321</td>
</tr>
<tr>
<td>3</td>
<td>88</td>
<td>264</td>
<td>9</td>
<td>7744</td>
</tr>
<tr>
<td>2</td>
<td>92</td>
<td>184</td>
<td>4</td>
<td>8464</td>
</tr>
<tr>
<td>1</td>
<td>85</td>
<td>85</td>
<td>1</td>
<td>7225</td>
</tr>
<tr>
<td>15</td>
<td>550</td>
<td>1819</td>
<td>55</td>
<td>64070</td>
</tr>
</tbody>
</table>
\[ n \in X Y \quad \epsilon \in X \in Y \]
\[ \sqrt{(n \in x^2 - (\epsilon X)^2)(n \in Y^2 - (\epsilon Y)^2)} \]
\[ 5(1819) - (15 \times 550) \]
\[ \sqrt{(5 \times 55) - (225))(5 \times 64070) - (550)^2} \]
\[ 845 \]
\[ \sqrt{50 \times 17850} \]
\[ = 845 \]
\[ \sqrt{892500} \]
\[ = \frac{845}{945} = 0.89 \]
\[ r = 0.89 \]

Converting to t, we have

\[ t = \frac{r \sqrt{n-2}}{\sqrt{1-r^2}} \]
\[ = \frac{0.89 \sqrt{2}}{\sqrt{1-0.79}} \]
\[ 0.89 \times 1.73 \]
\[ \sqrt{0.21} \]
\[ 0.89 \times 1.73 \]
\[ \sqrt{0.21} \]
\[ = \frac{1.54}{0.46} \]
\[ t = 3.35 \]

The computed value of t (3.35) is greater than its critical value, 2.35. We reject Ho and accept H1.

**Conclusion**

A high degree of relationship exists between effective use of the media and agricultural yield.