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SUSTAINABLE AGRICULTURE FOR NATIONAL FOOD SECURITY IN NIGERIA: AN EXPLORATORY JOURNEY IN SPACE AND TIME

ANTHONY UHUNOMWAN OMOREGIE, *Professor*
Department of Crop Science,
Ambrose Alli University, Ekpoma, Nigeria.

KEYNOTE PAPER

Preamble

I wish to use this opportunity to thank the organizers of the 6th Annual International Conference of the Agricultural Teachers Association of Nigeria (AETAN) for inviting me to give this Keynote Address. I have chosen, based on the theme: Challenges of Food Security, Agricultural Education and Training to speak on the topic – Sustainable Agriculture for National Food Security: Exploratory Journey in Time and Space.

This work will try to examine and discuss the issues relating to the challenges of sustainable agriculture, food security, economy, sustainable development vis – a-vis agriculture, agricultural education and training among others, within the Nigerian context. Some attempts will be made to proffer solutions to these challenges.

Introduction

The world's population is projected to be 9 billion by the year 2050 and 11 billion by 2100 (UNDE, 2017). This means that the global population is increasing with time a fixed landmass which is reducing agricultural value due to environmental degradation, and population pressure resulting from the provision of social services and amenities. There is also the issue of water pollution. Consequently, the global challenge of providing employment, quality food in the right proportion, and appropriate health care, among others have become more difficult, and perhaps illusive.

The 1963 population census in Nigeria, put the population at 56 million. Today, this has grown to an estimated value of over 220 million. Although the issue of Nigeria's population has been very controversial including the one done in 2006 by the NPC, however, the projected values always show that it is on the increase. Nigeria's population growth rate is put at 3.2 to 3.5% while the rate of growth in food production is less (2.5%). Nigeria's population is estimated to reach 440 million by 2030, which is 7 years from now (UNFPA, 2015). Currently, Nigeria is regarded as the poverty headquarters of the world with about 133m living below the poverty line.

The world is facing serious food crises. The situation is getting worse with the present population explosion, particularly in the developing countries in the continents of Africa and Asia. Nigeria exemplifies this gloomy picture in Africa and indeed in the world.

At the present estimated food production rate (2.5%), Nigeria cannot feed its estimated 220 million people. There are indications of food shortages on both national, regional, and local basis. Food shortages during the "hungry season" have been noted to be perennial in many areas of the country; particularly after an initial surplus in some periods (harvesting periods). Consequently, there are marked seasonal variations in the intake of principal staples and supplementary foods (Omoregie, 1990).

Arising from the above, there is wide underfeeding and malnutrition; the quality and quantity of diet varying to extents which can be related to local farming techniques and economic pressure. One way in which successive governments have tried to cope with this deficit has been through massive importation of major food items, which in itself has not been successful.

Agriculture: The Past and Present

Before independence, agriculture was the main stay of the Nigerian economy. Cocoa, oil palm and groundnut were "golden crops" that shaped the economy in the 50s and immediately after independence in the 60s and the various regional governments utilized the windfall from the crops to develop their regions (Remison, 2021).

Nigeria was a major exporter of such produce as palm oil, palm kernels, cocoa, rubber cashew, groundnuts and earned high foreign exchange. Apart from crops, animal products like hides and skins were also exported to gain the much-needed foreign exchange. Although, the majority of farmers were engaged in small scale subsistence agriculture; there were however, large farm settlements in many places across the regions.

An average of 44.8% (2008 - 2017) of the Nigerian active population was engaged in agriculture (NBS, 2015). Agriculture was contributing on the average, about 15.4% of the GDP in 1981 – 1989, 17.8% in 1990 – 19999, 24.2% in 2000 – 2009, and 23.8% from 2010 – 2017. The average growth rate of agric. GDP of the total in 1981 – 1989 (3.5%), 2000 – 2009 (10.9%) and 2010 – 2017 (4.2%).

The arable land (hectares)per capita has declined from 1.261 in 1961 to 0.2 in 2017, with a positive growth rate (1.3) in 1961 to a negative of – 0.7 in 2017 (FMARD). The above figures call for a new direction in agricultural production to arrest food insecurity.

Table 1a

Agricultural Output Growth Rate

Year	%
1970-1979	-2.9
1980-1989	4.8
1990-1999	4.0
2000-2009	4.2
2010-2015	-11.9

Source: NBS (In CBN)

Table 1b

Crop Production Growth Rate

Year	%
1970-1979	4.3
1980-1989	8.8
1990-1999	6.4
2000-2009	3.5
2010-2015	3.1
2016-2017	4.3

Source: NBS (In CBN)

Table 1c

Land Use in Nigeria

Land Use Type	Hectarage (m)	%
Total available	98.321	100
Available arable land	7.53	75.3
Forest resource	1.00	10
Permanent pastures	1.40	14
Built-up area	1.40	14
Uncultivable waste land	1.40	14

Source: Research Department, CBN. 3rd Edition

It should also be noted that the food supply to the populace was met through home production without importation. The major staple foods: rice, garri, yams, cocoyam, plantains, vegetables, spices, and meat were entirely produced from within. According to Anon (1988), before the decade of the 1960s, the dominant role of agriculture in Nigeria's economy was taken for granted. With very little support from the government, Nigeria's agriculture was able to grow at a sufficient rate to provide adequate food for an increasing population, raw materials for a budding industrial sector, increasing public revenue and foreign exchange for the government, and employment opportunities for an expanding labour force. The policy document continued that the little support provided by the government was concentrated on export crops like cocoa, groundnut, palm produce, rubber, and cotton as self-sufficiency in food production seemed not to pose any problem worthy of public attention.

It is worthy of mentioning that the discovery of crude oil in 1958 led to a "boom" which later turned to "doom" in the growth of the agricultural sector. Indications of problems in the sector started to emerge in the decade 1960 – 69, and fully deteriorated in the second decade of Nigeria's independence (1970 - 79). These problems were reflected in:

i. increasing food supply short falls;
ii. rising food prices;
iii. declining foreign exchange earnings from exports;
iv. the rapid decline in revenue from home-based agriculture; and
v. increasing food import bills; and declining supply of labour force required in agriculture due to migration of labour from agriculture.

The decline or deterioration in agricultural exports and food production has continued despite efforts made to arrest the situation through programmes like OFN Green Revolution and many others. The reason for the failure of these programmes is beyond the subject of this presentation. However, one major fact is that there is a need for a well thought - out and conscious policy instrument for achieving sustainable agricultural development that will guarantee food security for the country.

On 4th February 1988, an agricultural policy was released by the Federal Ministry of Agriculture, Water Resources and Rural Development. The policy instrument was expected to remain valid for about 15 years, that is, up to the year 2000 AD. I am not aware if there is a new updated one. In any case, the 1988 63-page document is yet to make any significant change in the agricultural landscape, mainly due to poor implementation. The ultimate goal of the 1988 Document was the attainment of self-sustaining growth in all the subsectors of agriculture. One of the specific objectives, indeed the first, was the attainment of self-sufficiency in the short term (within two years - 1990) for maize, guinea corn, millet, and cassava. In the medium term (within five years - 1993) Nigeria ought to be self-sufficient in the production of cowpeas, fish, poultry, meat and eggs, mutton, and goat meat. It was envisaged that in the long run, self-sufficiency would be attainable for rice, beef and dairy products. Today, we are in 2023; 35 years later, we are yet to achieve self-sufficiency and hence food security in the long run!

Nigeria has the potential for self-sufficiency in many crops across the different ecological zones (Table 1d – Remison, 2021). Tables 2, and 3 present the recent production of primary crops and meat in Nigeria for a population of over 220 million.

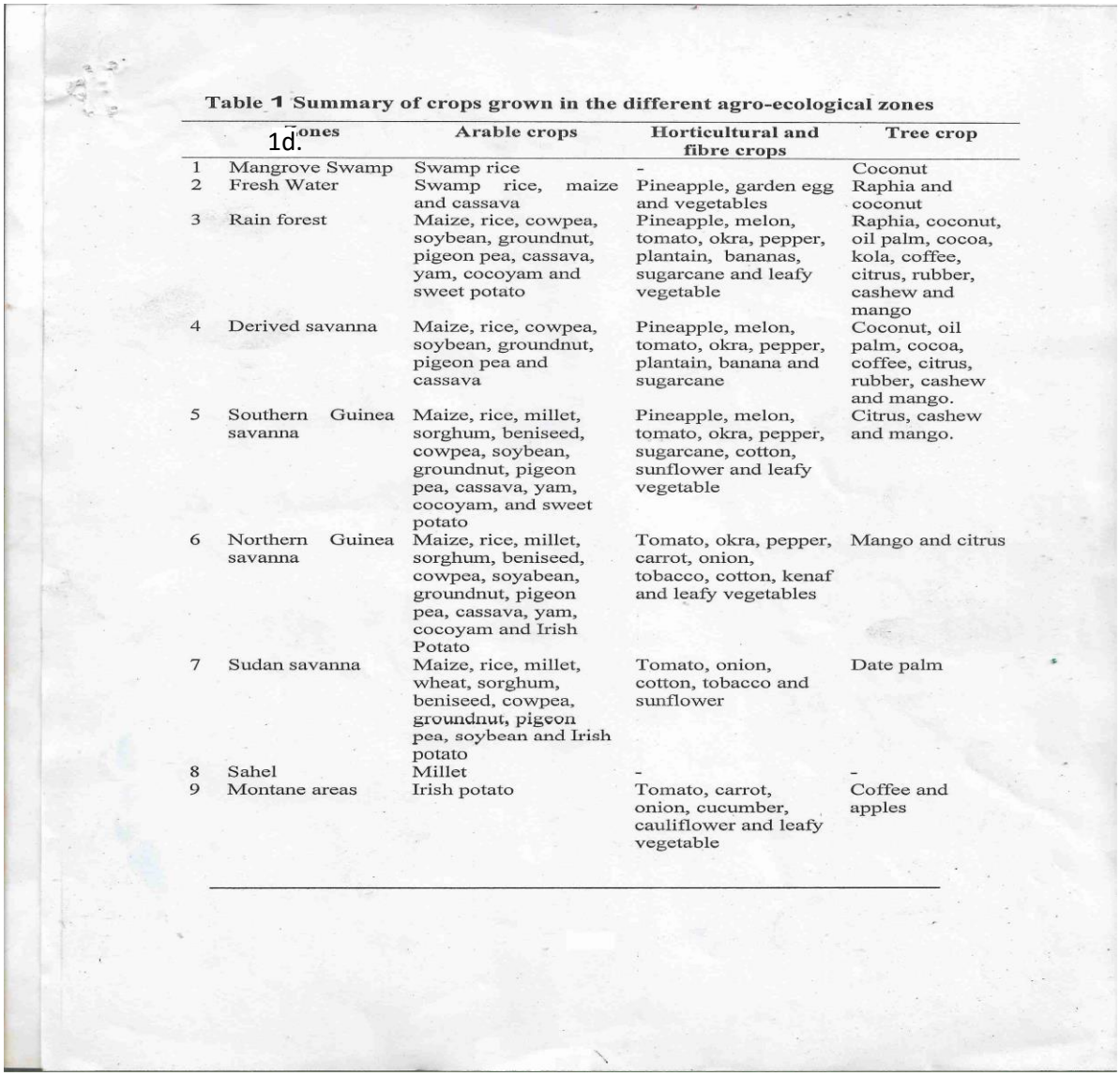


Table 1 Summary of crops grown in the different agro-ecological zones

	Zones	Arable crops	Horticultural and fibre crops	Tree crop
1	Mangrove Swamp	Swamp rice	-	Coconut
2	Fresh Water	Swamp rice, maize and cassava	Pineapple, garden egg and vegetables	Raphia and coconut
3	Rain forest	Maize, rice, cowpea, soybean, groundnut, pigeon pea, cassava, yam, cocoyam and sweet potato	Pineapple, melon, tomato, okra, pepper, plantain, bananas, sugarcane and leafy vegetable	Raphia, coconut, oil palm, cocoa, kola, coffee, citrus, rubber, cashew and mango
4	Derived savanna	Maize, rice, cowpea, soybean, groundnut, pigeon pea and cassava	Pineapple, melon, tomato, okra, pepper, plantain, banana and sugarcane	Coconut, oil palm, cocoa, coffee, citrus, rubber, cashew and mango.
5	Southern Guinea savanna	Maize, rice, millet, sorghum, beniseed, cowpea, soybean, groundnut, pigeon pea, cassava, yam, cocoyam, and sweet potato	Pineapple, melon, tomato, okra, pepper, sugarcane, cotton, sunflower and leafy vegetable	Citrus, cashew and mango.
6	Northern Guinea savanna	Maize, rice, millet, sorghum, beniseed, cowpea, soyabean, groundnut, pigeon pea, cassava, yam, cocoyam and Irish Potato	Tomato, okra, pepper, carrot, onion, tobacco, cotton, kenaf and leafy vegetables	Mango and citrus
7	Sudan savanna	Maize, rice, millet, wheat, sorghum, beniseed, cowpea, groundnut, pigeon pea, soybean and Irish potato	Tomato, onion, cotton, tobacco and sunflower	Date palm
8	Sahel	Millet	-	-
9	Montane areas	Irish potato	Tomato, carrot, onion, cucumber, cauliflower and leafy vegetable	Coffee and apples

Table 2

Production of Primary Crops in 2018 (Thousand Tone)

Country	Fruits	Cereals	Sugar Crops	Vegetables	Oil Crops	Root or Tubes	Others
World	86775	2,962868	2,182866	108883	966545	867.775	176518
Africa	11061	202,603	109947	81465	56452	307330	31660
America	163090	776498	1055793	80371	379383	80927	31805
Nigeria	11986	26216	1423	16386	13473	115704	3855
South Africa	7248	14972	19302	2573	2686	2554	153

Source World Food and Agriculture Statistical Yearbook (2020) 150 – 154

Table 3
Production of Meat (Thousand Tones)

	2018				Total meat			
Country	**Pork**	**Chicken**	**Beef**	**Others**	**2000**	**2010**	**2015**	**2018**
World	120881	114267	67353	39894	233441	294619	325427	342396
Africa	1588	5748	6700	6136	11585	16639	19191	20171
America	22334	48363	32460	4848	73793	92453	99425	108005
Nigeria	284	193	390	385	1053	1399	1432	1451
South Africa	265	1755	1003	218	1644	2784	3271	3241

Source: FAO Statistical Yearbook 2020: 170 – 180

Food Crisis: Nigeria and Global Hunger Index

In general, Africa is rich in mineral, human, and other material resources required for the development of agriculture to stave off food crises leading to hunger and malnutrition. Africa's inability to mobilize her resources for self-reliance in the economic, industrial, and agricultural spheres is quite regrettable. The consequences of this failure are grave on the citizens.

Self-reliance on food is a sure path to greatness. According to Ake (1981), the question for Africa is not which way they should go but whether they are able and ready to engineer their own industrial and social revolutions based on an indigenous collectivized technology and judicious handling of their abundant natural resources, especially food, and energy to attain self-sufficiency, is the issue.

Using Nigeria as an example, the food production growth rate is put at about 2.5% while demand is estimated to be at 3.5%; with a population growth rate of 3.2 to 3.5%. Some analysts have argued that low production in food crops is traceable to the disarticulated policy of the colonial masters who made no conscious efforts at the development of food crops but invested only when and where necessary such that emphasis was placed on few export crops like cocoa, oil palm, groundnuts, etc. Consequently, Africa's survival now depends on her ability to import food as well as food aid from erstwhile colonial masters. Most of the internally generated revenues are spent on food importation and the servicing of loans to the industrialized nations. Of course, exports, mainly primary products, are declining; with food production below the demand level. Thus, the food equation in Africa has been very critical (Omoregie, 1992).

In Nigeria, the major food imports include maize, rice, wheat, vegetable oil, sugar, fish, and milk among others. These constitute over 90% of Nigeria's total food imports. Despite these imports, retail food prices are still high because of the increasing population and increasing cost of local food production arising from:

i. low labour supply and high labour cost;
ii. high costs of farm inputs, such as fertilizers, and herbicides;
iii. inability to develop medium-level technology relevant to our agriculture, leading to high drudgery in farm work;
iv. farming is still largely subsistence by peasant farmers;
v. low outputs from farm due to low inputs;
vi. low returns to farmers' efforts, considering the cost-benefit ratio; and
vii. inconsistent government 'policies and pronouncements" e.g. pricing, etc.

Despite the various "efforts" over the years, Nigeria like many other African countries continues to feature, prominently, in the Global Hunger Index (Figs 1 & 2) and Table 4, where it was ranked 98 out of 107 countries in year 2020 (World Food Programme, 2020). With such low ranking, using human development indices of life expectancy, per capita income, schooling, and other indices of the SDGs (Table 4), Nigeria's fragile economy, high population, the challenge of feeding its population on diminishing land space, calls for an efficient

and sustainable agricultural system (Ikuenobe, 2021).

The need for sustainable development for enhanced agricultural production for self-sustenance and food security has been recognized in the Sustainable Development Goals of the UN. To achieve the goals, a sustainable agricultural system is required to avoid the food crisis and its attendant problems in Nigeria. The core issues in agriculture (Table 5) are well-defined by SDGs.

The target year, 2030, is 7 years away. How prepared is Nigeria for the attainment of these core values? Ikuenobe (2021) opined that the present mode of rudimentary and inefficient agricultural production system cannot cope with meeting the food needs of the nation with a fast-growing population. He further stated that Nigeria's agriculture needs to be modernized and transformed to be efficient; competitive and sustainably managed to keep pace with the inevitable increased food needs of the country to achieve the SDGs. Omoregie (1999) aligned his thoughts with this submission. Based on the statistics on food production, food demand and supply, population and agricultural growth rates, the need to overhaul our agriculture, particularly in food supply is inevitable. The timely; accurate and high-quality statistics coming from the FAO and other United Nations agencies are essential to monitor trends and inform policy decisions, concerning the long-term challenge of delivering on the Sustainable Development Goals (Moncayo, 2020) in meeting both the quantity and quality of food for all Nigerians.

Sustainable Agriculture: The Need

As stated earlier, food demand is higher than supply. The concomitant effect is high prices of food items; exacting great economic pressure on Nigerians. This pressure must be removed or at least ameliorated through vibrant agricultural policies and systems.

The quest to attain sustainable agriculture, which will ensure food security, has led to the employment of several farming techniques at both the traditional and commercial levels. Growth in food production in the past has depended primarily on increases in cultivated area at the expanse of the restorative bush fallow. Many tropical soils are fragile, losing organic matter and nutrients quickly if exposed or cultivated intensely; leading to declining soil productivity (Omoregie, 1999). He further advocated the urgent need for the development of new or improvement on existing agricultural systems which should involve the conservation and utilization of resources present at local levels at minimum input levels.

In Nigeria, food supply is mostly (90 – 95%) obtained from small peasant croppers and pastoralists. The cropping and animal production systems are generally operated separately. In recent years, increasing pressure on land has resulted in massive deforestation with the consequent soil erosion and reduction in soil fertility. Consequently, there is a need to integrate arable agriculture and animal husbandry. Integration of livestock and crops (or trees) (Agro-pastoralism) makes excellent sense for farmers, both in terms of intensification of land use and economic security among other gains (Omoregie, 1999).



Figure 1. Global Hunger Index 2020 : Source: World Food Program, 2020

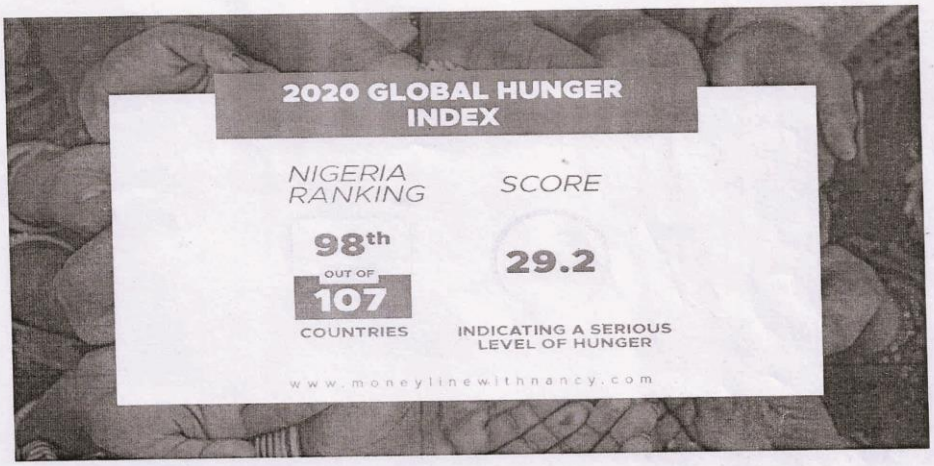


Figure 2: Nigeria in Global Hunger Index, 2020: Source: www.moneylinewithnancy.com

Nigeria and Human Development Indicators and Indices 2019

Table 4

Human Development Indicators and Indices in 2019

HDI 2019	HDI Rank	HDI Value	SDG3 life expectancy	GNI 2017	HDI 2016
1	Very high Norway	0.957	82.4	66,494	1
60	High Iran	0.789	76.2	19,130	61
113	Medium Philippines	0.699	69.2	9,154	111
161	Low Nigeria	0.54	54.7	4,910	156

Source: UNDP, Human development indicators 2019 statistical update

Table 5

Core Issues in Agriculture as Designed by the SDGs

SDG	To achieve
No poverty 1 – Zero hunger	End poverty in all its forms everywhere End hunger, achieve food security and improved Nutrition and promote sustainable agriculture
8 – Decent work and Economic growth	promote sustained, inclusive economic growth full productive employment and decent work for all
15 – Life on Land	protects, restores and promotes sustainable use of terrestrial ecosystems, sustainably manages forests, combats desertification, and halts biodiversity loss

Source: United Nations: transforming our world: the 2030 Agenda for Sustainable Development

The achievement of food security is greatly dependent on the sustainability of agricultural production. The concept of sustainability is receiving great attention, not only in agriculture but in other fields of human endevour, e.g. growth, development, environment, etc. Sustainable development connotes the process by which people satisfy their needs and improve their quality of life in the present while safeguarding the ability of future generations to meet their own needs (UNFPA, 1999).

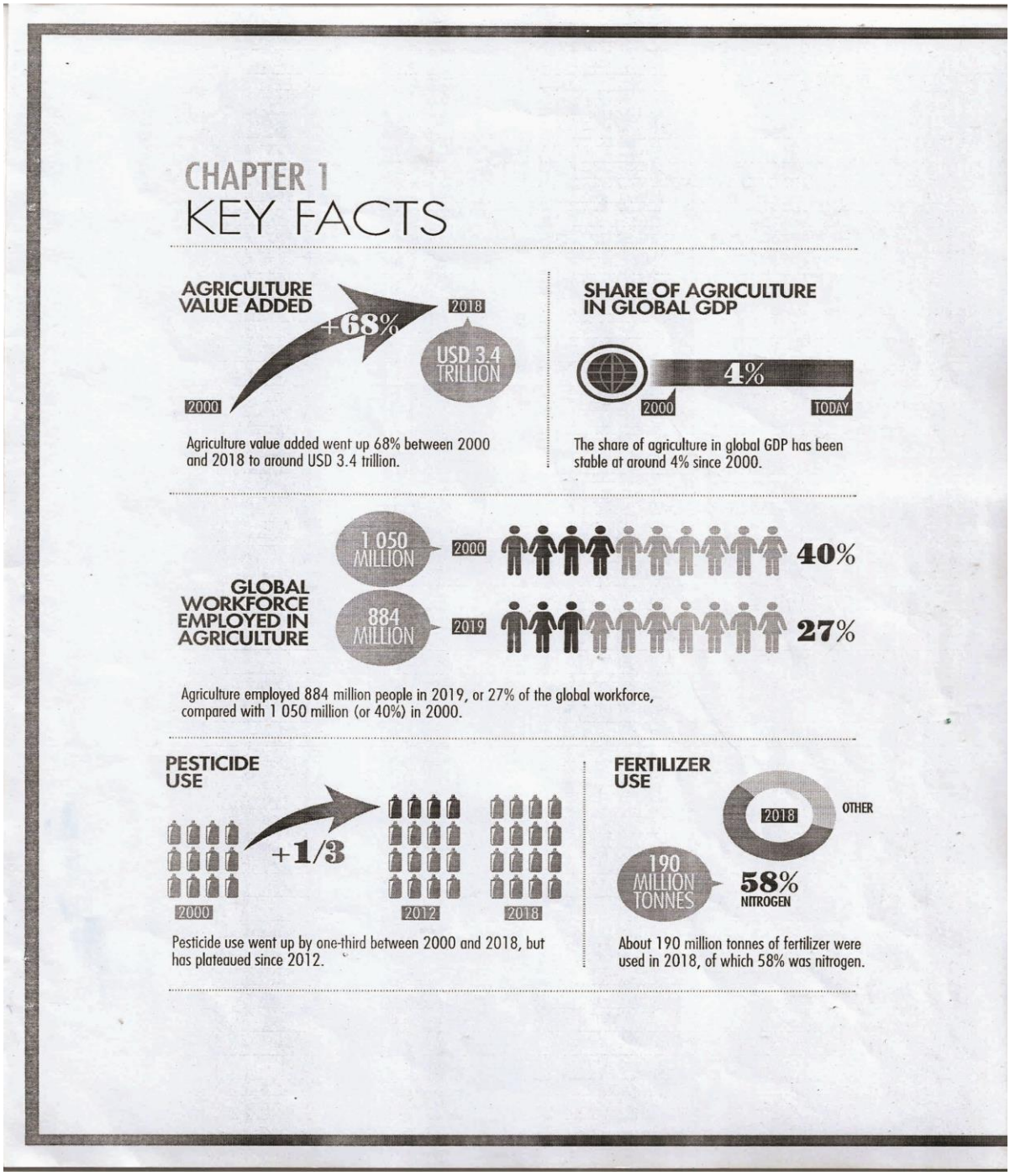
Sustainable agriculture according to Francis (1990) is a philosophy based on human goals and on understanding the long-term impact of our activities on the environment and other species. This philosophy guides our application of prior experience and the latest scientific advances to create integrated, resource conserving, equitable, farming systems. These systems reduce environmental degradation, maintain agricultural productivity, promote economic viability in both the short and long-term, and maintain stable rural communities and quality of life (Francis & Youngberg, 1989). For us in Nigeria, the main issue has always been how to go about sustainable agriculture for National Food Security. The central point is the ways of achieving sustainable agriculture needed for this security through the improvement of our farming system, based on the conservation of moisture, soil structure, and soil fertility and the close integration of livestock and arable farming (Agro Pastoralism) (Omoregie, 1999) as supported by Pralt and de Hann (1979) and Okigbo (1984).

National Food Security: The Challenges

Food security is a concept developed in the 1970s as an alternative to the one-dimensional, purely production-oriented approach. Food security precisely means the assurance and access to sufficient quantities (and quality in the right proportions) for all, including the poor (Schulthes, 1994).

The means of production, credit, agricultural advice, storage, marketing (particularly pricing) purchasing power, health facilities, social elements are among decisive factors in deciding food security status. Thus, the issue of food security for all pose a big challenge for Nigeria. In dealing with food security, both plant and animal sources are important. The matter of proper feeding and nourishment especially among growing children has to do with protein supply from all sources. Animal sources of protein supply is linked to the developments in the livestock industry.

The global level of the prevalence of undernourishment (PoU) has been rising since 2014, after decades-long decline. About 9% of the world population suffered from hunger in 2019. The situation is most alarming in Africa, where the (PoU) is the highest among all regions. By 2019, almost 20% of the populations in Africa were undernourished (FAO, 2020) (Fig 4-Chapter 3 Key Facts).



In Nigeria, there is a high level of undernourishment arising from both low supply and quality of food intake. There is insufficient supply of protein in the diets to meet the minimum daily dietary requirements for growth and development. The livestock industry in Nigeria consists mainly of cattle, sheep, goats, pigs poultry, camels, horses, donkeys, and small livestock species (Orheruata, 2014).

There are conflicting statistics on the livestock population in Nigeria (Orheruata, 2014; Omoregie, 2015). The cattle population is put at 12.5m (Onifade and Agisi, 2013), 13.9m (Bourn *et al*., 1994), and 12m (FAO, 1996). In the same vein, Aletor (2012) citing FAOSTAT (2007) put the population at 15.2m, as at 2005. The goat population is put at 34.5m (Bourn *et al*., 1994), 28m (Aletor, 2012), and 55.15m (FDL, 2010). In the same vein, the sheep population has been put at

22.1m (Bourn, *et al*., 1994), a combined figure of 12.85m of sheep and goats (FAO, 1996, 23m (FAOSTAT, 2007), 34.69 (FDL, 2010).

The figures above vary; to be able to arrive at accurate statistics. Ikhatua (2000) opined that accurate statistical data on Nigeria's livestock population are very scarce and are as varied as the human population figures. The inability of these livestock to meet the needs of Nigerians arises principally from two fronts:

i. The inadequate quantity (numbers); and
ii. the low productivity in terms of meat and other livestock products like milk.

The combined effect of the above problems is the short supply of protein in our diets. It is estimated that animal protein sources of Nigerians account for about 7 – 15g /day/ person less than the WHO/FAO recommended value of 34.7g/l/d (WHO/FAO, 2007) for proper growth, reproduction, lactation, and survival of the individual; particularly for growing children.

Omoregie (2015) dealt extensively with the issue of low productivity of our grazing livestock (ruminants) to include:

i. Extensive grazing system (open or free grazing).
ii. Low quality forages, which are mainly natural species.
iii. Low fertility status of nature rangelands.
iv. Pests and diseases.

The lack of sustainable agricultural production from both plant and animal sources has resulted in huge food insecurity. Table 6 shows the food insecurity levels of Nigeria against selected countries of the world, while Figs 3 and 4 (Chapters 2 and 3) show the key facts about global agricultural production and prevalence levels of hunger; respectively.

From the Table, it will be observed that the years of moderate to severe food insecurity tallies with the period of the intense croppers-herdsmen conflicts in Nigeria, that is, between 2014 and 2019.

Food Insecurity: Croppers and Herdsmen Conflicts

Africa is presently undergoing many crisis points which, inevitably, have jeopardized developments in all areas of endeavour, principally food security. It would appear that the precarious situations have overwhelmed the majority of the countries in the continent.

Food is the most basic of man’s needs. Thus, long ago, Sharman (1976) stated that the whole sum of man’s activities, the successful fulfillment of all his needs, and the creation of new needs that play an important role in the evolution of civilization depend largely on his food requirement being met. Consequently, food is the foundation for development because only a man who is adequately fed can engage in development. A society can only be said to be well equipped for development when it has food security. That is, there is food security when a country has an adequate food supply (in quantity and quality) to meet the minimal needs of its populace without depending on food imports and aid (Osaghae, 1992).

In Nigeria, meeting the food requirement of its people has been exacerbated by the outbreak of conflicts between the pastoralists (herdsmen) and croppers in the major areas of food production in Taraba, Plateau, Benue, and many states of the South. This internecine war has been more pronounced since 2015.

CHAPTER 2
KEY FACTS

PRIMARY CROP PRODUCTION



The production of primary crops was 9.2 billion tonnes in 2018, around 50% more than in 2000.

GLOBAL PRIMARY CROP PRODUCTION



Four crops account for half of global primary crop production: sugar cane, maize, wheat and rice.

VEGETABLE OILS PRODUCTION



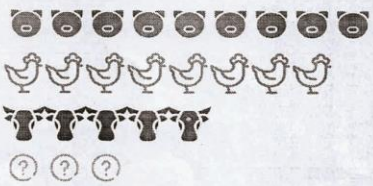
The production of vegetable oils more than doubled between 2000 and 2017, driven by a sharp increase in palm oil.

MEAT PRODUCTION



342 million tonnes of meat were produced in 2018, 47% more than in 2000, with chicken meat representing half of the increase.

MEAT PRODUCTION BREAKDOWN



Pig meat is the most produced type of meat.

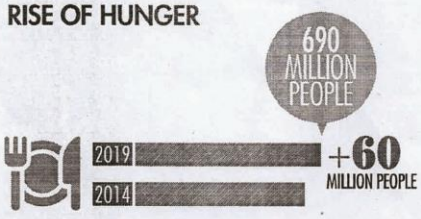
CEREALS TRADE



Cereals are the most traded commodity by quantity: the Americas and Europe are the largest exporters and Asia the largest importer.

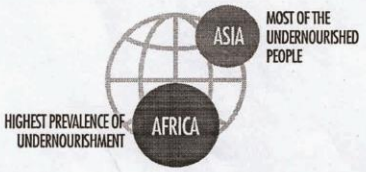
CHAPTER 3
KEY FACTS

RISE OF HUNGER



Hunger is on the rise, with almost 690 million people undernourished in 2019, close to 60 million more than in 2014.

PREVALENCE OF UNDERNOURISHMENT



While most of the undernourished people live in Asia, Africa has the highest prevalence of undernourishment.

PREVALENCE OF FOOD INSECURITY



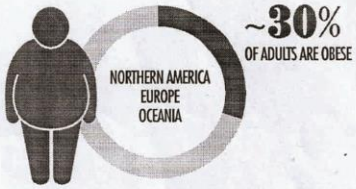
In every continent, the prevalence of food insecurity is slightly higher for women than for men, with the largest differences found in Latin America.

DIETARY ENERGY SUPPLY



Dietary energy supply went up in all regions since 2000, with the fastest increases in Africa and Asia.

INCREASE OF OBESITY



Obesity has increased in all regions. Almost 30% of adults in Northern America, Europe and Oceania are obese.

Table 6
Food Insecurity Levels (%)

Country	Prevalence of severe food insecurity				Prevalence of moderate or severe food insecurity			
	2014-16	2015-17	2016-18	2017-19	2014-16	2015-17	2016-18	2017-19
World	8.1	8.2	8.7	9.2	22.7	23.5	24.6	25.5
Africa	17.2	17.8	18.3	18.6	47.4	49.2	50.5	51.2
Asia	7.5	7.4	7.9	8.6	19.1	19.5	20.7	21.9
Latin America & Caribbean	7.2	8.0	8.9	9.4	25.9	28.9	31.0	31.7
North America & Europe	1.4	1.3	1.2	1.1	9.2	8.9	8.3	8.0
Algeria	13.0	12.7	11.4	9.3	22.9	21.5	9.7	17.6
Australia	2.8	3.4	3.6	3.9	10.8	11.8	12.7	13.5
Egypt	8.4	9.0	8.9	7.8	27.8	33.0	36.0	34.2
Indonesia	1.0	1.0	1.0	0.8	7.6	8.1	7.9	7.0
Nigeria	6.5	7.3	8.2	9.1	36.5	38.9	41.4	44.1
South Africa	18.0	18.0	-	-	42.9	42.9	-	-

Source: FAO statistical yearbook 2020 (P. 256 - 260).

Nigeria cannot afford to allow any disruption in the agricultural production system that threatens the food supply mechanism to its citizens because of the place of food in human life and development. The emergence of food as a "world power" has been acknowledged in world politics. The traditional role or function of food is for growth and development. Food over the years has become an instrument and weapon of war and international diplomacy; even in local politics. The movement of certain food items between northern and southern Nigeria is a lesson for all Nigerians (Omoregie, 1992; 2011). Hence, the need for real national integration and development of the many crops and livestock across the geographical space of Nigeria.

The interaction between the pastoralists (herdsmen) and croppers across the nation must be strengthened through appropriate and justice-based policies that will remove mutual distrust. Migration is not a recent or new phenomenon. Pieces of evidence through antiquity and history has shown that people have been moving for various reasons (Agara and Chizea, 2020). One major fall out of migration is inter-ethnic conflict which may arise from the differences in the ways of life or businesses of the people in conflict.

In our discussion, herdsmen or pastoralists are nomadic or semi-nomadic. A large majority of the cattle and sheep kept by the pastoralists in the semi-arid and sub-humid zones of Nigeria are kept by Fulanis. They derive their living mainly from grazing animals. They keep 80 – 90% of the total cattle populations and they rely on traditional extensive grazing systems (Omoregie, 2015). He further stated that these livestock depend mostly on the naturally growing forages of diverse species of grasses, and legumes made up of herbs, shrubs, and woody trees.

It should be noted that in the past, transhumance of livestock was fully practised, that is, north-south, and south-north reverse movements following the rainfall pattern in the geographic space. This pattern has changed as the reverse south-north movement has stopped; leading to a buildup of livestock population and herdsmen in the south (Omoregie, 2021); mainly due to:

i. availability of natural forages for a longer period;
ii. ready market; and
iii. there is less time for livestock to reach marketable weight in the higher rainfall zones of the South.

Furthermore, Omoregie (2021) observed that the open grazing system operated by the Fulani pastoralists, movement of animals, and interaction with non-pastoral populations have increased. The pastoralists are tracking forages to maximize production for their animals; most times to the detriment of others, particularly, the croppers. The open grazing system of livestock production, the unlimited or unrestricted movement of livestock from place to place to graze naturally occurring forages, is at the centre of the croppers-pastoralist conflict.

There has been a call for the sedentarization of livestock production from the open grazing system due to the limitations enumerated by Omoregie (2015). These include:

i. the destructive action of livestock on arable crops;
ii. raping of girls and women, including, married ones;
iii. cold-blooded murders through armed robberies and kidnapping;
iv. disruption of farming activities;
v. loss of income arising from the destruction of farms; and
vi. forceful take-over of farmlands.

The matter of croppers-herdsmen is now beyond the above. Some new dimensions have been thrown up to include:

i. ethno-religious interpretation of the conflict;
ii. the perceived expansionist policies of the central Government, directly or indirectly, in favour of ethnic nationality;
iii. the lack of political will of political leaders at all levels of governance to engage and solve the intractable problems arising from obvious damages done to croppers; and
iv. the emergence of some pastoralist groups as a "political force" in perpetual defense of the atrocities of herdsmen across the nation (Omorege, 2021).

It would be foolhardy to gloss over this conflict that has reached a political crescendo. One of the major effects of this conflict is reflected in the food crisis and food insecurity, resulting from a low supply of food items as evidenced in the high-prices of most food produce and products.

Food Insecurity, Food Aid, and Dependency Syndrome

Nigeria's dependency on other countries for food can be viewed from two perspectives viz:

i. food aid; and
ii. food imports.

It was the realization of the need of people to feed themselves that the UN inaugurated the FAO (Food and Agricultural Organization) on October 1945, and October 16 has been declared as World Food Day. The objectives were to raise the levels of:

i. nutrition and standard of living;
ii. improve production and distribution of agricultural products; and
iii. uplift the condition of the rural population by the year 2,000 AD.

With about 23 years above the years to get to the promised land, the food situation in many parts of the world, mostly Africa and Asia has not been achieved. There still exists a wide gap in per capital food intake between the developed and African countries (Table 6) on the one hand, and between the well-to-do urbanites and the largely subsistence rural dwellers of Africa on the other (Omoregie, 1992).

Food aid has become a major source of food, particularly during emergencies. Food imports have increased over the years. Food aid could be described as aid in kind, usually cereals and milk powder. It can also come through:

i. Agricultural assistance: - technical and manpower;
ii. concessional food prices,
iii. establishment of research facilities to develop methods of raising yield per hectare and also to increase the content of food crops; and
iv. humanitarian food gifts.

Food aid on the surface seems very harmless. This is a form of neo-colonialism. It must be stated that any political independence without sound economic base,

self-sufficiency, and sustenance in food production cannot guarantee food security. It leads to foreign dependency with the concomitant interference from external bodies into the body politic of Africa, including Nigeria. This is evident from the blockage of grains from Ukraine by Russia in recent times. Africa, with diverse advantages of climate, soil, varieties of crops and breeds of livestock, and human resources, cannot afford to depend on foreign powers for their needs in food.

As stated earlier, food has assumed a political status in world negotiations, for instance, friendly countries receive concessional food aid or preferential commercial trade while perceived unfriendly states experience blackout of food aid or embargo on commercial exports. As with most gifts, food aid has its limitations (Omoregie, 1992). Some of the limitations are summarized as follows:

i. It enters into direct competition with local products, thereby discouraging local farmers from production,
ii. It tends to transform the food habits of the beneficiaries and create dependency syndrome for the new produce,
iii. Most times, the food gifts are of low quality,
iv. It develops a beggar –mentality,
v. Sometimes, it may be used to exert pressure on the recipient nation by international donors.

Considering the negative effects of food aid and excessive food imports on the socio-political and economic sphere of a nation, the need for self-reliance and sustainable food delivery for the citizens need not be over-emphasized.

Implications of Food Insecurity

Having dealt with the foregoing aspects of food security, it is important to highlight some implications of its insecurity for Nigeria. This is of great essence considering the growing high levels of food insecurity in the country in the last years (Table 6). I wish to summarize the implications thus:

i. socio-economic problems arising from uncontrollable burgeoning food prices of farm products at the markets;
ii. socio-political problems that may lead to spontaneous citizen unrest leading to unstable polity;
iii. deficit in food supply resulting in unacceptable food shortages. This leads to marked seasonal variation in the intake of primary food products;
iv. the result of (iii) above is severe underfeeding and malnutrition among the vulnerable groups of children and nursing mothers;
v. the totality of (iii) & (iv) above is low quantity and quality of diet to underprivileged Nigerians living below poverty-line; with severe health issues. Healthy citizenship leads to a healthy nation that can be mobilized for further development.

Food Security and Training of Students and Teachers of Agriculture

It has been observed that both the federal, and state government agencies and institutions have conducted various in-school and out-of-school programmes to develop agriculture in Nigeria. It was noted, however, that these efforts have not yielded the desired results; due, mainly to the traditional course-based approaches used for the preparation of agricultural science teachers (Agwubike, 1991).

Apart from the various programmes of government aimed at increasing food production, farming in schools and higher institutions is one way that food security can be achieved at the local or regional levels. The teachers of agricultural science in schools are expected to stimulate interest and skills in the students. Nigerian agriculture graduates are expected to assist the farming communities in increasing agricultural output, both in quantity and quality (Dede & Ikhatua, 1991).

However, with the expansion of knowledge and skills in agriculture, graduates are expected to perform more and wider diversified functions than in the past.

Consequently, they need to be imparted with practical courses, extension methodologies, and basic management courses that will equip them for this vital role.

In realization of the above, a one-year practical training programme was designed to expose agriculture students to the task ahead in a modern agricultural production system. How effective this has been is another question! The main issue is: Have the agriculture graduates been imbued with the knowledge and practical skills that will enable them to withstand the impact of new technologies and management techniques for the transformation of the agricultural landscape? Another issue is, has there been consistency in policy for training agriculture students in terms of duration, practical skills, and course content? There are two major aspects of training in agriculture viz.

i. Training for the job of potential teacher (student).
ii. Training on the job of teachers of agriculture.

The training approaches will involve:

In-service training and acquisition of knowledge from:

- Workshops.
- Seminars.
- Conferences.
- Short Service Certificate/Diploma Programmes in specific areas of agriculture.

Further training, in-school and out of school programmes are meant to enhance competence. It is advocated that training should emphasize an entrepreneurial approach to replace the traditional mere course-based teaching. There should be a more practical orientation, using new methods or techniques, to be attractive to young people. Simple technology- based equipment is needed for training. The present programmes are still based on the manual and old traditional systems. This is outdated!

Training in agriculture should also emphasize competence and performance for a new generation of students, teachers of agriculture, and farmers, from the old imagen farmers in rural areas to knowledge, practical, and skill based new crops of farmers and teachers.

In the training of agricultural education students, there has been the issue of pedagogy (methods of teaching) and content (knowledge of subject matter); specifically, on which should take precedence. For me, both are good ingredients in student evaluation. A good teacher should have a good grasp of the subject and be able to impart the knowledge to his/her students. However, a good balance of both is needed to serve the purpose of teaching and training.

Meeting the Challenges of Food Security: Strategies

Having gone this far in my presentation, I wish to summarize the strategies needed to increase food and livestock production; to achieve food security in Nigeria. In proffering solutions to food insecurity in Nigeria, it should be approached from:

i. technical and technological (research, mechanization, manpower, etc);
ii. socio-economic (pricing, land policy, extension service, credit, capital, etc);
iii. organizational (structures, policy instruments, etc);
iv. institutional (agricultural banks, data banks, management boards etc); and
v. systems of agricultural production perspectives.

Consequently, some of the approaches to sustainable self-sufficiency in food production include:

a. Expanding cropped area through new land (farms) development under rainfed conditions;
b. Increasing the intensity of production in already cropped rainfed areas, through sustainable cropping systems which involve nutrient recycling and maintenance of soil fertility; and
c. Increasing the intensity of production in irrigated areas through higher yields from greater cropping intensities and maintenance of stable cropping system practices (Omorege, 1992).

The above approaches can be achieved through:

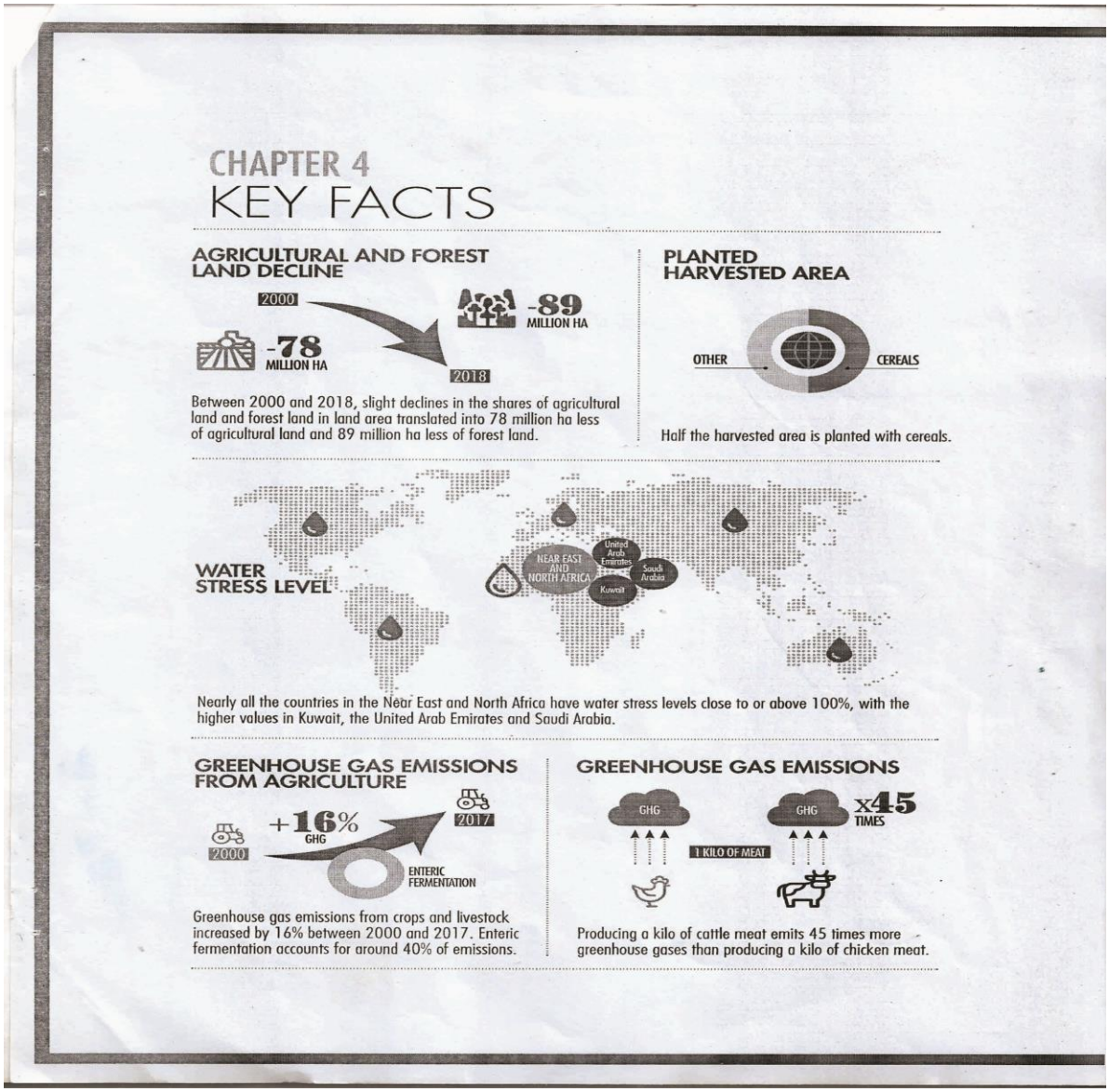
i. An aggressive and functional agricultural research policy, aimed at providing the best methods of managing and utilizing local agricultural resources, such as the provision of drought, pest and disease-resistant crop varieties and productive proven breeds of livestock;
ii. Good management strategies for land, to reduce the effect of drought, erosion, mineral resources exploitation, and environmental degradation through re-aforestation, soil management practices like restriction on the use of unsuitable land clearing equipment and methods, and activities of mineral explorers;
iii. Efficient training and retraining programmes for agricultural policy makers and implementers, extension agents, and farmers; to provide a supportive climate for the adoption of innovations;
iv. Adoption of innovations should be developed from existing local systems rather than supplanting over-science-based techniques of the agriculturally developed countries. There is room for adaptation of foreign innovations;
v. Wastages arising from post-harvest production can be reduced through highly efficient medium-level storage, preservation, and processing technology especially in rural environments by considering:
    a. the storage structures to use;
    b. methods of storage;
    c. the products being stored;
    d. the state of the products being stored; and
    e. the storage environment (Omoregie, 1990).
vi. The need for well-structured marketing and pricing policies that protect farmers of agricultural products to encourage them to produce more;
vii. Real farmers' funding programmes for the agriculture sector are a bedrock for food security. Incentives must be provided in the form of inputs e.g. herbicides, and fertilizers at highly subsidized rates. Farmers' cooperative societies or associations should be encouraged to pool resources together and tackle common problems;
viii. Integrated crop-livestock production system approach (Omoregie, 1991).

Conclusion

In this presentation, attempts have been made to analyze the role of agriculture in food and livestock production. Also, sustainable agriculture, food security and insecurity, and food crisis and their implications for national development were evaluated. The challenges of meeting the food requirements of Nigerians can be summarized as:

i. Production of adequate food and livestock in adequate quantity and quality;
ii. Poor storage and preservation of farm produce and products;
iii. Low local farming techniques and technology;
iv. The poor economic power of farmers in terms of capital and other inputs;
v. Inadequate and poor funding of research and development in agriculture;
vi. Poor and inconsistent implementation of agricultural policies.

Globally, the threat to human existence through hunger is real, looking at the Key Facts on land, water, and the environment. (Key facts: Chapter 4). The time for food security in Nigeria is now!



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ACHIEVING FOOD SECURITY THROUGH EFFECTIVE AGRICULTURAL EDUCATION AND TRAINING IN NIGERIA

JAMES O. S. BANJO, *Professor*
Tai Solarin University of Education, Ijebu-Ode.

LEAD PAPER

Introduction

Food security and agricultural education and training are critical areas of concern in Nigeria. Education is a key to all the facets of development including food production. Education in the agricultural way can be a vehicle or channel to food security. It is not out of context to say that we eat what we teach and teach what we eat. The United States of America with fewer enlightened citizens involved in agriculture has food security compared to Nigeria where about 35.21 of the total population is in agriculture whereas only 10.5% of the total population is involved in agriculture and its related industries. As a country with a growing population and significant agricultural potential, we need to beam our searchlight to ensuring food security and fostering a well-trained workforce in the agricultural sector which are vital for sustainable development and poverty reduction. However, Nigeria faces numerous challenges in achieving these goals. The problem at hand is that of suboptimal agricultural education leading to food security. Despite being an agricultural-based economy, Nigeria struggles to meet the nutritional needs of its population due to various factors such as climate change, limited access to modern agricultural technologies, insufficient infrastructure, and poor educational systems. Additionally, the existing agricultural education and training programs face challenges in terms of curriculum relevance, delivery methods, and access to marginalized populations. Understanding and addressing these challenges is crucial for sustainable food production and improved agricultural education in Nigeria.

This paper aims to provide an overview of the current trends/challenges and effects on food production and security and highlight the agricultural development efforts to boost food production over the years as well as the importance of agricultural education and training in Nigeria and setting the stage for ways of Strengthening the classroom, teacher, and learning environment to improve agriculture by providing valuable insights and recommendations to enhance existing programs and develop new strategies for sustainable agricultural practices and education.

Interestingly, the discourse on food security began as far back as 2009 at World Summit. As the population keeps growing geometrically, food production keeps growing in arithmetic progression as postulated by Thomas Malthus on food and population growth. The implication is that a time will come when the food produced will not be able to feed the population. This made the World Summit therefore to focus decisive efforts to guarantee food for all (food security). In the opinion of the World Food Summit, four pillars were used to represent the four dimensions (food availability, food accessibility, utilization, and stability). The Sustainable Development Goal 2 (SDG) was also emphatic about food security by 2030. World Bank also gave a target of 2050. Since how we teach goes a long way to determining what we eat and use as raw materials, we can now congratulate ourselves as teachers coming to discuss the way forward on how our teaching can bring about food security in Nigeria.

Concepts

Agricultural Education

Agricultural Education refers to the formal instruction, training, and dissemination of knowledge and skills related

to agriculture. It encompasses a wide range of topics, including crop production, animal husbandry, agricultural technology, sustainable farming practices, agricultural economics, and agribusiness management. Agricultural education aims to equip individuals with the necessary knowledge and skills to engage in various agricultural activities, such as farming, research, extension services, and agricultural entrepreneurship. According to the United Nations Food and Agriculture Organization (FAO), agricultural education plays a crucial role in promoting sustainable agricultural practices and enhancing rural development (FAO, 2014).

Training

Training in the context of agriculture refers to the process of imparting practical skills and knowledge to individuals involved in agricultural activities with informal instruction. It focuses on enhancing specific competencies required for successful farming, such as crop management techniques, livestock handling, pest control methods, soil conservation practices, and post-harvest handling. Training programs can be conducted by agricultural institutions, government agencies, non-profit organizations, and private entities. These programs often include hands-on fieldwork, demonstrations, workshops, and seminars to provide practical experience and promote effective learning. The Food and Agriculture Organization of the United Nations (FAO) emphasizes the importance of training programs to improve the capacity and skills of farmers, particularly in developing countries (FAO, 2012).

Food Security

Food security is a versatile concept as reflected by the many attempts to define it in research and policy usage. The concept of food security originated about 50 years ago, at a time of global food crises in the early 1970s. In the 2009 World Summit definition on Food Security, the Summit used for the first time the phrase "four pillars of food security" representing the four dimensions, namely, availability, accessibility, utilization, and stability, of food security (FAO,2009).

However, the visualization of pillars gives a rather misleading representation of the concepts in the four dimensions are surely interrelated and interdependent, rather than static and separate. Food security is best considered as a causal, linked pathway from production to consumption through, distribution to processing, recognized in several domains, rather than as four "pillars" (Berry, *et al*., 2015). Instead of pillars, a better analogy uses a pathway to describe the relations among the four dimensions of food security. This analogy was used by the state of food insecurity in the World in 2013 (FAO, WFP and IFAD, 2013) to show the links from food production (availability) to a household (accessibility) to an individual (utilization). Accessibility contains physical (transport, infrastructure) and Economic means (food purchasing power). Food security refers to the condition in which all individuals have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and preferences for an active and healthy life. It entails the availability, accessibility, and utilization of nutritious food for all individuals within a country or region. Nigeria's rapidly growing population, coupled with environmental constraints and socio-economic factors, poses significant challenges to achieving food security. Food security is defined as having sufficient food to eat, available as well as accessible.

The world's population is expected to grow to almost 10 billion by 2050, boosting agricultural demand – in a scenario of modest economic growth – by some 50 percent compared to 2013. (FAO, 2017). According to Ayinde and Adeyemi (2019), Nigeria has experienced a decline in food production due to various factors, including inadequate agricultural practices, climate change, and limited access to modern technologies. These challenges have led to increased food insecurity and malnutrition rates in the country. Achieving food security involves

ensuring food availability, access, utilization, and stability. It encompasses various dimensions, including food production, distribution, affordability, quality, and nutritional value. According to FAO (1996), "Food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life".

Food security is a global concern, and agricultural education and training play a significant role in enhancing food production, sustainable farming practices, and improving the livelihoods of farmers.

Agricultural Development Efforts to Boost Food Production in the Past

The World Bank in its 2023 report stated that agricultural development is one of the most powerful tools to end extreme poverty, boost shared prosperity, and feed a projected 9.7 billion people by 2050. Growth in the agriculture sector is two to four times more effective in raising incomes among the poorest compared to other sectors. As part of a comprehensive, global response to the food crisis, the World Bank is scaling up short- and long-term responses to boost food and nutrition security, reduce risks, and strengthen food systems.

In April 2022, the World Bank announced that it is making up to $30 billion available over a period of 15 months, including $12 billion in new projects and $18 billion from its existing portfolio. We have achieved the target of making a $30 billion commitment for food and nutrition security response. The Banks' food commitments in new lending have surpassed the $12 billion mark – almost half is earmarked for Africa, which is hit hardest by the food and nutrition security crisis. This funding including active interventions in 22 of the 24 hunger hotspots identified as countries with the most pressing needs by the FAO and WFP (World Bank, 2023).

Increasingly, the Bank supports the country efforts to transform their food systems by taking a holistic look at public policies and spending for agriculture and food. A new Multi-Donor Trust Fund, Food Systems 2030, provides a platform for change in this area.

Under the West African Agricultural Productivity Program, the Bank supported a research and development effort that promoted technology generation, dissemination, and support to local farming systems in 13 ECOWAS countries. The project reached over 2.7 million beneficiaries, 41% of whom were women. It also generated 112 technologies that reached over 1,850,000 hectares. Nigeria has long been a leader in agricultural production in Africa, and the government has taken steps to ensure that the country remains a major food producer. In recent years, the government has implemented various initiatives to increase agricultural productivity and reduce food insecurity.

Nigeria is the most populous country in Africa, with a population of over 200 million people. Agriculture is a major source of income for many Nigerians, and it is estimated that over 70% of the population is employed in the agricultural sector. Nigeria has 70.8 million hectares of agricultural land area with maize, cassava, guinea corn, yam beans, millet, and rice being the major crops. Nigeria's rice production rose from 3.7 million metric tons in 2017 to 4.0 million metric tons in 2018.

The World Bank's Past Efforts in Boosting Global Food Production

S/N	Country	Period of Project	Results
1.	Bolivia	2007-2023	Currently, more than 2,600 productive alliances have been implemented, benefiting 107,308 producer families
2.	Burkina Faso	2001-2018	The program also in water and soil conservation, agroforestry, and energy-saving stoves and other environmental technologies, helping to protect more than 200,000 hectares.
3.	Central Africa Republic		In its first year, the project reached 329,000 farmers with agricultural assets and inputs. Additionally, food crop production has surged, with 28,800 metric tons produced, representing a 125% increase in crop production. The project has also trained 8,560 vulnerable households, providing them with post-harvest handling equipment to help reduce losses and improve the quality of their produce.
4.	China	2014	Expansion of the climate-smart agriculture. Better water-use efficiency on 44,000 hectares of farmland and new technologies have improved soil conditions and boosted the production of rice by 12% and maize by 9%. More than 29,000 farmers' cooperatives report higher incomes and increased climate resilience.
5.	Columbia	2010-2023	The adoption of environmentally friendly Silvo-pastoral Production Systems for over 4,100 cattle ranches has converted 100,522 hectares of degraded pastures into more productive landscapes and captured 1,565,026 tons of CO2.
6.	Cote D'ivoire	2013-2017	Boost the productivity of 200,000 farmers and rehabilitated 6,500 kilometers of rural roads which allowed farmers to more easily bring their products to market and reduce post-harvest losses. The Bank-financed project also helped leverage $27.5 million in private investment to boost productivity on at least 26,500 hectares.
7.	Ethiopia	2011	A project has helped 2.3 million farmers with agricultural support services, agricultural research, small-scale irrigation, and market infrastructure development. In addition, almost 600,000 livestock and aquaculture farmers have been provided with various services (animal health, feeding, breeding and commercialization) and another 425,000 pastoralists and agro-pastoralists have been supported to build livelihoods resilience in the lowlands parts of the country.
8.	Madagascar	2016-2021	The Bank has boosted the productivity of over 130,000 farmers. Sixty-thousand hectares of irrigated rice fields have been rehabilitated. The Bank also supported the cocoa sector through research, the development of certified seeds, and the promotion of improved production and processing techniques. This allowed 4,000 cocoa producers to increase their incomes and increase production and export volumes by 50%. The Bank also financed the country's largest land rights registration, facilitating the delivery of over 200,000 land certificates to farmers.

Despite this, only a 57percent of the 6.7 million metric tons of rice consumed in Nigeria annually is locally produced leading to a deficit of about 3 million metric tons, which is either imported or smuggled into the country illegally. To stimulate local production, the Government banned the importation of rice in 2019 (FAO, 2022).

Despite its agricultural potential, Nigeria has struggled to achieve food security. The country has experienced periods of food shortages and high food prices due to a variety of factors, including poor infrastructure, inadequate access to markets, and limited access to agricultural inputs. In response, the government has implemented various initiatives to increase agricultural productivity and reduce food insecurity.

The Nigerian government has implemented various initiatives to increase agricultural productivity and reduce food insecurity which include the Agriculture Promotion Policy (APP), Nigeria–Africa Trade and Investment Promotion Programme, Presidential Economic Diversification Initiative, Economic and Export Promotion Incentives and the Zero Reject Initiative, Reducing Emission from Deforestation and Forest Degradation (REDD+); Nigeria Erosion and Watershed Management Project (NEWMAP); Action Against Desertification (AAD) Programme, among others. Some other documented policies of the colonial era include:

i. Forest Policy (1937);
ii. Forest Policy (1945);
iii. Agricultural Policy (1946);
iv. Policy for the Marketing of Oils, Oil Seeds, and Cotton (1948);
v. Forest Policy for Western Region (1952)
vi. Agricultural Policy (1952);
vii. Policy for Natural Resources (undated); and
viii. Western Nigeria Policy of Agricultural and Natural Resources (1959).

Misfortunes that Accompanied Yesterday and Today's Agricultural Policies

- Non-interaction between and among stakeholders
- Weak agricultural policy
- Role conflict between different programs and projects
- The short duration of agricultural policies and programmes
- Inconsistency/incompatibility of regional policies/programs with the national policies/programs
- Emphasis on mainly food and animal production
- Delay, embezzlement, misappropriation and lack of funds to pursue specific policy/programme to an expected end
- Inadequate virile technical advisory/ extension services
- Lack/ inadequate monitoring and evaluation of programme/project.

The Collapse of Farmer Education and Training in Nigeria

The collapse of farming education and training in Nigeria is a complex issue that stems from various factors. One significant factor is the lack of adequate investment in agricultural education and training programs. This can be linked to the issue of policy summersault or Policy changes. This is because the World Bank's programs and initiatives are influenced by the policies and priorities of both the organization itself and the countries it supports. Changes in government policies or shifts in the agricultural development agenda of Nigeria resulted in the suspension of the training and visitation provided by the Agricultural development programmes supported by the World Bank. According to the Food and Agriculture Organization (FAO), Nigeria's investment in agriculture education has been relatively low compared to other countries (FAO, 2017).

Inadequate funding has resulted in a lack of modern infrastructure, outdated teaching materials, and insufficient training opportunities for aspiring farmers. This limits the acquisition of practical skills and knowledge necessary for effective farming practices. Additionally, the absence of research and development initiatives in the agricultural sector further contributes to the decline in farming education. Furthermore, there is a perception issue surrounding agricultural occupations in Nigeria. Many individuals, particularly the younger generation, view farming as a less desirable

career path compared to other professions. This perception has led to a declining interest in pursuing agricultural education and training, resulting in a shortage of skilled farmers.

Moreover, the rural-urban migration trend in Nigeria has also impacted farming education. Many young people are leaving rural areas in search of better economic opportunities in urban centers, further reducing the pool of individuals interested in farming careers. This migration exacerbates the existing challenges in agricultural education and hampers the development of the sector.

To address the collapse of farming education and training in Nigeria, several measures need to be taken. Firstly, there should be increased investment in agricultural education, including the establishment of well-equipped training centers and the provision of modern teaching materials. This requires collaboration between the government, private sector, and educational institutions to allocate sufficient resources to improve the quality of farming education. Additionally, promoting the importance and profitability of agriculture as a viable career option is crucial. This can be done through awareness campaigns, showcasing successful farmers, and creating opportunities for young people to experience the rewards and potential of agricultural entrepreneurship.

The collapse of farming education and training in Nigeria can be attributed to inadequate investment, a negative perception of farming occupations, and rural-urban migration. To overcome these challenges, there is a need for increased funding, improved infrastructure, and efforts to change the perception of agriculture as a career choice. By addressing these issues, Nigeria can revitalize its farming education and training, ensuring a sustainable and prosperous agricultural sector.

Current Trends/Challenges and Effects on agriculture and Rural Development

There have been major drivers of change in the Nigerian Agricultural sector over the years. More recently is the Banditry and the COVID-19 pandemic outbreak; others include rural/urban migration and importation of agricultural produce. These challenges have stifled agricultural productivity affecting the sector's contribution to the country's GDP as well as increased food imports due to population rise hence declining levels of food sufficiency. For instance, between 2016 and 2019. Nigeria's cumulative agricultural imports stood at N3.35 trillion, four times higher than the agricultural export of N803 billion within the same period.

Covid-19

The covid-19 pandemic has significantly affected the health of millions of people as well as disrupted the socio-economic of millions of children and adults within the face of the globe. In Nigeria, there was an overwhelming spread of this virus because of the inadequacy of health and medical personnel available for rapid response action. There was also the challenge of inadequate technologies such as ventilators, public protection equipment, intensive Care unit facilities, and testing and treatment centres as a result of the lack of government investment in health facilities (Fidelis *et al*., 2021).

The food security status of Nigeria, a developing country that previously was problematic, has been worsened by the COVID-19 pandemic through several fronts including the disruption of the food supply chain, reduced agricultural output as a result of the global lockdown, and lack of access to agricultural facilities and products, such as fertilizers, manpower, and restrictive policies. These factors have generally resulted in food scarcity and price inflation, which increasingly threaten the political and economic stability of households within the country, leading to an insecure future for the people.

This is a call for concern for the giant of Africa with about 200 million population as the constant loss of manpower has affected agricultural production globally. According to the World Bank (2021) findings, the COVID-19 pandemic has caused disruptions across various industries, including agriculture. Some notable effects on agricultural production include:

1. Labor shortages: Restrictions on movement and social distancing measures have limited the availability of farm labor, especially for seasonal and migrant workers. This has resulted in challenges with planting, harvesting, and other farm activities.
2. Supply chain disruptions: Lockdowns and transportation restrictions have affected the timely delivery of agricultural inputs, such as seeds, fertilizers, and pesticides, as well as the distribution of harvested produce to markets.
3. Market volatility: Changing consumer behavior and shifting demand patterns during the pandemic have led to price fluctuations and uncertain market conditions for farmers.
4. Export/import challenges: Border closures and trade restrictions have affected the export and import of agricultural products, impacting international markets and trade relationships.
5. Reduced access to financial resources: Farmers, particularly small-scale farmers, have encountered challenges in accessing credit and loans during the pandemic. This has limited their ability to invest in agricultural inputs and technology, hindering productivity.

This review examines how the food security status of households in Nigeria has been affected by the COVID-19 pandemic and the effects of the lockdown and changing business environment on farmers' food production operations and marketing activities. It further evaluates the pandemic's impacts on agro-industrial projects and governments' efforts in making the agriculture sector more sustainable. Strategies to improve local food production, accessibility, and availability, through interventions, including financial incentives/grants to farmers, the revival of moribund agricultural agencies, and encouraging local production and processing of foods are explored (Borsellino, *et al.*, 2020).

Banditry

Banditry is common in northern Nigeria which is a notable agrarian geographical zone. Banditry refers to the activities of criminal groups that engage in acts of violence, such as kidnapping, robbery, and attacks on communities. These bandit groups often target rural areas where agriculture is a significant source of livelihood, leading to a negative impact on farmers and their output capacity. Some of the effects of banditry on agricultural production according to the United Nations Development Programme (UNDP), 2020) include the following:

1. Economic Impact: Bandit attacks disrupt farming activities, leading to a decline in agricultural productivity and output. Farmers are forced to abandon their fields or operate under constant threat, which affects their ability to cultivate crops, tend to livestock, and engage in other agricultural practices.
2. Food Security: The targeting of farmers by bandits contributes to food insecurity in the region. When farmers are unable to effectively carry out their agricultural activities, it results in a reduced supply of food crops and livestock products, leading to higher food prices and limited access to nutritious food for both rural and urban populations.
3. Farmer displacement: Banditry in northern Nigeria has caused the displacement of many farmers and their families. Fleeing from the violence, they seek refuge in other areas, leading to overcrowded settlements and increased pressure on limited resources in host communities. Conflict and insecurity force farmers to abandon their land,

leading to reduced agricultural activities and production.

4. Socioeconomic Challenges: The continuous threat of banditry affects the social and economic fabric of affected communities. Fear and insecurity can discourage investment in agriculture, limit access to markets, and hinder overall development opportunities.
5. Destruction of farmland and infrastructure: Banditry often involves attacks on farmland, irrigation systems, storage facilities, and transportation networks, resulting in damaged infrastructure and reduced agricultural output.
6. Fear and uncertainty: Insecurity creates a climate of fear among farmers, discouraging investments in agriculture and impeding productivity.
7. Disruption of market access: Banditry can disrupt transportation routes and markets, making it difficult for farmers to access buyers and sell their produce.

Efforts are being made by the Nigerian government, security agencies, and local communities to address banditry and its impact on farmers. These efforts include increased security presence, discouraging illicit gold mining, converting vast forests into government use, non-payment of ransoms when demanded, community engagement, and initiatives to support affected farmers in rebuilding their livelihoods.

Rural-Urban Migration

Rural-urban migration has been a significant phenomenon with both positive and negative impacts on farmers and their output capacity. Here are some key points to highlight the negative effects:

1. Land Abandonment: As rural inhabitants move to urban areas, agricultural land is often left uncultivated, leading to land abandonment and reduced agricultural output. According to a study by Davis et al. (2016), rural outmigration in several developing countries has resulted in increased fallow land and decreased agricultural productivity.
2. Labor Shortages: With the migration of rural youth to urban areas in search of better opportunities, farmers often face a shortage of labor. This has a direct impact on their ability to cultivate and maintain their farms effectively. The Food and Agriculture Organization (FAO) reported that labor shortages due to migration have hindered agricultural activities, resulting in reduced crop yields (FAO, 2018).
3. Aging Farming Population: Rural-urban migration contributes to an aging farming population, as young people leave rural areas. This demographic shift leads to a lack of innovation, adoption of modern farming techniques, and knowledge transfer. A study by DeWitt (2017) found that rural outmigration exacerbates the aging farmer population issue, which ultimately affects the overall agricultural productivity and output.
4. Reduced Access to Services: As rural communities decline in population, access to essential services such as healthcare, education, and infrastructure diminishes. This lack of access further hampers farmers' productivity and their ability to enhance their output capacity. Research conducted by El-Gazzar (2018) highlighted how rural-urban migration negatively affects access to agricultural extension services, hindering farmers' ability to receive crucial information and support.
5. Market Challenges: The migration of rural residents to urban areas can disrupt local agricultural markets, as the demand for local produce decreases. Farmers may struggle to sell their products at fair prices or find alternative markets, impacting their profitability and output capacity. A report by the International Fund for Agricultural Development (IFAD) indicated that rural-urban migration can create imbalances in agricultural markets, resulting in reduced incomes for farmers (IFAD, 2019).

6. Declining agricultural workforce: As individuals migrate to urban areas in search of better opportunities, the rural labor force diminishes, resulting in a shortage of skilled agricultural workers.
7. Land-use changes: As rural areas lose population, there may be pressure to convert agricultural land for other purposes, such as housing or industrial development, further reducing agricultural production capacity.

Importation

Reliance on agricultural imports can have both positive and negative effects on domestic agricultural production. According to the Organisation for Economic Co-operation and Development (OECD) (2020).

1. Market competition: Importation of agricultural products from other countries can create stiff competition for local farmers, especially if imported goods are cheaper or of better quality.
2. Reduced domestic production: In some cases, heavy reliance on imports may discourage domestic farmers from producing certain crops or goods, leading to a decline in agricultural output.
3. Food security concerns: Overdependence on imported food can pose risks to national food security, as disruptions in global supply chains or price fluctuations may impact access to essential food items.

Strengthening the Classroom, Teacher, and Learning Environment

Agriculture and agricultural Education teachers are not meeting the intended outcomes of teacher education for now. They must be effective in their teaching and above all make learning effective thus pursuing and acquiring quality education. Sesay (2014) opined that a good quality education is multicultural in nature. This means that education will enable its graduates to acquire the knowledge, manipulative skills, and conducive behaviors to earn a decent living and be able to live a productive, selfless, and peaceful life as a contributing and patriotic member of the society. The Agricultural education teachers are therefore expected to have good mastery knowledge of the subject content, and possess the right habits as well as the required practical skills to be inculcated into their learners of agriculture. These can be achieved by strengthening the classrooms, teaching process as well as learning environments through the following strategies:

1. Professional Development for Teachers: Continuous professional development plays a vital role in equipping teachers with updated pedagogical techniques and subject knowledge. Adequate training programs, workshops, and seminars should be organized to empower teachers with the necessary skills. According to a study by Ogunlade, *et al.* (2017), effective professional development positively impacts teacher competence and student learning outcomes.
2. Improved Infrastructure and Resources: Providing well-equipped classrooms with modern facilities and resources is essential for creating an optimal learning environment. This includes access to textbooks, technology, science laboratories, libraries, and other educational materials. According to the UNESCO Institute for Statistics (2019), adequate infrastructure and resources contribute to increased student engagement and better academic performance.
3. Supportive School Leadership: Strong leadership at the school level is vital for creating a positive and conducive learning environment. School administrators should provide effective guidance and support to teachers, promote collaboration among staff members, and foster a culture of continuous improvement. Research by Adesoji (2019) highlights the positive influence of supportive school leadership on teacher motivation and student achievement.
4. Student-Centered Teaching Approaches: Adopting student-centered teaching

approaches, such as active learning, problem-solving, and inquiry-based methods, can enhance student engagement and critical thinking skills. These approaches encourage students to actively participate in their own learning process. The World Bank Group (2018) emphasizes the importance of student-centered pedagogy in improving learning outcomes.

5. Parent and Community Engagement: Involving parents and the wider community in education can significantly contribute to the strengthening of schools. Regular communication, parent-teacher associations, and community outreach programs can foster a sense of ownership and support for the school. Research by Akpan and Udo (2016) emphasizes the positive impact of parent and community involvement on student achievement.

Agricultural Teacher Responsibilities and Duties

Teachers of agricultural education are expected to perform the following responsibilities:

1. Develop strategies to manage agriculture, food, and natural resources.
2. Develop lesson plans and instructional materials on agriculture and food management.
3. Deliver lectures on improving the quality of agriculture, food and other natural resources.
4. Teach students on various issues of agriculture and food including the environmental aspects.
5. Integrate research materials in agricultural lesson plans and curriculum.
6. Provide laboratory experiences to students on agriculture.
7. Supervise laboratory experiments on greenhouse, farm, meats and feeding centers.
8. Ensure the highest standards of teaching in Agric teacher functions and activities.
9. Assess, evaluate and grade students' overall academic performance and programs.
10. Conduct field visits, workshops and seminars on agriculture to students in conformance to the Agric teacher duties.

Classroom Teaching

Agricultural education is the teaching of agriculture, natural resources, and land management. At higher levels, agricultural education is primarily undertaken to prepare students for employment in the agricultural sector. Classes taught in an agricultural education curriculum may include horticulture, land management, turf grass management, agricultural science, small animal care, machine and shop classes, health and nutrition, livestock management, and biology.

Agricultural education is common at the primary, secondary (including middle and high school in the United States), tertiary (including vocational schools and universities), and adult levels. Elementary agriculture is often taught in both public and private schools and can cover such subjects as how plants and animals grow and how soil is farmed and conserved.

Vocational agriculture trains people for jobs in such areas as production, marketing, and conservation. College agriculture involves training people to teach or conduct research to advance the fields of agriculture and food science. General education informs the public about food and agriculture. Disciplines closely tied to agricultural education include agricultural communications, agricultural leadership, and extension education.

Curriculum and Teaching

Productive curriculum covers vocational education program, agricultural education focuses on three major components: formal classroom instruction, career experience programs, and leadership development. These components are delivered through a competency-based curriculum in the context of agriculture.

A productive curriculum is a process of making a product using four factors of production. Land, Labor, Capital, and entrepreneur. Production is the process that

involves the transfer of inputs to finished goods. It consists of the creation of products over some time. The method of production is carried out to satisfy human wants.

Productive curriculum teaches and trains students to become producers to create, or produce, goods and provide services, and consumers buy those goods and services with money. Most people are both producers and consumers. Producers create or provide a certain good (product) or service.

Consumption curriculum consists of the use of products, usually measured as the purchase of end of the production line goods and services. Consumption is a process in which a substance is used up. Consumption curriculum further consists of consumer education is the preparation of an individual to be capable of making informed decisions when it comes to purchasing products in a consumer culture. It generally covers various consumer goods and services, prices, what the consumer can expect, standard trade practices, etc. While consumer education can help consumers make more informed decisions, some researchers have found that its effects can drop off over time, suggesting the need for continual education.

New dimensions of consumer education are also beginning to emerge as people become more aware of the need for ethical consumerism and sustainable consumer behaviour in our increasingly globalized society.

Strengthening the Farmer Education Strategies

Strengthening farmer education strategies is a crucial aspect of enhancing agricultural practices and empowering farmers. Let's explore some key points with relevant citations, sources, and references.

1. Access to Agricultural Extension Services: Agricultural extension services play a vital role in providing farmers with knowledge, training, and technical assistance. According to the World Bank, "access to extension services significantly improves agricultural productivity, adoption of new technologies, and income growth for farmers" (World Bank, 2014).
2. Farmer Field Schools: Farmer Field Schools (FFS) are participatory and experiential learning platforms where farmers gain hands-on experience and exchange knowledge. Research by Katungi, *et al.* (2018) showed that FFS participants experienced increased crop yields, improved income, and enhanced adoption of sustainable agricultural practices.
3. Digital Agriculture Tools: The integration of digital agriculture tools, such as mobile apps and online platforms, can provide farmers with real-time information, market prices, weather forecasts, and expert advice. A study by Qamar et al. (2020) found that digital platforms improved farmers' access to knowledge, reduced information gaps, and facilitated decision-making.
4. Women's Empowerment: Promoting gender equality and women's empowerment in agriculture is crucial. A report by FAO (2011) emphasized that investing in women's education and training leads to improved agricultural productivity, household nutrition, and overall rural development.
5. Access to Finance and Market Linkages: Enhancing farmers' access to finance and market linkages is essential for their economic sustainability. Research by Minten, *et al.* (2018) highlighted that providing farmers with training on financial literacy and market-oriented production practices increased their income and profitability.

By incorporating these strategies, farmers can enhance their knowledge, improve agricultural practices, and increase their income and livelihoods.

Institutions/Farmers Linkage to Improve Agriculture

Linking institutions and farmers is crucial for improving food production. Effective collaboration between agricultural institutions and farmers can lead to enhanced

productivity, sustainable practices, and the overall development of the agricultural sector. According to the World Bank (2017) "Strengthening the linkages between agricultural institutions and farmers is essential for increasing agricultural productivity and improving food security". Also, the Food and Agriculture Organization (FAO) (2019), postulated that "Effective partnerships between agricultural research institutions and farmers can facilitate knowledge sharing, technology transfer, and capacity building, leading to improved food production and rural development."

Collaboration between agricultural institutions and farmers helps in identifying context-specific challenges, implementing innovative practices, and disseminating information to optimize agricultural productivity and resilience. (IFPRI, 2020). There is a need to promote linkages between agricultural institutions and farmers through extension services, training programs, and research collaborations that can enhance farmers' access to knowledge, resources, and technologies, resulting in increased agricultural productivity (USDA, 2018).

By fostering these linkages, farmers can benefit from the expertise, research findings, and resources offered by agricultural institutions. Conversely, institutions can gain valuable insights from farmers' practical experiences, contributing to more context-specific research and development. Together, they can develop and implement innovative farming techniques, sustainable practices, and efficient resource management strategies to improve food production.

Conclusion

In conclusion, the challenges surrounding agricultural education and training in Nigeria play a significant role in determining the country's food production and security. However, through effective mitigation strategies, these challenges can be addressed to pave the way for increased agricultural productivity and overall food security.

Firstly, the limited access to quality agricultural education and training programs hampers the development of skilled farmers and agricultural professionals. To overcome this challenge, it is crucial to prioritize investment in agricultural institutions, curriculum development, and the provision of modern learning resources. This will ensure that aspiring farmers receive comprehensive training and education to enhance their knowledge and skills.

Secondly, inadequate infrastructure, such as irrigation systems and storage facilities, poses a major obstacle to agricultural productivity in Nigeria. Addressing this challenge requires collaborative efforts between the government, private sector, and international organizations to improve infrastructure development in rural areas. By providing farmers with the necessary tools and facilities, we can enhance their ability to produce, store, and distribute food effectively.

Furthermore, the lack of awareness and adoption of modern farming techniques and technologies hinders agricultural progress. Promoting innovative and sustainable farming practices through farmer extension programs and knowledge-sharing platforms is essential. By empowering farmers with up-to-date information, best practices, and access to new technologies, we can significantly increase agricultural productivity and improve food security.

Lastly, the issue of climate change and its impact on agriculture cannot be overlooked. It is imperative to integrate climate-smart agricultural practices into education and training programs. This involves educating farmers on climate change mitigation strategies, resilient crop varieties, and sustainable land management techniques. By equipping farmers with the knowledge and skills to adapt to changing climatic conditions, we can ensure the continuity of agricultural productivity despite environmental challenges.

Mitigating the challenges of agricultural education and training is crucial

for achieving increased food production and security in Nigeria. By addressing the limitations in access to education, improving infrastructure, promoting modern farming techniques, and addressing climate change concerns, we can empower farmers to contribute significantly to the nation's food production and enhance food security for all Nigerians.

Recommendations

Having highlighted the various strategies in combating the challenges facing agricultural production, the following recommendations can enhance agricultural education and training, leading to increased food production, improved food security, and a thriving agricultural sector. These recommendations include:

i. Strengthen Curriculum: Update and align the agricultural education curriculum with modern farming techniques, technologies, and market demands. Integrate practical hands-on training to bridge the gap between theory and practice.
ii. Teacher Training: Provide comprehensive and continuous professional development programs for agricultural educators to enhance their knowledge and teaching skills. This will ensure that they are equipped with the latest information and methodologies.
iii. Infrastructure Development: Invest in the development of agricultural training institutions by providing necessary infrastructure such as laboratories, research farms, and modern equipment. This will facilitate practical learning experiences for students.
iv. Industry Collaboration: Foster partnerships between agricultural training institutions and industry stakeholders, including farmers, agribusinesses, and research organizations. This collaboration will facilitate knowledge exchange, internships, and job placement opportunities for students.
v. Entrepreneurship Education: Incorporate entrepreneurship education into agricultural training programs to equip students with the skills and mindset needed to start their agribusiness ventures. This will promote self-employment and create more opportunities in the agricultural sector.
vi. ICT Integration: Integrate information and communication technologies (ICTs) into agricultural education to enhance learning and access to agricultural information. This can include e-learning platforms, mobile apps, and online resources.
vii. Research and Innovation: Promote research and innovation in agricultural education and training to develop sustainable and context-specific solutions to agricultural challenges. Encourage students and faculty to engage in research projects and support their dissemination of findings.
viii. Extension Services: Strengthen agricultural extension services to provide ongoing support and advisory services to farmers. This can be achieved by integrating extension activities into agricultural training programs and establishing partnerships with existing extension agencies.
ix. Gender Inclusion: Promote gender equality in agricultural education and training by ensuring equal access and opportunities for both male and female students. Implement measures to address gender stereotypes and biases in the sector.
x. Policy Support: Advocate for supportive policies and increased government funding for agricultural education and training. Engage policymakers to recognize the importance of investing in human capital development for agricultural transformation.

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COST BENEFIT AND RESPONSE OF AFRICAN GIANT LAND SNAIL (*Archachatina marginata*) FED FORMULATED CONCENTRATE DIET AND MUNICIPAL ORGANIC WASTE

ENERUVIE, B. E.
AGUNANNAH, M. U.
Department of Agricultural Technology,
Akanu Ibiam Federal Polytechnic, Unwana, Ebonyi State.

AGBIDI, S. S., *Ph.D.*
Department of Vocational Education,
Delta State University, Abraka.

Abstract
Five hundred (500) hatchlings of Archachatina marginata with an average live-weight of 11.38g to 12.13g, were used to evaluate the response of African Giant Land Snail fed formulated concentrate diet and municipal organic waste. The snails were divided into 4 treatments and replicated five (5) times. Each replicate was housed in a box. Four experimental diets were formulated according to the treatment groups: T_1, T_2, T_3, and T_4 which contain T_1, 100% concentrate diet (CD); T_2, 75% municipal organic waste (MOW) + 25% Limestone; T_3, 50% MOW + 50% CD; and T_4, 50% CD + 50% Centrosema, respectively. Daily weight gain, feed conversion ratio, and daily feed intake were determined, while the cost benefit analyses were also carried out. Daily weight gain of T_1 and T_2 recorded the highest values (0.234g) and (0.215g) respectively, which differed ($p<0.05$) from those obtained for T_3 (0.198g) and T_4 (0.191g). Feed intake for T_1 (5.08g) was higher ($p<0.05$) than corresponding values for T_4 (4.20g), T_3 (4.13g) and T_2 (3.82g). However, for the feed conversion ratio, values for T_1, T_3, and T_4 were similar ($p>0.05$) and significantly lower ($p<0.05$) than the value for T_2. The cost of feed/g showed that T_2 (₦0.007) was the cheapest compared to T_3 (₦0.031), T_4 (₦0.031) and T_1 (₦0.061). The cost of production per snail was highest ($p<0.05$) in T_1 (₦54.53), followed by T_4 (₦32.75), T_3 (₦31.86), and T_2 (₦20.39), while the profit was generally higher ($p<0.05$) in T_2 (₦33.20), followed by T_3 (₦18.34), T_4 (₦17.09) and T_1 (₦6.14). Based on the cost of production and profitability, T_2 which is 75% municipal organic waste (MOW) + 25% limestone is recommended to farmers, to be used as snail feed.

Keywords: Response, Concentrate, Municipal Organic Waste, African Giant Land Snail, Cost Benefit

Introduction

In Africa, the demand by humans to meet their protein requirement has led to scarcity and high cost of meat, which has made researchers dive into the study of rearing non-conventional livestock such as snails (Jimoh, *et al.,* 2020). Snails belong to the Phylum Mollusca, with a soft-segmented exoskeleton in the form of a calcerous shell (Eze, *et al.,* 2016*;* Okonta, 2012). In West Africa, snails are gathered by villagers who dwell within the forest region for consumption and other purposes (Okonta, 2012).

The African giant land snails are a wildlife dietary protein source in Nigeria and some other parts of Africa (Alikwe *et al.,* 2014). Snail meat is tender and tastes good. It is highly nutritious and serves as a delicacy in native African dishes. Nutritious benefits of snail meat include being particularly rich in protein, iron, calcium and phosphorous and low in fat, saturated fatty acids and cholesterol when compared with beef, goat meat, mutton, pork, broiler meat and fish (Jimoh, *et al.,* 2020). The breed has a voracious appetite. They are known to eat at least 500 different types of plants including peanuts, beans, peas, cucumbers, and melons (Okonta, 2012). Despite the nutritional value of snail meat, the production has not reached large-scale production and commercialization

as compared with other livestock like cattle, goats, sheep, and poultry. Its demand is met by hunting the animals from their habitat in the wild. In recent years, wild snail populations have declined considerably, primarily because of the impact of human activities such as deforestation, pesticide use, slash-and-burn agriculture, spontaneous bushfires, and the collection of immature snails (Oyeagu *et al.,* 2018). Commercial snail production is necessary to conserve this important resource, meet the animal protein demand, and optimize the nutritional and medicinal qualities of the snail meat. There is an increasing interest in the rearing of snails to make them available in commercial quantities for marketing at all seasons of the year (Jimoh *et al.,* 2020) and this occasioned the need for adequate snail diet to be formulated. Hence, this study seeks to assess the cost benefit and response of African Giant Land Snail (*Archachatina marginata*) fed formulated concentrate diet and municipal organic waste.

Purpose of the Study

The broad purpose of this study was to assess the cost benefit and response of African Giant Land Snail (*Archachatina marginata*) fed formulated concentrate diet and municipal organic waste. The specific objectives of the study are as follows:

i. To determine the cost benefit of African Giant Land Snail (*Archachatina marginata*) fed formulated concentrate diet and municipal organic waste; and
ii. To assess the response (performance) of African Giant Land Snail (*Archachatina marginata*) fed formulated concentrate diet and municipal organic waste.

Methodology

This study was conducted at the Snail Unit of Teaching and Research Farm of Micheal Okpara University of Agriculture Umudike, Abia State, Nigeria, with an annual temperature of 22^0C and 29^0C and relative humidity of 50% to 90%. The site is located between Latitude 5.4800 N and Longitude of 7.5437^0 E with an altitude of 123m above sea level. It is situated in the rainforest region of Southeast Nigeria.

The municipal organic waste was obtained from traders at Ahiaeke markets and the *Centrosema* used in this experiment was sourced from Micheal Okpara University of Agriculture, Umudike. The limestone and other ingredients used for the formulation of the concentrate diet were obtained from a feed mill in Umuahia, Abia State. The ingredients and composition of experimental diets (kg) and the chemical composition of the experimental diets are presented in the Table below.

Computation of Concentrate Diet

Ingredients	**Percentage (%)**
Maize	22.00
Wheat Offals	12.00
Palm Kernel Cake (PKC)	5.39
Limestone	50.00
Soyabean	10.00
Salt	0.25
Premix	0.25
Methionine	0.10
Lysine	0.10
Total	**100.00**

Composition of Experimental Diets (kg) and Chemical Composition

Feed Stuff (kg)	**T_1 Concentrate Diet**	**T_2 Muncipal Organic Waste + Limestone**	**T_3 Muncipal Organic Waste + Concentrate Diet**	**T_4 Concentrate Diet + Centrosema**
Municipal Organic Waste	-	75	50	-
Concentrate Diet	100	-	50	50
Limestone	-	25	-	-
Centrosema	-	-	-	50
Total	100	100	100	100
Chemical Composition (%)				
Crude Proteins	19.68	9.19	10.97	17.49
Ether Extract	1.85	13.43	9.88	2.53
Crude Fibre	2.91	12.68	9.91	17.36
Ash	47.33	29.86	31.07	27.57
Calcium	19.07	10.92	10.48	10.06
Phosphorus	0.26	0.22	0.28	0.29
Metabolizable Energy for Snail (ME/kg as fed)	1192.11	1930.36	1882.36	2263.51

The municipal organic waste used in feeding the snails passed through the following preparatory stages:

i. Collection of food waste from the traders (markets).
ii. Removal of undegradable materials such as nylon, metals, etc from the waste that was used as feed.
iii. Chopping/ cutting of waste into smaller pieces.
iv. The municipal organic wastes were combined with other feed ingredients and were fed to the snails.

A little quantity of water was added to the limestone/formulated concentrate diets, and were mixed to produce paste which was fed to the snails. The *Centrosema* leaves were sourced within the Micheal Okpara University of Agriculture environment and fed fresh to snails. Five hundred (500) hatchlings were used in this study, the experiment lasted for a period of one hundred and twenty (120) days (17 weeks). The experimental animals were penned in 20 wooden boxes that were covered all around with small nets. The 500 hatchlings were distributed into 4 treatments, with 5 replicates per treatment giving 25 hatchings per replicate, each replicate (25 hatchlings) was housed in one wooden box.

The experimental diets consist of four (4) treatments as follows: T_1= Concentrate diet only (100%), T_2 = 75% Municipal organic waste + 25% limestone, T_3 = 50% Municipal organic waste + 50% Concentrate diet, T_4= 50% Concentrate diet + 50% *Centrosema pubescens*. The animals were housed in different pens and fed the diets for 120 days. Feed and water were given adlibitum to the snails.

All data were gathered as weekly liveweight and daily feed intake, from where the average daily weight gain, average daily feed intake, and feed conversion ratio were calculated. Snails were weighed in groups. Left-over feed was weighed before new feed was given to the snails. The data is based on the method applied by Eneruvie (2020). The cost benefit analysis was based on the method as applied by Anigbogu (2011).

A completely Randomized Design (CRD) was used, while the hatchlings were

randomly divided into four (4) treatment groups and replicated five (5) times. Each group was assigned to one of the four (4) experimental diets. Data collected were subjected to analysis of variance (ANOVA) procedure and the mean separation for significant effect was done using LSD, Duncan New Multiple Range Test (Steel & Torrie, 2000).

Results and Discussion

Table 1

ANOVA Showing Performance Characteristics of Snail (Feed Intake, Average Daily Weight Gain, and Feed Conversion Ratio)

	T_1 CD Only	**T_2 MOW + Limestone**	**T_3 MOW + CD**	**T_4 CD + Centrosema**	**SEM**
Initial Weight (g)	12.130[a]	11.750[a]	11.380[a]	12.000[a]	0.190
Final Weight (g)	40.500[a]	37.500[b]	35.130[c]	34.880[c]	1.148
Average Daily Weight Gain (g)	0.236[a]	0.215[a]	0.198[b]	0.191[b]	0.009
Average Daily Feed Intake (g)	5.080[a]	3.820[b]	4.130[c]	4.200[b]	0.155
Feed Conversion Ratio (g)	0.179[b]	0.148[a]	0.174[b]	0.184[b]	0.006
Mortality	-	2	1	-	-

[abc] Row means with different superscripts are significantly different (P<0.05) MOW: Municipal Organic Waste, CD: Concentrate Diet

The daily weight gain as observed, was higher in treatment T_1 (0.236g), followed by T_2 (0.215g), which were different ($p<0.05$) over T_3 (0.198g) and T_4 (0.191) respectively. The high daily weight gain observed in snails fed the diet (T_1) could be due to the higher nutrient intake on the concentrate diets. This finding is in line with the observation made by Okonkwo *et al*. (2000), who noted that the growth of tissues and weight gain is influenced by the nutritive value of feed.

The values obtained for the average daily feed intake for the snails fed treatment diets were 5.08g, 3.82g, 4.13g, and 4.20g for T_1, T_2, T_3, and T_4 respectively. The results showed that the snail-fed concentrate diet (T_1) had higher daily feed intake when compared to other groups, and was significantly different ($P<0.05$) from the others. The high daily feed intake recorded in T_1 was an indication that the treatment containing concentrate diet only is palatable to the snails. This result was in line with the report of Anigbogu *et al*. (2009) who reported that high-quality feed helps to improve productivity in farm animals.

The snails fed T_2 and T_3 had a lower feed conversion ratio than T_1 and T_4, this points to the nutritional value of municipal organic waste which resulted in better metabolism/utilization by the snails. This is in line with observations made by Belewu *et al*. (2004) and Anigbogu (2003[a]) who reported an improved feed conversion ratio of goat-fed waste-based diets.

Table 2
Cost Benefit Analysis of Feeding Snails with Experimental Diets

	T_1 CD Only	T_2 MOW + Limestone	T_3 MOW + CD	T_4 CD + Centrosema	SEM
Cost of Feed/g (₦)	0.061	0.007	0.031	0.031	-
Cost of Feed Consumed (₦/g)	0.310[a]	0.030[c]	0.130[b]	0.130[b]	0.023
Cost of Snail/g (₦)	1.429	1.429	1.429	1.429	-
Cost of Production (₦/snail)	54.53[a]	20.39[c]	31.86[b]	32.75[b]	2.926
Cost/g of Weight Gain (#)	0.011[a]	0.001[d]	0.005[c]	0.006[b]	0.001
Gross Profit (₦/Snail)	57.88[a]	53.59[b]	50.20[b]	49.84[b]	0.990
Profit (₦/Snail)	3.35[c]	33.20[a]	18.34[b]	17.09[b]	2.466
Return on Investment (%)	6.14[d]	162.83[a]	57.56[b]	52.18[c]	13.190

[abcd] Row means with different superscripts are significantly different (P<0.05) MOW: Municipal Organic Waste, CD: Concentrate Diet.

The results on cost of feed/g, cost of feed consumed, cost of production, gross profit, profit, return on investment, and economic efficiency are presented in Table 2.

The cost of feed/g was high in T_1 (₦0.061) when compared to T_3 (₦ 0.031), T_4 (₦ 0.031), and T_2 (₦ 0.007). This could be attributed to the cost of feed materials as noted in this study. This is in line with Anigbogu *et al.* (2009) who reported that high feed cost has a great impact on cost benefit determination of farm animal production.

The cost of feed consumed by snails was generally better in T_2 (₦ 0.030) compared to treatment T_3 (₦0.130), T_4 (₦ 0.130), and T_1 (₦ 0.310) diets, respectively. There were significant differences ($p<0.05$) among treatment groups. The cost of feed consumed as observed by the various treatment groups, also affected the cost of production, gross profit, net profit, and return on investment. The high cost of feed/g as observed in T_1 could be attributed to the high cost of feed materials per gram of the concentrate feed. This is in line with the observation of Rana and Hasan (2009) who reported a high cost of production of fish as a result of high feed costs.

Based on the cost of production studied, there were significant differences among treatment groups. The T_2 group recorded the lowest cost of production (₦20.39/snail) followed by T_3 (₦31.86/snail), T_4 (₦32.75/snail) and T_1 (₦54.53/snail). The high cost of production recorded in T_1 was due to the high cost of feed/g and the high quantity of feed consumed by the snails. Rana and Hasan (2009) had a similar report in their previous studies, and as revealed by Anigbogu (2011) when fish waste/corn offals based feeds were fed to lambs.

The cost/g of weight gain was significant ($p<0.05$) higher in T_1 (₦0.011), when compared to T_4 (₦0.006), T_3 (₦0.005), and T_2 (₦0.001). This could be attributed to the cost of feed materials as noted in this study. This is also in line with Anigbogu *et al.* (2009).

The gross profits were higher in T_1 (₦57.88), followed by T_2 (₦53.59), T_3 (₦50.20) and T_4 (₦49.84). The high values noted in T_1 and T_2 could be attributed to the good performance of snails in terms of body weight gain. Amata (2004) and Eneruvie (2018) reported that the nutrient composition of feed resulted in better performance of snails.

Snails in the T_2 group recorded the highest net profit, followed by T_3 (₦18.34), T_4 (₦17.09) and T_1 (₦3.35). The high profit recorded in the T_2 group could be attributed to low cost of feed/g, low cost of feed consumed and low cost of production, which

in agreement with Anigbogu and Ajekule-Agbalel (2013) in a similar study using goats.

The T_2 snails recorded the highest ($p<0.05$) return on investment (162.83%), when compared to T_3 (57.56%), T_4 (52.18%) and T_1 (6.14%) respectively. This could be attributed to cost of feed/g, cost of feed consumed, and cost of production. This was also in agreement with Rana and Hasan (2009) and Anigbogu and Ajekule-Agbale (2013) in their previous reports.

Conclusion/Recommendation

This study revealed that snails fed a 100% formulated concentrate diet (FCD) responded better in weight gain which might be due to the nutritive content of the diet. Snails fed 75% municipal organic waste (MOW) + 25% Limestone (T_2) was also observed to respond well in terms of feed conversion ratio and weight gain despite the high fibre and fat content of the feed. The response of T_2 was better in terms of cost of production and higher profit margin. Based on the conclusion, it is therefore recommended that snail farmers should be encouraged to use the T_2 diet as snail feed.

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PEDAGOGICAL SKILLS AND PRINCIPLES REQUIRED BY AGRICULTURAL SCIENCE TEACHERS FOR EFFECTIVE JOB DELIVERY IN SECONDARY SCHOOLS IN BAYELSA STATE

OSEMENE, EMIZIBO SAMUEL
SUWARI, GOD'STIME SAMUEL, *Ph.D.*
Department of Vocational and Technology Education,
Faculty of Education,
Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.

Abstract
This study investigated pedagogical skills and principles required by agricultural science teachers for effective job delivery in secondary schools in Bayelsa State. The study's research methodology was a descriptive survey. Two specific objectives and research questions guided the study. The study's population comprised all agricultural science teachers in Bayelsa State. A sample size of 157 agricultural educators was purposively chosen for the study. A 20-item structured questionnaire titled "Agricultural Education Teachers for Effective Job Delivery Questionnaire (AETEJDQ)" was used for data collection. Three experts from Niger Delta University in Bayelsa State conducted the validation process. The Kuder-Richardson No. 20 method yielded a reliability coefficient of 0.79. The research questions were analysed using the mean, whereas the hypotheses were tested using a t-test with 155 degrees of freedom and an alpha level of 0.05. Results of the paper suggested that the ability to communicate effectively, good project management skills, creativity in the teaching-learning process in agriculture, sterling leadership skills, being technical in the teaching-learning process in agriculture, etc. are teaching skills required by agricultural science teachers for effective job delivery in secondary schools in Bayelsa State. The study suggested that teaching and learning in agricultural education can never be successful without the consideration and application of pedagogical theories and skills. As such, the teacher of agriculture should always update himself on the pedagogical theories and skills to guide himself in the implementation of the agricultural education curriculum.

Keywords: Agricultural Science Teachers, Job Delivery, Pedagogical Skills, Principles.

Introduction

Education is the vehicle through which societal development is driven. The development, growth, progress, and advancement of society is to a great degree dependent on the level and advancement of the system of education of the society. Education is the key medium through which a nation consciously transfers its bank of heritage from one generation to another. The importance of education cannot be over-emphasized in any society. The role of education is recognized all over the world. Hence, countries invest a large proportion of their national resources in education. Countries get together to set for themselves minimum standards of education that they try to meet and surpass (Omieibi-Davids, 2011).

Education is crucial in the advancement of human capital and is a vital investment for any nation. In Baba's view (2019), education is a means of personal growth through the acquisition of learning, knowledge, skills, and habits that are passed down from one generation to the next. As a result, education plays a crucial role in the economic, social, and moral advancement of any country. Education is a fundamental human right that should be prioritized and made available to all individuals simply because they are human.

Education is essential in the comprehensive advancement of a nation, encompassing social, cultural, and moral aspects. Baba (2019) emphasizes that an advanced and knowledgeable society is one in which each person occupies the proper place in order and changes the way people live.

In all, if there is any education that is crucial for national development; it is agricultural education. Agricultural education is focused on nurturing the holistic potential of individuals. According to Egbule (2004), agricultural education centres on the holistic nature of human existence. The focus is on training learners in agricultural productivity and teaching farming techniques. This programme focuses on preparing teachers in agricultural production and pedagogical skills in the agricultural subject matter area.

Agricultural education aims to equip students with the skills necessary to excel in farming and efficiently produce farm products. According to Osinem (2008), agricultural education encompasses the education and training provided in the field of agriculture, starting from primary school up to secondary and special schools and even universities. It is a significant educational program that is available at various levels of education, including home, school, and community. This indicates that it can take on formal, informal, and non-formal formats.

To effectively equip learners for prosperous careers in agriculture, the primary focus of agricultural education is to provide them with learning experiences that are personally meaningful and aligned with societal expectations.

Having identified the place of vocational education, which houses agricultural education as a subset to national development, the federal government of Nigeria deems it necessary to include it in the National Policy on Education. This is because agricultural education which equips the recipients with the needed attitudes, skills, competencies, knowledge, and aptitude will contribute greatly to the development of the country. This Policy in different sections outlined the need for skills acquisition in self-reliance. The National Policy on Education (FRN, 2014) in section 7 affirmed the following as goals and objectives of vocational (agricultural) education: acquiring essential skills fosters self-reliance, supports sustainable development, and combats poverty. Training in agriculture, commerce, and technology at various levels equips individuals for economic independence. By providing quality career guidance and lifelong learning, institutions address skill gaps, ensuring a competent workforce aligned with market demands for national progress.

Agbulu and Wever (2011:5) corroborated this claim by stating that vocational agricultural education is a crucial component of the general education programme in public schools across the country. It helps students develop their critical thinking, study, and problem-solving skills, all of which require the ability to gather and interpret data.

The achievement of the above-stated goals and objectives would not be possible without the effective and efficient inputs of the agricultural education teacher. According to the National Association of Agricultural Educators [NAAE] (2022), an agricultural educator (teacher) is an individual who provides the learner with information regarding agricultural processes, national resources, and technology of the food industry. He is someone who teaches students about dairy science and farming, business and growing of crops. An agricultural educator, or teacher, is any individual who contributes significantly to the viability and visibility of agricultural education in the community, acts as a catalyst for change in the field, delivers high-quality instruction, and offers solutions to issues of the sort. Middle school pupils lack access to agricultural coursework and the opportunity to explore the pros and cons and fulfillment of a farming career, in part, due to a scarcity of instructors (quality agricultural teachers), according to NAAE (2022). Although agricultural classes are available in many schools across the country, some students do not have this opportunity.

Essentially, the agriculture teacher who is saddled with the responsibility of implementing the agricultural education curriculum could be a professional or a non-professional. A professional agricultural teacher is the one with the necessary teaching

experience, while a non-professional agricultural teacher is the one with no requisite teaching qualification. Solomon (2022) defined professionally qualified teachers as those who have completed professional teacher preparation programmes from accredited educational institutions and possess the necessary abilities to work as teachers in the public education system. On the other hand, non-professional teachers are those who have completed academic training without receiving professional teacher training because they enrolled to get credentials that would allow them to work in a field other than teaching.

However, both professional and non-professional agricultural teachers are expected to be qualitative and effective to meet all professional standards in their job delivery. Most importantly, for effective job delivery in agricultural education, the teacher of agriculture must be skillful in teaching skills, mastery of pedagogical theories, and practice in delivering lessons. Teachers need to acquire these skills to succeed in the teaching profession. These skills include temperaments, emotional intelligence, communication, classroom management, topic mastery, and curricular material understanding. Teaching abilities are the hard and soft talents that enable a teacher to maintain student engagement, according to Glassdoor (2021). By positioning themselves as educators, instructors may gain the respect and attention of their pupils through the use of these talents. These abilities support a teacher in maintaining student interest and engagement in the classroom. Teachers may greatly benefit from knowing the most desired teaching qualities and how to emphasize them in their work performance.

Pedagogical principles, according to Edelenbos, *et al.* (2006), represent philosophical ideals like respect for others as well as results in successful practice. The authors went on to say that there are two useful interpretations of pedagogical principles: those that regard them as "maxims for action" or as "aims for" or "reasons behind" (e.g., to help develop every child's potential by giving them autonomy). Compared to the more detailed concepts of best practices, these maxims are often more abstract and most likely stem from presumptions. These might be more philosophical in character (for example, they can consider the different learning styles of children) or pedagogical-didactic, focused more on gaining information about learning. According to Atjonem, *et al.* (2011), pedagogical principles —which outline standards and aspirations for students—are examined as value principles in the philosophy of education. Teaching professionals might benefit from using statements of principles as a reminder of the values that guide choices regarding goals and activities. Different degrees of expression exist for these concepts, ranging from the very abstract to the micro-context of a teacher's views that serve as the foundation for both planned and unplanned classroom activities.

In a related development, pedagogical skills are the skills and techniques employed by teachers to ensure effective and thorough learning (Shah, 2021). These skills help the teacher to make sure that students can comprehend and apply their learning in real-life situations. "Pedagogical abilities" refers to a teacher's capacity to instruct students and manage the classroom. Educators gain knowledge from various sources, develop an understanding of their students, engage in dialogue with parents, collaborate with fellow professionals, and establish policies that are fair and consistent. Many instructors continuously improve their pedagogical abilities throughout their careers in order to be more successful in their chosen field and establish stronger connections with both students and instructional materials.

However, with teachers of agriculture being very effective in job delivery, the achievement of national development can be guaranteed to a larger extent. National development involves enhancing the social and economic well-being of a country's citizens by providing essential amenities like quality education, well-maintained roads,

medical facilities, and other necessary social infrastructure. Tolu and Abe (2011) provided a comprehensive description of national development, encompassing the holistic progress in the socio-economic, political, and religious aspects of a country or nation. A country can raise the standard of living of its citizens. It can be achieved through the provision of basic livelihood requirements to citizens and supplying them with all food supply chains.

Moreover, the development of a country is hinged on, several factors, and one of such factors is a functional agricultural education system. The world book Encyclopedia in According to Egbule (2004), agricultural education is beneficial for general education as well as for farmers and those working in non-farm agricultural vocations. According to Egbule (2004), education that teaches students agricultural production processes and instructional methods is essential to advancing agriculture. Any institution's agricultural education programme's success is largely dependent on the knowledge and commitment of its agriculture teachers.

It becomes imperative, thus, to investigate the pedagogical skills and principles required by agricultural science teachers for effective job delivery in secondary schools in Bayelsa State. Precisely, the study sought to:

i. identify teaching skills required by agricultural science teachers for effective job delivery in secondary schools in Bayelsa State; and
ii. outline pedagogical principles required by agricultural science teachers for effective job delivery in secondary schools in Bayelsa State.

Research Questions

The following research questions guided the study.

1. What are the teaching skills required by agricultural science teachers for effective job delivery in secondary schools in Bayelsa State?
2. What are the pedagogical principles required by agricultural science teachers for effective job delivery in secondary schools in Bayelsa State?

Hypotheses

The following null hypotheses were tested at a 0.05 level of significance.

Ho_1: There is no significant difference between the mean ratings of the responses of professional and non-professional agricultural science teachers on teaching skills required by agricultural teachers for effective job delivery in secondary schools in Bayelsa State.

Ho_2: There is no significant difference between the mean ratings of the responses of professional and non-professional agricultural science teachers on pedagogical principles required by agricultural teachers for effective job delivery in secondary schools in Bayelsa State.

Methodology

Bayelsa State was the place of the study, which used a descriptive survey research approach. All 289 agricultural education instructors working in all of Bayelsa State's public secondary schools made up the study's population. Nonetheless, due to their ease of access, a deliberate sample size of 157 agricultural science teachers was chosen for the research. Two clear goals and two research questions served as the study's compass. Additionally, two study hypotheses with 155 degrees of freedom were developed and evaluated at the 0.05 alpha level. The "Agricultural Education Teachers for Effective Job Delivery Questionnaire (AETEJDQ)" was a structured questionnaire used to gather data. Four-point scale was used to rate the instrument. To get replies from the respondents, the instrument included twenty self-structured items.

Three experts—one from the Department of Educational Foundations' Measurement and Evaluation Unit and another from the Departments of Vocational and Technology Education at Niger Delta

University's Faculty of Education—face-validated it. Using Kuder-Richardson No. 20, an instrument's dependability was assessed, yielding a coefficient index of 0.79.

The research questions underwent analysis utilizing mean and standard deviation, and hypotheses was tested by applying an independent t-test with 155 degrees of freedom and a 0.05 alpha level. Those with mean score values less than 2.50 were categorized as "disagreed," while those with mean score values of 2.50 and above were classified as "agreed." Item retention was based on a computed t-value less than the crucial t-table value of 1.645; rejection was based on a calculated t-value larger than the critical t-table value of 1.645.

Results

Research Question 1

What are the teaching skills required by agricultural science teachers for effective job delivery in secondary schools in Bayelsa State?

Table 1

Mean and Standard Deviation Analysis of Professional and Non-Professional Teachers of Agriculture on Teaching Skills Required by Agricultural Science Teachers for Effective Job Delivery in Secondary Schools in Bayelsa State

S/N	Items	Professionals		Non-Professional		Decision
		$\bar{x}$	SD	$\bar{x}$	SD	
1.	Ability to communicate effectively.	3.12	0.97	2.96	1.06	Agree
2.	Project management skills.	2.84	1.24	2.80	1.26	Agree
3.	To be creative in the teaching-learning process.	2.92	0.99	2.68	1.14	Agree
4.	Sterling leadership skills.	3.05	1.02	2.96	0.93	Agree
5.	Being technical in the teaching-learning process	3.18	0.97	2.92	1.08	Agree
6.	Ability to adapt to accommodate all learners without disrupting the class.	3.11	0.97	3.00	1.06	Agree
7.	Be collaborative in the teaching-learning process of agriculture.	2.90	0.92	2.96	1.06	Agree
8.	Should be able to operate an all-inclusive teaching-learning process in agriculture.	3.08	0.88	2.84	1.03	Agree
9.	Be compassionate while delivering in the teaching-learning process.	2.90	0.94	2.76	0.97	Agree
10.	Must have the ability to evaluate effectively and efficiently.	2.90	1.08	3.17	0.94	Agree
	Grand Mean and Standard Deviation	**3.00**	**1.00**	**2.91**	**1.05**	**Agree**

The mean scores of the items used by professional agricultural science teachers varied between 2.84 and 3.18, with a standard deviation ranging from 0.88 to 1.24, as shown in Table 1. For educators in the field of agricultural education who do not have professional backgrounds, the scores ranged from 2.68 to 3.17, with a standard deviation of 0.93 to 1.26. However, based on the fact that the grand means of 3.00 with a Standard Deviation. of 1.00 for professional agricultural science teachers and 2.91 with a standard deviation of 1.05 for non-professional agricultural science teachers respectively are more than the bench mark of 2.50; this, therefore, suggesting that participants agreed that all the items are teaching skills required by agricultural science teachers for effective job delivery in secondary schools in Bayelsa State.

Research Question 2

What are the pedagogical principles required by agricultural science teachers for effective job delivery in secondary schools in Bayelsa State?

Table 2

Mean and Standard Deviation Analysis of Professional and Non-Professional Teachers of Agriculture on Pedagogical Principles Required by Agricultural Science Teachers for Effective Job Delivery in Secondary Schools in Bayelsa State

S/N	Items	Professionals		Non-Professional		Decision
		$\bar{x}$	SD	$\bar{x}$	SD	
1.	Teaching-learning in agriculture should principally be for the cultivation of intellectual virtues and the development of skills.	3.19	1.00	2.64	1.15	Agree
2.	Teaching-learning in agriculture should provide intellectual and skills training in the various aspects/disciplines of agriculture.	2.98	1.06	2.76	1.01	Agree
3.	Teaching-learning in agriculture should inspire and develop the learner in the various capacities of the mind such as intelligence, knowledge, skills, spiritual nature, etc.	3.17	0.99	2.84	1.14	Agree
4.	Guidance and counseling should be provided as a means of helping learners to realize their potential and function properly in the ever-changing society.	2.92	0.99	2.72	1.02	Agree
5.	The teaching-learning process in agriculture should aim to cultivate a holistic approach, where learners are encouraged to engage their intellect, emotions, and physical skills to develop their overall capabilities.	3.12	0.97	2.88	0.28	Agree
6.	Agricultural education should produce a functional personality who can contribute to societal development	3.33	0.92	2.64	1.16	Agree
7.	For the teacher of agriculture to be effective, he should bring himself as close as possible to the learners.	2.53	1.18	2.84	1.10	Agree
8.	Teaching-learning agriculture should be such that learners should be made to discuss issues intelligently and analyze them critically.	3.38	0.96	2.80	1.00	Agree
9.	Teaching-learning in agriculture should be such that objectives are achieved to a considerable degree with the time available.	2.84	1.24	2.96	0.89	Agree
10.	Evaluation in agricultural education should be based on all the domains of learning.	3.20	1.02	2.96	1.25	Agree
	Grand Mean and Standard Deviation	**3.07**	**1.03**	**2.80**	**1.00**	**Agree**

As demonstrated in Table 2, the mean values of the relevant items for non-professional agricultural science teachers ranged from 2.64 to 2.96, while for professionals in the field varied from 2.53 to 3.38. The respective ranges of standard deviations were 0.28 to 1.25 and 0.92 to 1.24. However, based on the fact that the grand means of 3.07 with a Std Dev. of 1.03 for professional agricultural science teachers and 2.80 with a standard deviation of 1.00 for non-professional agricultural education teachers respectively are more than the bench mark of 2.50; this therefore suggests that participants agreed that all the above items are pedagogical principles required by agricultural teachers for effective job delivery in schools in Bayelsa State.

Hypothesis

Ho_1: There is no significant difference between the mean ratings of professional and

non-professional agricultural science teachers on teaching skills required by agricultural science teachers for effective job delivery in secondary schools in Bayelsa State.

Table 3

t-Test Analysis of Professional and Non-Professional Agricultural Education Teachers on Teaching Skills Required by Teachers of Agriculture for Effective Job Delivery in Secondary Schools in Bayelsa State

S/N	Variables	N	$\bar{x}$	SD	df	t-Cal	t-Crit	Decision at P<0.05
1	Professional	132	3.00	1.00	155	0.409	1.645	NS
2	Non-Professionals	25	2.91	1.05				

NS at P<0.05 alpha level; N=157

Table 3 revealed that the computed t-value of 0.409 is less than the crucial t-table value of 1.645 with 155 degrees of freedom, indicating that the t-test analysis is not substantial at the 0.05 alpha level. Hence, the null hypothesis which states that there is no significant disparity between the mean ratings of professional and non-professional agricultural science teachers on teaching skills required by agricultural science teachers for effective job delivery in secondary schools in Bayelsa State is upheld.

Ho_2: There is no significant difference between the mean ratings of professional and non-professional agricultural science teachers on pedagogical principles required by agricultural science teachers for effective job delivery in secondary schools in Bayelsa State.

Table 4

t-Test Analysis of Professional and Non-Professional Agricultural Science Teachers on Pedagogical Principles Required by Agricultural Science Teachers for Effective Job Delivery in Secondary Schools in Bayelsa State

S/N	Variables	N	$\bar{x}$	SD	df	t-Cal	t-Crit	Decision at P<0.05
1	Professional	132	3.07	1.03	155	1.227	1.645	NS
2	Non-Professionals	25	2.80	1.00				

NS at P<0.05 alpha level; N=157

Table 4 indicates that the t-test analysis is not statistically significant at the 0.05 alpha level, given that the calculated t-value of 1.227 is lower than the critical t-value from the t-table, which is 1.645, and the t-test has 155 degrees of freedom. Hence, the null hypothesis which states that there is no important disparity between the mean ratings of professional and non-professional agricultural science teachers on pedagogical principles required by agricultural science teachers for effective job delivery in secondary schools in Bayelsa State is upheld.

Discussion of Findings

Following the order of the research questions, the discussion of the study's findings ensued. The results in Table 1 revealed that the ability to communicate effectively, good project management skills, creativity in the teaching-learning process in agriculture, sterling leadership skills, being technical in the teaching-learning process in agriculture, etc. are teaching skills required by agricultural education teachers for effective job delivery in schools in Bayelsa State. Consistent with Omieibi-Davids' (2011) research, which suggests that the level of proficiency exhibited by educators in their cognitive, affective, and psychomotor abilities significantly influences their effectiveness in carrying out their responsibilities, these results support this notion. That is to say, to facilitate the

acquisition or development of desirable skills among the students, the instructor must possess the requisite physical abilities, knowledge, and attitude. Utilizing acquired knowledge and abilities for the betterment of society is one of the primary goals of agricultural education. As such, the effectiveness of the teacher lies in his ability to bring about desired changes in the learners. In corroboration, Omieibi-Davids (2011:98) further maintained that,

> *to be able to teach effectively, the teacher should have not only the necessary knowledge but also the competence (skill) in communicating this knowledge to the learner. It is only when the knowledge or skill the teacher possesses has been communicated to the learner that it can be said that the teacher has taught because the change of behaviour can be observed in the learner.*

Furthermore, the study revealed that teaching-learning in agriculture should principally be for the cultivation of intellectual virtues and development of skills, skills training in the various aspects/disciplines in agriculture, inspire and develop the learner in the various capacities of the mind, etc. are pedagogical theories required by teachers of agriculture for effective job delivery in secondary schools in Bayelsa State. Notwithstanding this, the divergent perceptions of agriculture teachers are primarily attributable to a lack of comprehension regarding the professional responsibilities and obligations of agricultural education instructors. In essence, the agriculture instructor executes a variety of contrasting tasks daily, each of which has the potential to render his position both intriguing and demanding, contingent upon his skill set.

Accordingly, Clouse in Egbule (2004) asserts that an effective agricultural educator must possess the following qualities: a broad education; current knowledge of the subject matter and its pedagogy; awareness of the expectations placed upon educators and schools; proficiency and diligence in devising, organizing, and executing instructional activities; regard for students; and active engagement in faculty, professional, and community affairs.

Appropriate evaluation is necessary at the outset, throughout, and after the educational process in agriculture, which encompasses numerous activities that benefit both individuals and society. The primary objective of agricultural education and instruction in schools is to produce self-reliant, capable, and productive individuals who adhere to societal standards and competencies. Achieving efficiency and proficiency in production agriculture is another objective for the learner. However, this can only be possible with effective teaching by the teacher of agriculture to foster effective learning in agricultural education.

Conclusion

In light of its findings, the research concludes that:

1. Effective communication, proficient project management, innovative approaches to the teaching-learning process in agriculture, exceptional leadership abilities, technical proficiency in agriculture education, and other relevant proficiencies are essential teaching competencies that agricultural educators in Bayelsa State must possess to execute their duties efficiently.
2. The primary objective of teaching and learning in agriculture should be the development of skills and the cultivation of intellectual virtues. Pedagogical theories that inspire and cultivate the learners in their various mental capacities, as well as those that promote skills training in the diverse aspects and disciplines of agriculture, are necessary for agriculture teachers in Bayelsa State to ensure effective job delivery in schools.

Recommendations

The recommendations made were in light of the study's findings.

1. The teacher of agriculture should improve on his/her teaching skills for the achievement of the desired results.
2. Teaching and learning in agricultural education can never be successful without the consideration and application of pedagogical theories and skills. As such, the teacher of agriculture should always update himself on the pedagogical theories and skills to guide himself for the implementation of the agricultural education curriculum.

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CONTRIBUTION OF NIGERIA INCENTIVE-BASED RISK SHARING SYSTEM FOR AGRICULTURAL LENDING TO RICE FARMERS' PRODUCTIVITY AND FOOD SECURITY IN OGUN STATE, NIGERIA

ABIALA, A. A.
BANJO, O. S.
OLAWUMI, A. T.
JOLAYEMI, J. O.
ASAMU, Y. I.
AKINNAGBE, O. S.
Department of Agricultural Science,
College of Vocational & Technology Education,
Tai Solarin University of Education, Ijagun, Ogun State, Nigeria.

Abstract
This study investigated the contribution of Nigeria Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL) to rice farmers' productivity and food security in Ogun State, Nigeria. A simple random sampling technique was used to select 255 respondents and a structured questionnaire guide was used to obtain data on farmers' socio-economic characteristics, output, and income before and after benefiting from NIRSAL. Data were analyzed using descriptive statistics and inferential statistics such as t-test and linear regression. Results showed that the majority (60.0%) of the respondents were males with a mean age of 43 years, 84.3% were married, 89. 8% had formal education while the mean household size was (7±3) persons, farming experience (8±4) years, hectares of land (4±2) respectively. Access to credit facilities, improved and certified seeds, and provision of fertilizers were highly benefited. Limited farmland, high cost of inputs, and poor storage and processing facilities were major challenges faced by the respondents. Farmers' output increased from 24,000 (kg) to 35,000 (kg). Incentives received from NIRSAL significantly contributed to rice productivity which were improved and certified seeds, agro-chemicals, financial assistance, and guaranteed market. This study concluded that NIRSAL contributed significantly to rice farmers' productivity, income, and food security in the study area. The study recommended that funding and subsidy schemes should be established for farmers and problems associated with high cost of inputs, pests and diseases and poor quality of extension services should be addressed to achieve food security in Nigeria.

Keywords: NIRSAL, Contribution, Incentives, Rice farmers, Productivity

Introduction

Food security and agricultural education and training are critical areas of concern in Nigeria. Education is a key to all the facets of development including food production. Education in agriculture can be a vehicle or channel to food security. It is not out of context to say that we eat what we teach and teach what we eat. As a country with a growing population and significant agricultural potential, we need to beam our searchlight to ensuring food security and fostering a well-trained workforce in the agricultural sector which are vital for sustainable development and poverty reduction. However, Nigeria faces numerous challenges in achieving these goals. The problem at hand is that of suboptimal agricultural education leading to food insecurity (Mahood & Muller, 2020). Despite being an agricultural-based economy, Nigeria struggles to meet the nutritional needs of its population due to various factors such as climate change, limited access to modern agricultural technologies, insufficient infrastructure, and poor educational systems. Additionally, the existing agricultural education and training programmes face challenges in terms of curriculum relevance, delivery methods, and access to marginalized populations. Understanding and addressing these challenges is crucial for sustainable

food production and improved agricultural education in Nigeria.

Precisely, since 1980, several interventions, policies, and programmes have been executed by different governments aimed at redirecting Nigerians to the farms to attain food security. Examples include the River Basin Development Programme (RBDP), Operation Feed the Nation (OFN), Green Revolution (GR), the Directorate for Food, Roads and Rural Infrastructure (DFRRI) and Agricultural Development Programme (ADP). Notwithstanding these interventions, import bills of Nigeria kept soaring such that she imports approximately US$3.5 billion in food products annually causing food imports to grow at an unsustainable rate of 11% per annum (Samuel, 2020). Moved by the desire to reduce import dependency, as well as by the need to relieve dependence on the oil sector for economic growth, Federal and State governments stepped up efforts to promote agricultural development through the establishment of several agricultural credit schemes. These schemes include the Agricultural Credit Guarantee Scheme Fund (ACGSF) established in 1978, the Supervised Agricultural Credit Scheme (SACS) established in 1979, the Special Emergency Agricultural Loans Scheme (SEALS) established in 1984, the Agricultural Credit Support Scheme (ACSS) established in 2006.

During the era of Sanusi Lamido Sanusi as Governor of the Central Bank of Nigeria, various schemes were also established, such as the Commercial Agricultural Credit Scheme (CACS) established in 2009, the Small and Medium Scale Enterprise Credit Guarantee Scheme (SMECGS) established in 2011, and Anchor Borrowers' Program (ABP) established in 2015 and the establishment of the Nigerian Incentive-based Risk Sharing System for Agricultural Lending (NIRSAL); though not a scheme as such, but it encourages farmers to insure their farms against natural disaster and to borrow from commercial banks guaranteeing the interest paid by the farmer up to 60%. The establishment of colleges and universities of agriculture for the teaching and training of individuals will later boost food production and security in Nigeria and the employment of agricultural science teachers and lecturers for training and retraining of intended youths who are interested in taking a career in agriculture for increased food production and security in Nigeria (Balana and Oyeyemi, 2022).

The Nigeria Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL) was launched and incorporated in 2013 by the Central Bank of Nigeria (CBN) as a dynamic, holistic USD500 Million public and private initiative to catalyze the flow of finance and investments into fixed agricultural value chains. (Tippe et al., 2017). NIRSAL is a state-owned Nigerian institution designed with the scope of ensuring the existence of affordable financing schemes to all players along the agricultural value chain in Nigeria. NIRSAL has several schemes or facilities embedded in its institution and was established in collaboration with the Federal Ministry of Agriculture and Rural Development (FMARD) and Nigerian Bankers' Committee in 2013, NIRSAL's mandate is to stimulate the flow of affordable finance and investments into the agricultural sector by de-risking the agriculture & agribusiness finance value chain, fixing agricultural value chains, building long-term capacity, and institutionalizing incentives for agricultural lending through its five (5) strategic pillars, namely: Risk Sharing, Insurance, Technical Assistance, Incentives and Rating (CBN, 2016). On 16 September 2016, NIRSAL signed a MoU with the Bank of Industry. The core scope of this MoU is for these two institutions to establish a scheme that would enable them to boost the local Nigerian agriculture sector through enhancing the rates of job creation and import substitution at a local level and contributing towards the realization of the key objectives of the National Agricultural Promotion Policy i.e. a Policy which core objectives are to ensure that the local agriculture industry does meet the domestic food requirements as well as can export high-level quality output in

foreign markets (Gona, *et al*., 2020). Therefore, the highlighted scheme embedded in this MoU is aimed to function according to the following principles:

i. Bank of Industry is set to provide loans to agricultural projects which NIRSAL as an institution mandated to fix the local agriculture value chain has identified to be impactful and sustainable for loan provision purposes. Although no specific details are provided concerning the terms under which these loans will be granted, the official statements do indicate that the loans will be provided under very low interest rates as well and their credit approval process will be 50% faster than the standard one predominating in the country.
ii. NIRSAL is to provide credit guarantees for all the agricultural project loans that are to be granted by the Bank of Industry. The credit guarantees that are to be provided by NISRAL amount up to 75% of the total value for each granted loan, and are part of its USD 300 million Risk Sharing Facility (Mojeed, 2022).

Balana and Oyeyemi (2022) reported that an increase in farm output leads to an increase in income and is liable to the reduction in poverty status and improved standard of living. The low rice production challenge in Nigeria could be linked to several factors of which agricultural credit facility (loan) remains dominant (Saheed et al., 2018). Most of the smallholder farmers in rural areas engage in subsistence rice production and lack sufficient funds to operate, expand their business, or even practice mechanized farming. It has been over five years since the inception of the anchor borrowers' programme and enough period based on the contractual arrangement for the rice farmers' productivity and due to inadequate current scientific research on assessment of the impact of anchor borrowers' programme and since credit has been recognized as a powerful instrument for tackling the food security and poverty crisis among smallholder farmers (Gona, *et al.*, 2020). Therefore, this study seeks to assess the contribution of NIRSAL to smallholder rice farmers' productivity and food security in Ogun State, Nigeria. The research specifically:

i. described the socio-economic characteristics of the beneficiary rice farmers;
ii. identified the benefits derived from participating in NIRSAL by rice farmers;
iii. compared the differences in rice farmers' output before and after NIRSAL involvement;
iv. determined the differences in rice farmers' income before and after NIRSAL involvement;
v. identified the constraints faced by farmers in accessing NIRSAL facilities; and
vi. assessed the contribution of NIRSAL on rice farmers' productivity and food security.

Hypothesis

Ho1: There is no significant relationship between the benefits derived from NIRSAL to rice farmers' productivity in the study area.

Methodology

The study was conducted in Ogun State. The state is located in South Western Nigeria, Ogun State covers 16,762 square kilometres. It borders Lagos State to the south, Oyo and Osun states to the North, Ondo State to the east, and the Republic of Benin to the west. Agriculture is one of the primary occupations of the people in the State. Ogun State is endowed with natural resources which include an extensive fertile soil suitable for agriculture and mineral deposits. The climate and soil of the state are suitable for the cultivation of a wide range of food crops which include rice, maize, cassava, yam, banana, and cash crops which include cocoa, kola nut, rubber, palm oil and palm kernels. Ogun State is one of the largest producers of kola nut, timber, rubber, and ofada rice on a large scale. There are twenty (20) Local Government Areas (LGAs) in the state and Ogun State Agricultural Development Project (OGADEP) is sub-divided into four (4) agricultural zones

namely Abeokuta, Ijebu-Ode, Ikenne, and Ilaro. However, out of the 20 LGAs, eight (8) are renowned for rice cultivation which are Abeokuta North, Ewekoro, Ifo, Ijebu North, Yewa North, Yewa South, Ogun waterside and Obafemi Owode (Ogun State Diary, 2023).

The population of the study consists of rice farmers who benefited from NIRSAL in 2023. There were a total of 851 registered beneficiary rice farmers under NIRSAL at the time of the study. A simple random sampling technique was used to select 30% of the farmers. This gave a total of 255 respondents selected for the study. Primary data were obtained from rice farmers in the study area via well-structured questionnaire based on the objectives of the study. Benefits derived from NIRSAL was measured on a three-point scale of highly beneficial (2), beneficial (1) and not beneficial (0) and they were also asked to add other options not listed. The individual mean scores were determined for each benefit item and used to rank the benefits in order of most benefit derived. Differences in respondents' output and income before and during NIRSAL intervention were measured by using pooled mean value and constraints faced during NIRSAL were measured on a three-point scale of severe (2), mild (1), and not a constraint (0). Using the individual mean score for each item with the cut-off (1.4), benefits derived from NIRSAL and constraints faced during NIRSAL were ranked accordingly. The contribution of NIRSAL to rice farmers' productivity and food security was determined by using multiple regression analysis. Descriptive statistics such as frequency counts, percentage, mean, and standard deviation were used to describe the socio-economic characteristics of NIRSAL beneficiary rice farmers while inferential statistics such as Pearson Product Moment Correlation (PPMC) and multiple regressions were used to test the hypothesis of the study.

To estimate the productivity of the rice farmers and food security, their rice output was used. The multiple regression technique was used to analyze the effect of the socio-economic characteristics of the farmers on their rice productivity and food security in the study area. Three functional models were specified which included; linear, semi-log, and double-log functional forms:

$Y=f(X)$……(1)

The model is stated implicitly as

$Y_i = b_0 + b_1X_1 + b_2X_2 + b_3X_3$……$b_nX_n$ (Semi-log Model)……(2)

$Y_i = b_0 + L_nb_1X_1 + L_nb_2X_2 + L_nb_3X_3$……$nb_nX_n$ (Semi-log Model)….(3)

$L_nY_i = b_0 + L_nb_1X_1 + L_nb_2X_2 + L_nb_3X_3$……$nb_nX_n$ (Double-log Model)...(4)

Where:

Y = Output of rice (kg) (Productivity)
X_1 = Farm size (ha)
X_2 = Improved seed (kg/ha)
X_3 = Fertilizer (kg)
X_4 = Crop protection products (kg)
X_5 = Agro-chemicals (litre)
X_6 = Extension services (Yes = 1, No = 0)
X_7 = Financial assistance (Yes = 1, No = 0)
X_8 = Farming experience (years)
X_9 = Education (years)
e_i = Random error term

Results and Discussion

Table 1

Socio-Economic Characteristics of the Rice Farmers (n=255)

Variables	Frequency	Percentage	Mean	SD
Age				
< 30 yrs	22	8.6	43	18
31- 40 yrs	66	26.0		
41- 50 yrs	149	58.4		
51- 60 yrs	12	4.7		
Above 60 yrs	6	2.3		
Sex				
Male	153	60.0		
Female	102	40.0		
Marital Status				
Single	22	8.6		
Married	215	84.3		
Divorced	11	4.3		
Widowed	7	2.7		
Educational Status				
No Formal	26	10.2		
1-6 yrs	100	39.2		
7-12 yrs	110	43.1	7	3
> 13 yrs	19	7.5		
Household size				
0 - 5	77	30.2	7	3
6 - 10	156	61.2		
> 10	22	8.6		
Farming experience				
1 - 5 yrs	50	19.6	8	3
6 – 10 yrs	154	60.4		
> 10 yrs	51	20.0		
Farm size (ha)				
0 - 2	25	9.8	4	2
3 – 5	177	69.4		
> 5	53	20.8		
Membership cooperative				
Yes	210	82.4		
No	45	17.6		
Special training on farming				
Yes	180	70.6		
No	75	29.4		
Extension contact				
1 - 5	53	20.8		
6 - 10	102	40.0		
> 10	100	39.2		

The result in Table 1 shows the socio-economic characteristics of the respondents. The mean age of the respondents was 43±18 years and the majority (60.0%) were males. This indicates the dominance of males over females in rice production. This agrees with Tiwasing, Dawson and Garrod (2018) that both male and female farmers were accessing credit facilities. A good number of the respondents were married (84.3%) and the means for years of educational status was 7±3, household size was 6±3 members, farming experience was 7±3 years and farm size was 4±1 ha. This implies that the rice

farmers in the study area were literate, and had manageable household sizes and this could be translated to ready family labour. The mean output was 25,000±9,990 kg before NIRSAL and 35,000±15,500 kg after NIRSAL; this implies that most of the respondents improved their rice production which may be linked to improved and certified seed and other input received from participating in NIRSAL. It could have implications for certain outcomes concluded from the previous work of Akinbile et al. (2023) that the contribution of ABP increased rice farmers' productivity in Ekiti State. The means for annual income before and after NIRSAL were ₦475,500±154,000 and ₦775,500±200,000 respectively. The implication is that income is expected to increase after a funding programme has been successfully implemented and is also a major key determinant of whether a rice farmer is rich or poor as reported by Samuel (2020). The overwhelming majority (82.4%) were members of cooperative societies while 17.6% did not belong to cooperative societies but belonged to other social associations to have access to NIRSAL since one of the requirements stated by NIRSAL is that, a farmer must belong to a particular group or unit before being given loans or inputs. This shows that most of the rice farmers might see an association as a means to benefit their farming activities in terms of access to loans, input, extension education, marketing, and price information. A good number of respondents (70.6%) received special training on rice farming while 29.4% did not receive it. This implies that the special training received on rice farming is to boost yield and increase income to reduce poverty among rice farmers. This result supports the finding of Oyekunle et al. (2018) that age, household size, farm size, and education played a significant role in farmers' patronage of banks. The mean for extension contact was 8±3 times and this implies that extension workers were also used to monitor the rice farming activities and provided farmers with needed information on NIRSAL and rice production. This figure agrees with Ibrahim et al. (2018) who established a significant association between income, household size, family type sources of motivation and their involvement in farm produce marketing activities.

Table 2
Distribution and Ranking of Benefits Derived from NIRSAL by Respondents

Items	Mean	Rank
Access to credit/loan facilities	2.114	1st
Improved and certified seeds	1.656	2nd
Provision of fertilizers	1.638	3rd
Special training on rice farming	1.562	4th
Provision of herbicides and insecticides	1.549	5th
Mechanized input (land preparation)	1.501	6th
Extension services	1.493	7th
Provision of sprayers	1.447	8th
Pay back with portions of produce	1.369	9th
Farming infrastructures	1.324	10th

The result in Table 2 shows that after rating the benefits derived from NIRSAL by respondents in rice production through mean values and ranking, ten (10) major benefits were identified. They include access to credit/loans (2.114), improved and certified seed (1.656), provision of fertilizers (1.638), special training on rice farming (1.562), provision of herbicides and insecticides (1.549), mechanized input (1.501), extension services (1.493), provision of sprayers (1.447), pay back with portions of produce (1.369) and farming infrastructures (1.324). It can therefore be deduced that access to credit, improved and certified seeds, fertilizers, special training, herbicides and insecticides

and many more brought about increased rice yield thereby increasing their income in the study area. Benefits derived are expected to increase rice production, and income and alleviate poverty among rice farmers and this is opined by Amusa, *et al.* (2022) that a good number of rice farmers benefited from NIRSAL through farm inputs which included assorted fertilizer, pesticides, high yield seeds and technical know-how to operate in farms and more importantly rice farming received a boost across all the states in Nigeria.

Table 3
Distribution and Comparism of Respondents' Output (n=255)

Output (Kg)	Before NIRSAL Frequency	Percentage	After NIRSAL Frequency	Percentage
1,000 – 10, 000	205	80.4	27	10.6
10,001 – 20, 000	27	10.6	22	8.6
20,001 – 30, 000	16	6.3	131	51.4
> 30,001	7	2.7	75	29.4
Total	100	100.0	100.0	100.0
Min. Output	2,500		4,500	
Max. Output	25,000		35,000	
Mean	9,990		15,500	

Result in Table 3 shows the differences in respondents' output were 1,000 – 10,000 kg (80.4%), 10,001 – 20,000 kg (10.6%), 20,001 – 30,000 kg (6.3%) and 30,001 and above (2.7%) before their involvement in NIRSAL while 1,000 – 10,000 kg (10.6%), 10,001 – 20,000 kg (8.6%), 20,001 – 30,000 kg (51.4%) and 30,001 and above (29.4) after their involvement in NIRSAL. These figures were indications that most of the rice farmers had lesser output before and higher output after their involvement in NIRSAL. The rise in rice output could be traced to their involvement in NIRSAL and the benefits received. These results support the findings of Akinbile, *et al.* (2023) that farmers' rice productivity increased from 1.67mmt to 2.65mmt under ABP in a similar study carried out on the contributions of anchor borrowers' programme to rice farmers' productivity in Ekiti State, Nigeria.

Table 4
Distribution and Comparism of Respondents' Annual Income (n=255)

Income	Before NIRSAL Frequency	Percentage	After NIRSAL Frequency	Percentage
<₦500,000	200	78.4	25	9. 8
₦500,001 – ₦1,000,000	51	20.0	156	61.2
> ₦1,000,001	4	1.6	74	29.0
Total	255	100.0	255	100.0
Mean	475,500		775,500	
SD	154,000		200,000	

The result in Table 4 shows the differences in respondents' annual income; 78.4% of the respondents earned less than ₦500,000, 20.0% earned ₦500,001 – ₦1, 000,000, and 1.6% earned ₦1, 000,001 and above before their involvement in NIRSAL while 9.8% of the respondents earned less than ₦500,000, 61.2% earned ₦500,001 – ₦1, 000,000, and 29.0% earned ₦1, 000,001 and above after their involvement in NIRSAL. This result supports the findings of Ojo, *et al.* (2019) on the impact of credit demand on the productivity of rice farmers and credit facilities are pillars in any

agricultural production. Dossou, *et al.* (2020) stated that microfinance services for smallholder rice farmers and farmers' expectations have positively reduced the level of poverty among rice growers in Nigeria.

Table 5
Distribution and Ranking of Major Constraints Faced by Respondents

Items	Mean	Rank
High cost of labour	1.970	1st
High cost of input	1.761	2nd
Politicization of input	1.755	3rd
Late release of input	1.742	4th
Underfunding	1.720	5th
Late disbursement of loan	1.711	6th
Dishonest middlemen	1.656	7th
Poor quality of extension services	1.633	8th
Government policy	1.619	9th
Limited farmland	1.424	10th
Poor storage and processing facilities	1.391	11th
Poor marketing system	1.125	12th
Poor irrigation facilities	0.974	13th
Poor drainage system	0.942	14th

The result in Table 5 shows that after rating the major constraints by respondents in rice production through mean values and ranking, fourteen (14) major constraints were identified. They include high cost of labour (1.970), high cost of input (1.761), politicization of input (1.755), late release of input (1.742), underfunding (1.720), late disbursement of loan (1.711), dishonest middlemen (1.656), poor quality of extension services (1.633), government policy (1.619), limited farmland (1.424), poor storage and processing facilities (1.391), poor marketing system (1.125), poor irrigation system (0.974) and poor drainage system (0.942). It can therefore be stated that the high cost of labour and input, the politicization of input, late release of input, underfunding, late disbursement of the loan, dishonest middlemen, and many more were faced by the rice farmers in the study area and this may render the programme unattractive to younger farmers and may also discourage them from participating in future funding programmes. This result is in line with the findings of Balana and Oyeyemi (2020) that late disbursement of loans and political influence were major challenges women rice farmers faced when accessing anchor borrowers' loans.

Table 6
Result of Correlation Showing Significant Correlation Between Benefits Derived from NIRSAL and Rice Farmers' Productivity and Food Security

Variable	r value	p value	Decision
Benefits derived	0.427	0.013	S

Significance at $p<0.05$

The result in Table 6 showed that a significant correlation existed between benefits derived from NIRSAL and rice farmers' productivity ($r = 0.427$, $p = 0.013$) in the study area. This implies that the benefits derived by respondents from NIRSAL significantly contributed to their productivity and food security. This result corroborates the findings of Sennuga, *et al.* (2020) who found that benefits derived from

participating in anchor borrowers' programme have a significant relationship with their output, income, standard of living, and the poverty status of farmers. This result is also in line with the findings of Samuel (2020) that access to formal credit in rural areas of Ethiopia and age, farming experience, income, and household size are significantly related as far as farmers' poverty status is concerned.

Table 7

Regression Analysis for Socio-Economic Factors Affecting Farmer's Productivity and Food Security

Independent variables	**Coefficient**	**SE**	**t-value**
Farm size	4.296***	0.007	2.654
Improved seeds	1.023***	-0.073	-15.432
Fertilizer	0.995**	0.002	2.911
Crop protection products	0.82**	0.021	2.904
Agro-chemicals	0. 831**	0.030	2.900
Extension Services	0.091	0.040	0.324
Financial assistance	0.37	0.036	0.997
Farming experience	0.396	0.043	2.79*
Education years	-0.553*	0.032	-2.953
Constant	0.573	0.453	1.374
R-squared	0.622		
Adjusted R-squared	0.765		
F	67.221		
F (Sig)	0.000		

Note: The t-values were the computed value of T-statistics from the t-distribution *** 1%; ** 5% and *10% Significant

Table 7 shows the regression results on the effect of socio-economic factors on rice farmers' productivity and food security. The double log function form of the regression model was used. The results showed that only farm size, improved seeds, quantity of fertilizer, crop protection products, agro-chemicals, and years of formal education of the farmers were significant. The value of the coefficient of determination (R^2) shows that 62.2% of the variation in the output of the farmers was explained by the independent variables in the model.

The coefficient of farm size was positive and significant at 1%. This indicates that a unit increase in farm size increases the output of farmers by 4.296. The coefficient of quality and quantity of improved seeds was positive and significant at 1%. This indicates that a unit increase in the quantity of improved seed increases the output by 1.023. The coefficient of quantity of fertilizer was positive and significant at 5.0%. This indicates that a unit increase in the quantity of fertilizer used will increase the output by 0.995. The coefficient of quality of crop protection products is positive and significant at 5%. This implies that a unit increase in the quality of crop protection products will increase the output by 0.82. The coefficient of quantity of agro-chemicals is positive and significant at 5%. This implies that a unit increase in the quantity of agro-chemicals will increase the output by 0.831. The coefficient of years of formal education is positive and significant at 10%. This implies that a unit increase in the year of formal education will increase the output of farmers by 0.553. This finding supports the findings of Sennuga, *et al.* (2021) who found out that the higher the farmer's education, farm size, and financial ability, the higher the output. Bello, *et al.* (2022) also found out that credit facilities and farm subsidies are capable of boosting agricultural productivity.

Conclusion and Recommendations

The findings from this study revealed that rice farmers' productivity and food security increased as a result of farm incentives benefited from NIRSAL through the provision of credits, farm inputs, extension services, and special training received. High cost of labour and input, late release of input, underfunding and late disbursement were ranked major constraints faced by respondents. Rice farmers with higher education, and more years of farming experience with larger farm sizes were more benefited from NIRSAL. This study concluded that NIRSAL contributed significantly to rice farmers' productivity, income, and food security in the study area. The study recommended that funding and subsidy schemes should be established for farmers and problems associated with high cost of inputs, pest and diseases and poor quality of extension services should be addressed in order to achieve food security in Nigeria.

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ORGANIC AGRICULTURE TRAINING REQUIREMENTS OF FARMERS' FOR ENHANCING FOOD SECURITY IN CROSS RIVER STATE

STEPHANIE SEDOO BISHIE-UNUNG
DAVID ADIE ALAWA
FELIX A. AKOMAYE
Department of Vocational Education,
Faculty of Vocational and Science Education,
University of Calabar, Cross River State.

Abstract
The main purpose of this study was to identify the organic agriculture training requirements of farmers for enhancing food security in Cross River State. A descriptive survey design was adopted for the study. The population comprised 137 respondents made up of 73 agricultural experts (51 from University of Calabar and 22 from Cross River State University) and 64 extension agents from the study area. Data was collected using a researcher-made instrument titled: Organic Agriculture Training Requirements of Farmers for enhanced Food Security Questionnaire (OATRFFSQ) structured under a four-point scale of Highly Required (HR), Required (R), Not Required (NR), and Highly Not Required (HNR). The instrument was validated by five experts from the Department of Vocational Education, University of Calabar. The instrument yielded a reliability coefficient of .75 with Cronbach Alpha. Collected data were analyzed using mean and standard deviation in answering the research questions. Findings indicated that farmers required training in all the identified areas for enhanced food security in the State. It is recommended among others that, agricultural experts and extension agents educate farmers on various organic farming systems such as crop rotation, companion farming, breeding techniques, etc. for improved production.

Keywords: Organic Agriculture Training, Farmers, Food Security

Introduction

As the global population continues to grow, ensuring access to safe and nutritious food for all has become a serious concern hence the need for food security. Food security ensures that all individuals have access to sufficient, safe, and nutritious food. It is a critical global issue, with the increasing population and changing climatic conditions posing challenges to the availability and accessibility of food. According to the Food and Agriculture Organization (FAO) (2012), food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life. The World Summit on Food Security held in 2009 identified "three pillars of food security: availability, accessibility and utilization" to align with three earlier mentioned by the World Health Organization (WHO) (2004) as determinants of food security: food availability, food access, and food use and misuse. Two additional pillars of food security were recommended in 2020 by the High-Level Panel of Experts (HLPE) for the Committee on World Food Security Agency and Sustainability. The FAO (2012) added another pillar: stability to the first three (availability, accessibility, and utilization) dimensions of food security over time.

Based on these pillars, food security can be defined as the availability of food and its resources to individuals and their ability to access, use, and ensure a steady supply of food to all and sundry living on the globe with emphasis on the underdeveloped regions. Food security emphasizes healthy and safe food for all to maintain a healthy and active lifestyle.

With growing concerns about the negative impact of conventional agriculture on the environment and human health, there is a growing interest in organic agriculture as an alternative approach. Organic agriculture

is a production system that sustains the health of soils, ecosystems, and people (International Federation of Organic Agriculture Movements - IFOAM, 2008). The organization further stated that organic agriculture relies on ecological processes, biodiversity, and cycles adapted to local conditions, rather than the use of inputs with adverse effects. It combines tradition, innovation, and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved. Organic agriculture, also known as ecological farming or biological farming is an agricultural system that uses fertilizers of organic origin such as compost manure, green manure, and bone meal and places emphasis on techniques such as crop rotation and companion planting (Hanten, 2022). Organic agriculture can yet again be defined as "an integrated farming system that strives for sustainability, the enhancement of soil fertility and biological diversity while, with rare exceptions, prohibiting synthetic pesticides, antibiotics, synthetic fertilizers, genetically modified organisms, and growth hormones (Martin, 2022).

Organic agriculture emerged as a sustainable alternative to conventional farming practices, promoting environmentally friendly production while ensuring food security; promotes sustainable farming practices that prioritize soil health, biodiversity conservation, and the use of natural fertilizers and pest control methods; as well as offers a sustainable and environmentally friendly approach to food production, but it requires specialized knowledge and skills. Organic agriculture can be very beneficial though oftentimes there are complaints of lower yields compared to conventional farming and the need for additional agricultural land use which can lead to loss of biodiversity. However, to successfully transition towards organic agriculture on a larger scale to achieve food security, it is essential to address the training needs of agricultural stakeholders particularly farmers who are the major producers.

Training programmes in line with farmers' requirements will not only address farmers' problems but will at the same time provide them with the necessary knowledge and skills to adopt organic farming practices and minimize the negative environmental impacts of conventional farming methods; help farmers enhance their agricultural productivity by teaching them advanced techniques, such as organic pest management, soil conservation, and crop rotation. These practices can lead to increased yields and improved agricultural produce quality, ultimately contributing to food security. Training opportunities promote knowledge transfer and innovation within the farming communities.

Training is therefore essential for farmers to gain new knowledge and skills (Sankar & Chandrasekaran, 2020). International Fund for Agricultural Development (IFAD) (2021) opined that training assists farmers in becoming food secure by guiding how to set up an integrated farming system, that produces a range of foods including local crops and vegetables, livestock (chicken and pigs) and fish. Knowledge and training enable farmers to escape from poverty by providing them with the awareness and skills to improve their agricultural produce and income (Ogundele *et al.,* 2012).

Farmers who receive training in organic farming techniques can serve as mentors to others, sharing their expertise and contributing to the overall development of sustainable agriculture. Training programmes can equip them with the necessary skills to access organic produce markets, enabling them to fetch premium prices for their produce thus creating new income opportunities for farmers. This can contribute to poverty alleviation and improve overall livelihoods. Muthie (2021) opined that linking farmers to markets ensures they have an outlet that benefits their sweat. Identifying the training needs of farmers in organic agriculture will help address knowledge gaps, enhance farming practices, and create market

access and economic opportunities that farmers would benefit from.

Farming systems or practices that encourage organic agricultural production would enable sustainable and conservation agriculture bringing about environmentally friendly production and healthy agricultural produce. According to FAO (2011), the use of green manure/cover crops, crop rotation, etc. is a way of achieving agricultural sustainability on small farms. Green manure has a high potential for biomass production that allows the soil organic matter levels to be maintained and/or increased in a way that is both practical and economical. The relevance of this practice makes it necessary for farmers to acquire the needed knowledge and skill in this regard. Umar (2017) reported that farmers required training in various aspects of organic farming (crop rotation techniques, green manure, compost manure, planting of cover crops, biological pest control methods, application of animal manure, and use of natural feeds for livestock) to enable them to benefit from the financial and environmental opportunities offered by organic farming. Nwosu (2023) reported that rural farmers needed training in organic fertilizer production from solid waste for sustainable production. The use of organic manure will also increase the activities of microorganisms in the soil, and improve soil structure and soil fertility leading to increased yields.

Biological pest control would reduce pollution among other hazards which chemical control would have caused to both the environment and man. Muthie (2021) asserted that significant agricultural transformation is within our reach due to the availability of relevant technologies that provide solutions to challenges being faced by farmers and our farmers can improve their productivity, increase their wealth and health, and become sustainable if they have access to the right mix of farming technologies and innovations. Hashemi, *et al.* (2009) identified biological pest control as one of the options for training needs for farmers since it encourages natural use. The authors added that knowledge of biological pest control options and differentiation among fungal, viral, and bacterial diseases was highly needed by farmers.

Training in organic agriculture will not be complete without empowering farmers with adequate knowledge and skills on market access and entrepreneurship. Teaching farmers about market trends, value addition, and organic product marketing can open new economic opportunities for them thereby connecting farmers with the local and international market for enhanced income and in the long run valuable contribution to food security. In the view of Ugwoke *et al*., (2020), women farmers require training in the e-marketing of farm products for a higher value. Rahman, *et al.* (2018) asserted that farmers required training on integrated pest and diseases management, production of biocontrol agents and biopesticides, vermicompost production, marketing, and transportation.

Addressing the training requirements of farmers' particularly in the area of farming systems, use of organic manure, biological pest control and marketing of agricultural produce will no doubt enhance food security in Cross River State. This is because organic agriculture involves different techniques and practices compared to conventional farming. Proper training in this regard can provide the necessary knowledge about organic farming methods, soil management, and pest control processes. Prudent *et al*., (2007) opined that training programmes can play a crucial role in pest management decisions, providing farmers with the technical knowledge necessary for the selection of appropriate pest control methods and also for safe and effective pesticide use. Empowering farmers with the necessary knowledge and skills to implement sustainable practices such as crop rotation, composting, cover cropping, and integrated pest management, among others is very necessary. Reddy and Kumar (2020) in their study reported that farmers needed training in areas such as plant protection, cropping patterns, and soil reclamation to help increase yields and avoid crop damage and losses. These practices contribute to

healthier soils, reduced dependency on chemical inputs, and increased resilience to climate change.

Achieving food security through organic agriculture is possible with adequate training and education that promotes sustainable farming practices. By utilizing various training approaches, such as Farmer Field Schools, extension programmes, online learning, and collaborations, farmers' needs can be effectively addressed and on the other hand, farmers will be empowered for secured food production through organic agriculture.

As every aspect of agricultural production continues to work towards the achievement of food security by 2030, organic agriculture is not left out. Organic agriculture concerns itself with ensuring that food availability, accessibility, and utilization are not only possible but maintaining a healthy and active lifestyle as well. By imparting farmers with requisite/needed knowledge and skills in organic agriculture, farmers will be able to boost their production and ensure a steady supply of healthy food for all living citizens. Organic agriculture training programmes on the technicality of agricultural production, resources management, and business can play a pivotal role in enhancing food security. Therefore, imparting knowledge and skills to farmers in this regard can empower them to contribute effectively to sustainable food production. Identifying and addressing the specific training requirements of farmers and getting them involved in organic agriculture production will promote the adoption of organic farming practices, enhance agricultural productivity, and ultimately ensure food security for all. However, the successful implementation and widespread adoption of organic agriculture requires adequate training and education. The researcher has observed that due to the quest for increased production and improved profitability, most farmers engage in non-organic farming practices which may likely be detrimental to human and environmental health. It is therefore pertinent to keep farmers constantly informed with organic farming knowledge and skills for food security. Hence, the need to identify those areas where farmers require training to address them for enhanced and sustainable organic agriculture as well as food security in Cross River State.

Purpose of the Study

The main purpose of the study was to identify the organic agriculture training requirements of farmers for enhancing food security in Cross River State. Specifically, the study sought to identify training requirements of farmers in:

i. selecting farming systems for enhancing food security in Cross River State;
ii. the use of organic manure for enhancing food security in Cross River State;
iii. biological pest control for enhancing food security in Cross River State; and
iv. marketing agricultural produce for enhancing food security in Cross River State.

Research Questions

The following research questions guided the study:

1. What are the training requirements of farmers in the selection of farming systems for enhancing food security in Cross River State?
2. What are the training requirements of farmers in the use of organic manure for enhancing food security in Cross River State?
3. What are the training requirements of farmers in biological pest control for enhancing food security in Cross River State?
4. What are the training requirements of farmers in marketing agricultural produce for enhancing food security in Cross River State?

Methodology

The study made use of descriptive survey design and was conducted in Cross River State. The population of the study was made up of 137 respondents comprising of 73 agricultural experts (51 from University of

Calabar; 22 from Cross River State University) and 64 extension agents in the State. The entire population was used for the study since it was quite manageable. Data was collected using a researcher-made instrument titled: Organic Agriculture Training Requirements of Farmers' for enhanced Food Security Questionnaire (OATRFFSQ) structured under a four-point scale of Highly Required (HR), Required (R), Not Required (NR) and Highly Not Required (HNR). The instrument was validated by five experts from the Department of Vocational Education, University of Calabar. The instrument yielded a reliability coefficient of .75 with Cronbach Alpha. Collected data were analyzed using mean and standard deviation in answering the research questions. The decision was based on the real limit, thus:

Response Options	Values	Real Limit
Highly Required (HR)	4	3.50 – 4.00
Required (R)	3	2.50 – 3.49
Not Required (NR)	2	1.50 – 2.49
Highly Not Required (HNR)	1	0.50 – 1.49

Results

Research Question 1

What are the training requirements of farmers in the selection of farming systems for enhancing food security in Cross River State?

Table 1

Mean Responses of Agricultural Experts and Extension Agents on Training Requirements of Farmers on Farming Systems for Enhancing Food Security (N = 137)

S/N	Items on Farming Systems	$\overline{X}$ AE	SDAE	$\overline{X}$ EA	SDEA	$\overline{X}-_x$	Decision
1	Knowledge of proper crop rotation to make available different kinds of food stuffs	3.99	.66	3.97	.78	3.98	HR
2	Proper utilization of companion farming to ensure food availability	2.55	.78	3.29	.98	2.92	R
3	Skills for natural selection of improved species and breeds for a steady supply of agricultural produce	2.91	.94	2.31	.92	2.61	R
4	Knowledge of sowing times that promote soil health for the stability of food production	2.55	.65	3.60	.82	3.06	R
5	Use of locally formulated feeds for livestock production to enhance affordability	3.41	.88	3.72	.74	3.57	HR
6	Knowledge of breeding techniques for sustainable animal production	3.11	.91	3.11	.86	3.11	R
	Cluster Mean					**3.21**	**Required**

$\overline{X}$ AE-Mean response of Agric. Experts; $\overline{X}$ AE-Mean response of Agric. Extension agents SDAE-Standard deviation of Agric. Experts; SDAE-Standard deviation of Agric. Extension agents; $\overline{X}-_x$-Average Mean for Agric. Experts and Extension agents

The data in Table 1 indicates that two items had their mean value within the limit of 3.50 – 4.00, while the remaining four items' mean value fell within the limit of 2.50 – 3.49. On the whole, the table cluster mean 3.21 also falls within the limit of 2.50 – 3.49. This implies that agricultural experts and extension agents agreed that farmers in the study area require training in all the identified areas of farming systems to enhance food security.

Research Question 2
What are the training requirements of farmers in the use of organic manure for enhancing food security in Cross River State?

Table 2
Mean Responses of Agricultural Experts and Extension Agents on Training Requirements of Farmers on the Use of Organic Manure for Enhancing Food Security (N = 137)

S/N	Items on the Use of Organic Manure	$\overline{X}$ AE	SDAE	$\overline{X}$ EA	SDEA	$\overline{X}-_x$	Decision
1	Knowledge of composting for enhancing soil health for increased production	2.54	.99	3.44	.82	2.99	R
2	Recycling of organic materials for improved soil health and sustainability	3.14	.87	3.23	.62	3.19	R
3	Knowledge of green manure for improving soil properties to ensure food availability and utilization	2.50	.95	3.56	.81	3.03	R
4	Skills in using green manure for enhanced food production	2.87	.96	2.71	.67	2.79	R
5	Use of manure and vegetable residues for increased yield	3.10	.88	3.02	.78	3.06	R
	Cluster Mean					**3.01**	**Required**

$\overline{X}$ AE-Mean response of Agric. Experts; $\overline{X}$ AE-Mean response of Agric. Extension agents SDAE-Standard deviation of Agric. Experts; SDAE-Standard deviation of Agric. Extension agents; $\overline{X}-_X$-Average Mean for Agric. Experts and Extension agents

The data in Table 2 indicates that all five items had their mean value within the limit of 2.50 – 3.49. On the whole, the table cluster mean 3.01 also falls within the limit of 2.50 – 3.49. This implies that agricultural experts and extension agents agreed that farmers in the study area require training on all the identified areas of use of organic manure for enhancing food security.

Research Question 3
What are the training requirements of farmers in biological pest control for enhancing food security in Cross River State?

Table 3

M*ean Responses of Agricultural Experts and Extension Agents on Training Requirements of Farmers on Biological Pest Control for Enhancing Food Security (N = 137)*

S/N	Items on Biological Pest Control	$\overline{X}_{AE}$	SDAE	$\overline{X}_{EA}$	SDEA	$\overline{X}-_{x}$	Decision
1	Knowledge of sowing times that prevent pests/diseases outbreaks	2.75	.77	3.61	.63	3.18	R
2	Use of natural enemies for pest control for healthy food production and affordability	3.46	.75	3.00	.70	3.23	R
3	Knowledge of resistant species and varieties for sustainable agricultural production	3.48	.65	2,76	.67	3.12	R
4	Use of alternative plants for protection and development of crops for increased production	2.99	.88	3.30	.99	3.15	R
5	Knowledge of organic pesticides used to enhance the availability of healthy agricultural produce	2.54	1.01	3.52	.59	3.03	R
	Cluster Mean					**3.14**	**Required**

$\overline{X}$AE-Mean response of Agric. Experts; $\overline{X}$AE-Mean response of Agric. Extension agents SDAE-Standard deviation of Agric. Experts; SDAE-Standard deviation of Agric. Extension agents; $\overline{X}-_{X}$-Average Mean for Agric. Experts and Extension agents

The data in Table 3 indicates that all items had their mean value within the limit of 2.50 – 3.49. On the whole, the table cluster mean 3.14 also falls within the limit of 2.50 – 3.49. This implies that agricultural experts and extension agents agreed that farmers in the study area require training in all the identified areas of biological pest control to enhance food security.

Research Question 4

What are the training requirements of farmers in marketing agricultural produce to enhance food security in Cross River State?

Table 4

Mean Responses of Agricultural Experts and Extension Agents on Training Requirements of Farmers on Marketing of Agricultural Produce for Enhancing Food Security (N = 137)

S/N	Items on Marketing of Agricultural Produce	$\bar{X}_{AE}$	SDAE	$\bar{X}_{EA}$	SDEA	$\bar{X}-_{x}$	Decision
1	Market survey skills to promote farmers' involvement in the marketing of organic products	2.07	.1.02	2.93	.99	2.50	R
2	Marketing skills for grading, sorting, and fixing prices for produce	3.83	.99	2.45	.81	3.14	R
3	Knowledge of both online and offline advertisement	2.50	.87	2.92	.76	2.71	R
4	Online skills required to enhance farmers' access to economic opportunities for increased income generation	2.91	.75	2.94	.1.07	2.93	R
5	Use of information on organic markets to ensure a steady supply of food produce to consumers at beneficial prices	2.81	.95	3.01	.89	2.91	R
	Cluster Mean					**2.84**	**Required**

$\bar{X}$ AE-Mean response of Agric. Experts; $\bar{X}$ AE-Mean response of Agric. Extension agents SDAE-Standard deviation of Agric. Experts; SDAE-Standard deviation of Agric. Extension agents; $\bar{X}-_{X}$-Average Mean for Agric. Experts and Extension agents

The data in Table 4 indicates that all items had their mean value within the limit of 2.50 – 3.49. On the whole, the table cluster mean 2.84 also falls within the limit of 2.50 – 3.49. This implies that agricultural experts and extension agents agreed that farmers in the study area require training on all the identified areas of marketing of agricultural produce for food security.

Discussion of Findings

The finding of the study indicates that agricultural experts and extension agents agreed that farmers require training on the identified areas of farming systems for food security in the study area. Farming systems that will bring about healthy and adequate food production at affordable rates and at the same time ensure availability and accessibility to consumers should be encouraged among farmers. This finding is in agreement with the findings of Umar (2017), that farmers need training in various aspects of organic farming such as crop rotation techniques, planting cover crops, use of natural feeds for livestock, etc. to enable them to benefit from the financial and environmental opportunities offered by organic farming. The findings of the study also agree with Reddy and Kumar (2020), that farmers needed training in areas such as plant protection, cropping patterns, and soil reclamation to help increase yields and avoid crop damage and losses.

The finding of the study indicates that agricultural experts and extension agents agreed that farmers require training on the identified areas of use of organic manure for food security in the study area. Knowledge of organic fertilizer production can transcend the use of organic manure. When farmers understand that the use of organic manure can result in the improvement of soil structure and fertility, they will adopt the practice without much persuasion. This study finding agrees with the findings of Umar (2017) who reported that one of the training needs of farmers was on the use of green manure, use of composed manure and application of animal manure, etc. In addition, Rahman, *et*

al. (2018) asserted that farmers required training on vermi-compost production among others. Similarly, Nwosu (2023) reported that rural farmers needed training in organic fertilizer production from solid waste for sustainable production.

The finding of the study indicates that agricultural experts and extension agents agreed that farmers require training on the identified areas of biological pest control for food security in the study area. Organic agriculture is all about ensuring that agricultural production does not only achieve quantity but also quality and healthy consumption. Knowledge of the use of alternative plants for protection, use of resistant varieties, sowing times, and organic pesticide use can enhance the availability of healthy agricultural produce. This finding is in line with the findings of Hashemi, *et al.*, (2009) who reported that one of the training needs for farmers was knowledge of biological pest control options since it encourages natural use. This finding also agrees with Prudent *et al*., (2007), training programmes can play a crucial role in pest management decisions, providing farmers with the technical knowledge necessary for the selection of appropriate pest control methods and also for safe and effective use. Moreover, Umar (2017) also reported that farmers required training on biological pest control methods in terms of how and type of predators to use for pest control.

The finding of the study indicates that agricultural experts and extension agents agreed that farmers require training in the identified areas of marketing of agricultural produce for food security in the study area. Production will not be complete if producers do not have the right marketing skills to dispose of their produce in a way that will benefit them. Marketing becomes a very important aspect of the production cycle as it channels production to the right people at the right prices. This finding is in line with the findings of Ugwoke *et al.*, (2020), who reported that women farmers needed training in the area of e-marketing of farm products for higher value of their production. Also, Rahman, *et al.* (2018) asserted that farmers needed training on other aspects of agricultural production including marketing.

Conclusion

Food insecurity will continue to be a challenge if nothing is done to curb it. However, with workable strategies such as organic agricultural training and adoption by individual farmers who are shouldered with the responsibility of increasing agricultural production, it is possible to enhance secured food production around the globe particularly in Cross River State. It was also concluded that farmers require training in the selection of farming systems, use of organic manure, biological pest control and marketing of agricultural produce for enhancing food security in Cross River State.

Recommendations

Based on the study findings it is recommended that:

1. Agricultural experts and extension agents should educate farmers on various organic farming systems such as crop rotation, companion farming, breeding techniques, etc. for improved production.
2. Farmers should utilize organic manure in the cultivation of their crops to foster sustainability of the ecosystem.
3. Technologists should package organically formulated pesticides and make it accessible to farmers for use.
4. Ministry of agriculture should organize exhibition and symposium for advertisement and marketing of organic farm inputs such as organic manure, organic pesticides, organic herbicides and others.

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DETERMINANTS OF ON-THE-JOB-TRAINING MECHANISMS FOR IMPROVING EXTENSION AGENTS' EFFECTIVENESS IN DELIVERING AGRICULTURAL INFORMATION TO FARMERS FOR SUSTAINABLE LIVELIHOOD IN DELTA STATE

EZE, MARYANN OGOCHUKWU, *Ph.D.*
EZE, S.O., *Professor*
UZOKA IWALEWA OMOKHEKPE
Department of Agricultural Education,
Federal College of Education (Technical), Asaba, Delta State.

OKECHUKWU, FRANCES OBIANUJU
Department of Technology & Vocational Education,
Ebonyi State University, Abakaliki.

Abstract
This study was carried out to determine on-the-job training mechanisms for improving extension agents' effectiveness in delivering agricultural information to rural farmers for sustainable livelihood in Delta State. Two purposes, two research questions and one hypothesis guided the study. The work specifically adopted a descriptive research design using a survey method. The population of the study was 200 which consisted of 120 extension agents and 80 agricultural education lecturers in tertiary institutions of Delta State. There was no sampling because the whole population was of a manageable size. Three experts validated the instrument, two from the Department of Technology and Vocational Education and one from Measurement and Evaluation in the Department of Science Education, all from Ebonyi State University, Abakaliki. The instrument used for data collection was a questionnaire tagged Job Training Mechanisms for Improving Extension Agents in Delivering Agric Information to Rural Farmers Questionnaire '(JTMIEADAIRFQ)'. Two hundred (200) copies of the questionnaire were administered to respondents and were returned. The data collected were analyzed using mean and standard deviations to answer the research questions while the hypothesis was tested using a t-test, at a confidence level of 0.05. The result of the analysis showed that ICT-facility-based training and career training constitute mechanisms to improve extension agents' effectiveness in delivering agricultural information to rural farmers. Based on the result of the study, it is recommended that the Ministry of Agriculture should continue to emphasize on training and retraining of extension agents, Governments at all levels should mobilize lecturers and trainers of extension agents for effective 'on the job training' so as to equip them with innovative ideas.

Keywords: On-the-job training, extension agents, rural farmers, mechanisms, agricultural information, and sustainable living.

Introduction

Extension implies informing, teaching, and advising farmers on new and improved technologies and getting feedback from farmers to research stations (Imoloame & Olanrewaju, 2014). This is done to help the farmers improve their productivity, earn more income, and improve their standard of living. Therefore, agricultural extension brings about changes in knowledge, skills, and attitudes. According to FAO (2019), an Agricultural extension service is an out of school program in which an extension agent is made to work with rural farmers to assist them to change their knowledge, skills and farming activities. The main role of agricultural extension is to build the capacity of the farmers, change their mindset and help them to make informed decisions for better use of extension services. An effective agricultural extension service is seen as one of the major catalysts in agricultural modernization (Asiabak, 2002).

Extension Services in this study are agricultural packages sent to rural farmers in the form of education, farm input, new

technologies, and technical advice and information services. The agricultural information gets to farmers through extension agents. According to Okeowo (2015), agricultural extension agents are the trained persons in extension education who are made to spread agricultural information to rural farmers. Okeowo (2015) also stated that extension agents train farmers, provide advisory services and information, and help them form organizations for sustainable food production and marketing, as well as teach rural farmers about improved cultivation, rearing of animals, and processing of crops.

Furthermore, Imoloame and Olarewaju (2014) stated that extension agents help to collect basic information relating to rural agricultural programmes, supervise beneficiaries on agricultural loans, change rural farmers' attitudes relating to agricultural production, raise the standard of rural farmers, identify appropriate marketing channels for the farmers to sale their agricultural products as well as teaching farmers land management techniques which improves land fertility and productivity. They are also the go- between the farmers and the government/research station; sending information from the research stations to farmers and getting feedback on farmers' problems to the government (Mbgenka & Mbah, 2018). Agricultural extension agents are trained officers who teach rural farmers to acquire knowledge and skills in agricultural production. They are agents working under the Ministry of Agriculture either at the state or federal level and the Agricultural Development Programme (ADP). In the opinion of Akpomedaye and Jegbefume (2010) extension agents can fully carry out their duties if they improve on their work.

To improve means to increase the quality or effectiveness of a programme or a person (Obaniyi & Adewole, 2014). Therefore, to improve the effectiveness means to increase the efficiency. Furthermore, to improve is explained as the use of ''on the job training'' to increase the efficiency and the effectiveness of extension workers in delivering agricultural information to the rural farmers. Oluwasusi and Akanni (2012) said that an improved extension information delivery program brings out its worth or goodness in terms of functional contents, effective methods, needed facilities, and resource personnel. The main goal for improving extension service delivery is to increase its quality, relevance, and effectiveness in information delivery.

According to the Food and Agricultural Organization (FAO) (2019), the Ministry of Agriculture seeks to improve agricultural production and productivity to achieve food security. The ministry provides an enabling environment for extension agents by promoting appropriate research, market systems, and extension input delivery. The FAO (2019) added that for extension agents to improve their work 'on-the-job training' is paramount. United State Agency for International Development (USAID) (2017) reported that after the withdrawal of the World Bank from funding the Agricultural Development Project (ADP) in 2002, the Nigerian government till now found it extremely difficult to fund the extension and advisory service information delivery).

The Nigerian agricultural extension service is bedeviled by several problems as identified by Imoloame and Olarewuju (2014) such as inadequate funding, poor logistic support, poorly trained personnel at local, State, and federal levels, ineffective agricultural research extension linkages, insufficient agricultural technologies for farmers and a disproportionate number of extension agents to farm family ratio. Asikadi, (2010) attested to the fact addressing the above problems of the extension agents that require certain mechanisms such as on-the-job training, career training, and Information and communication technology (ICT) based training.

Mechanisms are action plans for achieving the objectives of a program. (Ziderman, 2016). In the context of this work, mechanisms are special methods, actions or techniques that inform training that are to be utilized to enhance extension agents to deliver agricultural information, training is

teaching, or development of oneself or others to acquire skill, knowledge or fitness that relates to specific useful competencies. In the course of knowledge transfer, subject matter experts from different universities provide On-the-job training to extension agents' on innovations. Chukwurome, *et al.* (2008) viewed on-the-job training of extension agents as a technique of equipping extension agents to tackle farmers' challenges. In the view of Saleh (2017), on–the–job training mechanisms include; ICT facility-based induction, career or development, human resource, refresher, vestibule, and apprenticeship training. Saleh (2017) further stated that on-the-job training of extension agents would help them advance in teaching farmers and/or farmer groups modern skills. The focus of this work is on the use of ICT facility-based and career training to improve extension agents' work.

Anunobi and Anunobi (2018) acknowledged that Information and Communication Technology is seen as a form of technology that is used to transmit, store, create share or exchange information. The author added that the ICT-based training facilities that are provided to improve extension agents include; digital cameras, computers/laptops, mobile/smart phones, digital radios and television. However, career training is the type of training given to extension agents to expand their skills and knowledge on their job. Eze and Egbe (2016) posited that this type of training leads to job satisfaction.

Agholor and Nkosi (2020) outlined the advantages of on-the-job training to include; the acquisition of skills in the production of hybrids of crops and animals and the delivery of innovative information, such as time of planting and rearing of good species of animals, creativity in the job skills, facilitating the education of farmers, acquire the relevant knowledge and skills on new innovations, helps the extension agents to be more proficient in performing their duties. Therefore, it is important to improve capacity of extension agents in the delivery of agricultural information.

Agricultural information refers to bundles of knowledge, skills, facts figures, and data relating to various aspects of agricultural activities which are beneficial to the rural farmers (Opara, 2013). The sources of agricultural information according to Achugbue and Anie (2011) are from research centers, government establishments and extension agents, stating that agricultural research centers generate and disseminate technological data, while government and extension workers interact with farmers. Thus, agricultural information service follows a life cycle that involves the creation of information, organizational use and disuse of the information, and feedback to the research centers.

The information source service in agriculture has several uses as identified by Adio, *et al.* (2016) such as achievement of household food security and reduction of poverty. Therefore, the availability of agricultural information at the grass root is imperative in educating the rural farmers on innovations in agricultural production.

Rural farmers are those farmers who live in rural areas and fully depend on agricultural information for sustainable food production (Ndem & Eze, 2014). Ndem and Eze (2014) stressed that rural farmers depend mostly on traditional information in producing such food as rice, beans, cassava domestic animals, and so on.

According to Richardson (2017), the food produced by rural farmers in Nigeria is not enough to feed the ever-increasing population because they lack access to knowledge and timely information that would help them achieve maximum agricultural yield. Richardson added that the rural farmers need the services of the extension agents to get agricultural information that would improve their production and make them have sustainable livelihoods.

Generally, sustainability is the ability to maintain or support a process over time. In the agricultural context, it is seen as an integrated system of plant and animal production that avoids damaging natural resources, and provides quality and healthy

food adequate to sustain the present population without compromising the needs of future generations (Smith & Gregory, 2015). Therefore, according to Makenzie and Willians (2015), sustainable living is the ability of a system to meet current and future human and environmental needs. Makenzie and Williams (2015) added that sustainability comes when food production has a high output level that can increase the standard of living of the rural farmers, based on timely information received from extension agents without endangering the food meant for future generations. FAO report (2019) has it that food production that leads to sustainable living aims at economic profitability, social equity environmental safety, and a healthy food supply to all people.

Delta State is an agrarian state with over eighty percent estimated population earning their living from the agricultural sector. The bulk of farmers in the state are rural dwellers who depend greatly on extension agents for agricultural information and education services (Ovarhe, *et al*., 2020). Most farmers in Delta State live in rural areas and are into agricultural production as their major occupation. As such, they need more of the services of extension agents. The State also has large land and fertile soil for cultivation of crops such as cassava yam, oil palms, forages for rearing of animals, and rivers for aquatic farming but they suffer from low agricultural yields.

This problem could be attributed to inadequate information from extension agents. Ovarhe, *et al.*, (2020) observed that despite natural endowment made especially by this present administration in the state, such as the "Okowa Food Sufficiency Program" the programme advocates an increase in activities of extension agents to boost food production, farmers find it difficult to get reliable agricultural information for surplus and sustainable food production (Opara, 2013). As it stands now, the rural farmers in the state are not having sustainable living because the extension agents are not doing their work as it is supposed to be because they are not encouraged. Hence, there is a gap between rural farmers and agricultural information centers. Therefore, it is in the bid to curb this problem that necessitated this work, thus, assessment of the use of on-the-job training to improve extension agents in delivering agricultural information to rural farmers for sustainable living in Delta State.

Purpose of the Study

The general purpose of this study is to determine the use of on-the-job training as a mechanism for improving extension agents' effectiveness in delivering agricultural information to rural farmers for sustainable living in Delta State. Specifically, the study sought to determine:

i. the Use of ICT-facility-based training by extension agents in delivering agricultural information to rural farmers; and
ii. the importance of 'on the job' career training in improving extension agents in delivering agricultural information to rural farmers.

Research Questions

The following research questions guided this study.

1. What are ICT-facilities-based training mechanisms for improving extension agents in delivering agricultural information to rural farmers for sustainable livelihood in Delta State?
2. What is the importance of on-the-job career training in improving extension agents in the delivery of agricultural information to rural farmers in Delta State?

Hypothesis

The following formulated hypothesis was tested at the alpha level of 0.05 level of significance.

Ho1: There is no significant difference between the mean responses of extension agents and agricultural education lecturers on the ICT-facility-based mechanisms for enhancing extension agents in delivering

agricultural information to rural farmers for sustainable livelihood in Delta State.

Methodology

The study adopted a descriptive research design using a survey method. A survey research design is a procedure used to obtain information from a sample or population that is familiar with the ideas relating to the objectives of the study (Abonyi, *et al*., 2006). This study was carried out in Delta State of Nigeria. Delta State is a state in the South-South geopolitical zone of Nigeria. The state is divided into three agricultural zones: Delta North, Delta Central and Delta South. The population of the study is two hundred (200) made up of 80 agricultural education lecturers from 5 tertiary institutions in Delta State (Department of Planning, Research and Statistics in Teaching Service Commission of Delta State, 2021) and 120 agricultural extension agents in Delta State (Delta State Ministry of Agriculture and Rural Development, 2021). Due to the small size of the population of the study, the entire population was used as sample. Therefore, all eighty (80) agricultural education lecturers and 120 extension agents respectively were accommodated. A structured questionnaire titled "Job Training Mechanism for Improving Extension Agents in Delivering Agricultural Information to Rural Farmers Questionnaire (JTMIEADAIRFQ)'' was developed by the researcher for the collection of data for the study. The response options in each of the sections are Strongly Agree (SA = 4), Agree (A = 3), Disagree (D = 2), and Strongly Disagree (SD = 1).

The instrument was validated by three experts, two from technology and vocational education, and one from the Measurement and Evaluation Unit, all from Ebonyi State University Abakaliki. Data collected were analyzed and the reliability coefficient of 0.78 was established using Cronbach alpha's method. The researchers administered 200 copies of the questionnaire to the respondents which was used for analysis.

Two research questions and one hypothesis guided the study. Data collected for the study were analyzed using mean and standard deviation to answer the research questions. The response scale value of the instrument was used to estimate the cut-off point of the mean. Thus, any item with a mean value of 2.50 and above was regarded as a mechanism for enhancing extension agents' effectiveness in the delivery of agricultural information to rural farmers while any item with a mean value less than 2.50 is not required as a mechanism for enhancing extension agents' effectiveness. A t-test was used to test the hypotheses of the study at a 0.05 level of significance. If the calculated t-value was greater than their critical (table) value, the null hypothesis is rejected; while the one with the calculated t-value less than the critical value was accepted.

Results

Research Question 1

What are the ICT facilities-based mechanisms for improving extension agents in delivering agricultural information to rural farmers in Delta State?

Table 1

ICT Facility Based Mechanism for Improving Extension Agents in Delivering Agricultural Information to Rural Farmers in Delta State (N = 200)

S/N	Item Statement	Lecturers		Agents		Decision
		$\bar{x}$	SD	$\bar{x}$	SD	
1.	Use of mobile/smart phone enable the extension agents to disseminate information to rural farmers very easily	2.51	1.16	2.52	1.14	Agree
2.	Use of digital camera enables the extension agents to show pictures and videos that enhances understanding of the rural farmers during teaching	2.56	1.16	2.54	1.14	Agree
3.	Use of social media applications such as Facebook, WhatsApp etc. can enhance extension agents effectiveness in sharing weather reports to rural farmers	2.56	1.16	2.54	1.14	Agree
4.	Use of laptop enhances extension agents' effectiveness in making graphic work with the production of images in teaching the rural farmers	2.56	1.16	2.54	1.14	Agree
5.	Use of electronic extension application such as farm Crowdy, Verdant, Agrikore app among others facilities extension agents effectiveness in delivering agricultural information to rural farmers	2.56	1.16	2.54	1.14	Agree
6.	Use of radio programme promotes extension agents effectiveness in reaching out to a large number or rural farmers at a time	2.60	1.15	2.57	1.14	Agree
7.	Use of television programme promotes extension agents effectiveness, as it helps the rural farmers in grasping and retaining information very easily.	2.60	1.15	2.57	1.14	Agree
8.	Use of Power Point facilities extension agents effectiveness in delivering agricultural information to rural farmers	2.61	1.16	2.58	1.14	Agree
9.	Use of desktop discourages extension agents effectiveness in delivering agricultural information to rural farmers	2.13	1.02	2.25	1.07	Disagree
10.	Use of internet facilities extension agents' effectiveness in delivering agricultural information to rural farmers	2.66	1.16	2.60	1.14	Agree
11.	Use of telegram reduces extension agents' effectiveness in delivering agricultural information to rural farmers	2.31	1.07	2.37	1.09	Disagree
12.	Use of digital green video discourages extension agents effectiveness in delivering agricultural information to rural farmers	2.25	1.05	2.33	1.07	Disagree
13.	Use of plantix application enhances extension agents' effectiveness by supporting in recognizing plant diseases, pest and nutrient deficiencies.	2.68	1.14	2.62	1.14	Agree
14.	Use of iPad/Tablet facilities by extension agents' effectiveness in making the information handy	2.68	1.15	2.62	1.14	Agree
	Grand Mean	2.52	1.13	2.51	1.13	

Table 1 indicates that the lecturers had their mean scores above the cut-off points of 2.50 except items 9, 11, and 12 which had the mean score of 2.13, 2.31, and 2.25 respectively which are below the cut-off point of 2.50 but the grand mean is 2.52 and

standard deviation ranging between 1.02 and 1.05. This implies that the respondents agreed that ICT-facility-based mechanisms can be used to improve extension agents' effectiveness. The same Table 1 indicated that extension agents had their mean scores above the cut-off point of 2.50 except 9, 11, and 12 which had their mean scores of 2.25, 2.37, and 2.33 but the grand mean is2.51 and the standard deviation ranging between 1.07 and 1.09. This signifies that the respondents were in agreement that ICT-facility-based mechanisms can enhance extension agents' effectiveness in delivering agricultural information to rural farmers.

Research Question 2

What are the importance of on the job career training in improving extension agents in delivery of agricultural information to rural farmers in Delta State?

Table 2

The Importance of 'On The Job' Career Training in Improving Extension Agents Delivery of Agricultural Information to rural farmers in Delta State (N = 200)

S/N	Item Statement	Lecturers		Agents		Decision
		$\bar{x}$	SD	$\bar{x}$	SD	
1.	It helps extension agents to become more qualified and proficient in performing their duties	2.65	1.14	2.50	1.14	Agree
2.	It helps extension agents to get acquainted with ever- changing environment	2.82	1.11	2.54	1.14	Agree
3.	It enhances technical skills of extension agents in agricultural information delivery	2.86	1.10	2.54	1.14	Agree
4.	It aids extension agents to understand the statement of the purpose of their work	2.81	0.99	2.54	1.14	Agree
5.	It helps to link the extension agents with modern innovation in their work	2.73	1.05	2.54	1.14	Agree
6.	Career training helps the extension agents to acquire relevant knowledge relating to their job	2.60	1.15	2.56	1.14	Agree
7.	Career training helps the extension agents in streamlining their work	2.60	1.15	2.56	1.14	Agree
8.	Career training also helps in increasing work productivity	2.62	1.16	2.58	1.50	Agree
	Overall	**2.71**	**1.14**	**2.55**	**1.90**	**Agree**

Table 2 revealed the importance of 'on the job' career training in improving extension agents' delivery of agricultural information to rural farmers with overall mean of 2.71 and 2.55 This showed that all means of the items were above the cut-off point of 2.50, indicating that all items on the importance of 'on the job' career training in improving extension agent's delivery of agricultural information to rural farmers were accepted. This means that career training is very important in improving extension agents in the delivery of agricultural information to rural farmers. The table also showed that the standard deviations (SD) of the items are within the range of 0.99 to 1.05 and 1.50 to 1.90 respectively indicating that the mean values of the respondents were not far from one another in their responses.

Hypothesis 1

There is no significant difference in the mean responses of the Lecturers and Extension Agents the on the use of ICT-facilities-based mechanisms in improving extension agents' effectiveness in delivering agricultural information to rural farmers.

Table 3

Analysis of t-test of Respondents' Responses on the Use ICT Facility Based as a Mechanism in Improving Extension Agents' Effectiveness in Delivering of Agricultural Information to Rural Farmers

S/N	Variables	Lecturers (N = 80)		Agents (N = 113)				
		$\bar{x}$	SD	$\bar{x}$	SD	T	p	Decision
1.	Use of mobile/smart phone enable the extension agents to disseminate information to rural farmers very easily	3.97	0.11	3.97	0.28	0.841	0.402	Rejected
2.	Use of digital camera enables the extension agents to show pictures and videos that enhances understanding of the rural farmers during teaching	3.96	0.19	3.94	0.91	0.752	0.453	Rejected
3.	Use of social media applications such as Facebook, WhatsApp etc. can enhance extension agents effectiveness in sharing weather reports to rural farmers	3.96	1.19	3.91	0.29	1.392	0.165	Rejected
4.	Use of laptop computer enhances extension agents' effectiveness in making graphic work with the production of images in teaching the rural farmers	3.99	0.11	3.97	0.16	0.672	0.502	Rejected
5.	Use of electronic extension application such as farm Crowdy, Verdant, Agrikore app among others facilities extension agents effectiveness in delivering of agricultural information to rural farmers	3.98	0.16	3.99	0.13	1.693	0.092	Rejected
6.	Use of radio programme promotes extension agents effectiveness in reaching out to a large number or rural farmers at a time	3.99	0.11	3.96	0.19	0.984	0.326	Rejected
7.	Use of television programme promotes extension agents effectiveness, as it helps the rural farmers in grasping and retaining information very easily.	3.98	0.11	3.96	0.19	0.984	0.326	Rejected
8.	Use of Power Point facilities extension agents effectiveness in delivering agricultural information to rural farmers	3.96	0.19	3.96	0.18	0.077	0.939	Upheld
9.	Use of desktop improves extension agents effectiveness in delivering agricultural information to rural farmers	1.07	0.27	1.08	0.29	0.333	0.739	Upheld

10.	Use of internet facilities extension agents effectiveness in delivering agricultural information to rural farmers	3.99	0.01	3.99	0.09	0.841	0.402	Rejected
11.	Use of telegram enhances extension agents effectiveness in delivering agricultural information to rural farmers	1.01	0,11	1.12	0.47	2.097	0.037	Upheld
12.	Use of digital green video enhances extension agents' effectiveness in delivering of agricultural information to rural farmers	1.03	0.16	1.07	0.26	1.414	0.159	Rejected
13.	Use of plantix application enhances extension agents' effectiveness by supporting in recognizing plant diseases, pest and nutrient deficiencies.	3.96	0.34	3.95	0.39	0.286	0.775	Upheld
14.	Use of iPad/Tablet facilities extension agents effectiveness	3.99	0.11	3.96	0.19	0.984	0.326	Rejected

Table 3 shows the result of individual items on how ICT facility based mechanisms could improve extension agents' effectiveness in delivering agricultural information to rural farmers in Delta State. The result presented showed that items; 1, 2, 3, 4, 5, 6, 7, 10, 11, 12, and 14 with calculated (t-cal) values were greater than their respective t-crit. values. This meant that the hypotheses were rejected, meaning that there was significant differences in the opinions of lecturers and extension agents in the use of ICT facilities based as a mechanism for improving extension agents in the delivery of agricultural information to rural farmers.

Discussion of Findings

The data presented in Table 1 revealed 14 ICT facility-based training as a mechanism for improving extension agents' effectiveness in delivering agricultural information to rural farmers based on the overall mean which is 3.35. This showed that most mean of each of the items was above the cut-off point of 2.50, indicating that all 14 ICT facility-based training mechanisms listed can improve extension agents delivering agricultural information to rural farmers. The table also showed that the standard deviations (SD) of the items are within the range of 0.07 to 0.37; this indicated that the mean values of the respondents were not far from one another in their responses.

The findings of this study revealed that 11 (79%) out of fourteen ICT facilities namely, the use of smart phones, digital cameras, social media, laptops, electronic extension applications, radio programmes, television programmes, PowerPoint, internet facilities, telegram, plastics application and use of iPad/Tablet can enhance extension agents' effectiveness. Furthermore, three of the fourteen items namely, use of desktop, use of telegram, and digital green video were not identified as mechanisms. The result presented that the p-value of individual items ranged between 0.037 and 0.939. Each of these was greater than the p-value of 0.050. It, therefore, means that there was no significant difference in the mean responses of lecturers and extension agents on each of the items meant to find how ICT facility-based mechanism could enhance extension agents' effectiveness in delivering agricultural information to rural farmers. Therefore, the null hypothesis was upheld as it confirms the authenticity of the findings as there was not much disagreement between the extension agents and lecturers on the use of ICT facilities in enhancing extension agents' effectiveness in disseminating agricultural information to rural farmers.

The finding is in agreement with Anunobi and Anunobi (2018) who opined that facilities ICT are used by extension agents to transmit, store, create, share or exchange information with rural farmers. In conformity with this, Sennuga, *et al.* (2021) said that number of Notable smart phone apps used in agriculture such as Arikore, Farm Crowdy, Verdant, AgroData, Hello Tractor, and Probityfarms appsAgrikore app can help the extension agents to bring farmers, agro-dealers, commodity traders and insurers together under one platform. These are also used for farm management as well as to connect farmers to the market, and Compare-the-market is designed to compare daily market prices of food crops and livestock in Nigeria. As well enables rural farmers to achieve higher incomes, with lower transaction and distribution costs from output sales as well as input supplies thereby leading to sustainable food production. Oladele (2015) added that they aid the extension agents to deliver broad information to rural farmers.

The researchers believed that extension agents are effective in delivering agricultural information to rural farmers when they are improved with ICT facility based training.

The data presented in research question 2 revealed that 8 on the importance of career training of improving extension in delivering of agricultural information to rural farmers based on the overall mean which is 2.73. This showed that most mean of each of the items was above the cut-off point of 2.50, indicating that all 8 items on the importance of career training listed can stand as a mechanism for improving extension agents in delivering agricultural information to rural farmers. The table also showed that the standard deviations (SD) of the items are within the range of 0.97 to 1.19 this indicated that the mean values of the respondents were not far from one another in their responses.

The study found that 'on-the-job' career training is very important in improving extension agents in the delivery of agricultural information to rural farmers in Delta State. This finding is in line with the findings of Asikadi, (2010) who attested that it is important for extension agents to go through career training to address the farmers' problems adequately.

Conclusion

Extension agents provide information and facilitate interaction between researchers and farmers. They provide the knowledge and information that will make a farmer understand and welcome innovations in agriculture. The study focused 'on the job training mechanisms for improving extension agents' effectiveness in delivering agricultural information to rural farmers for sustainable livelihood in Delta State. Based on the findings of the study, it was concluded that extension agents require ICT-Facility-based training and 'on the job' career training for effective information delivery of agricultural information.

Based on the test of hypothesis, there were significant differences between the opinions of lecturers and extension agents in using ICT- facility based and 'on the job' career training as mechanisms for improving extension agents in delivering agricultural information.

Recommendations

Based on the findings the researchers recommend that:

1. The Ministry of Agriculture should continue to emphasize on training and retraining of extension agents to equip them with innovative ideas.
2. The federal government, state government, and non-governmental organization should mobilize the lecturers or the trainers of extension agents to effectively deliver on-the-job training programs for extension agents in Delta State.

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AGRICULTURAL SKILL IMPROVEMENT NEEDS OF TEACHERS IN ANIMAL PRODUCTION FOR ACHIEVING FOOD SECURITY IN DELTA STATE, NIGERIA

IMOBIGHE MABEL ULEBURIN, *Ph.D.*
Department of Vocational Education,
Delta State University, Abraka.

Abstract
This paper examined the agricultural skill improvement needs of teachers in animal production for the achievement of food security in Delta State, Nigeria. The aspect of the agricultural skill focused on in this study was the technical skills of Agricultural Science teachers in secondary schools in Delta State. Three research questions were raised to guide the investigation. The literature review was undertaken in line with the objectives of the study. The study employed the descriptive survey as its design. The population of the study comprised one thousand (1000) Agricultural Science teachers. A simple random sampling technique was used to select 10% of teachers, which is one hundred (100) as the sample size for the study. The questionnaire is the instrument employed for data collection, and it encompasses items on animal production aspects of the current Agricultural Science curriculum. The reliability of the instrument was determined using Cronbach alpha approach where a reliability index of 0.89 was obtained, making the instrument reliable for use. Data collected were analyzed using Need-Gap Analysis. Findings, amongst others revealed that teachers of Agricultural Science in secondary schools in Delta State needed skill improvements in technical skills in the area of pig, poultry, and rabbit production. The study therefore concluded that Agricultural Science teachers in Delta State secondary schools needed skills improvement in animal production. Arising from the conclusion, it was recommended that the state government combine these technical knowledges of animal production into a training module to retrain Agricultural Science teachers in secondary schools through an in-service training programme.

Keywords: Agriculture, Skills, Teacher, Animal Production, Food Security

Introduction

Agricultural Science is taught in secondary schools as a pre-vocational course. Agriculture had been the backbone of the Nigerian economy before the discovery of crude oil, which led to the start of the nation's oil boom. Being one of the fundamental courses, agricultural science is taught in secondary schools across the country. According to Babayo and Kesiki (2019), agricultural science is a subject designed to improve students' cognitive and physical skills in the subject, as well as their knowledge, attitude, and talents for personal development and social improvement. Ndem (2016) defines agricultural science as the application of basic scientific knowledge to the breeding and culture of plants and animals for human use. According to the Ndem study, agricultural science is taught in secondary schools to help students gain knowledge, abilities, and attitudes about animal production that would improve their sense of security. The goals of agricultural science at the senior secondary school level, according to the Federal Republic of Nigeria (FRN) (2013), include to stimulate and sustain student interest in agriculture, equip students with knowledge and skills in agriculture, prepare students for occupations in agriculture, prepare students for further studies in agriculture, among others.

In order to achieve the stated objectives of agricultural science in secondary school, the government had separated the subject into animal production and animal husbandry. Iwena (2015) defines "animal production" as a general strategy or set of rules for keeping farm animals. It comprises the situation-appropriate integrated application of the foundations of animal breeding, feeding, housing, reproduction, health, and disease control. In this study, the production of pigs, poultry,

and rabbits is examined concerning the senior secondary agricultural science curriculum. By the conclusion of secondary school, students must have a basic understanding of animal production; thus, teachers of agricultural science are expected to convey this component of the curriculum to students in a way that will stimulate their interest in animal production. To assist students in building these capacities for independence, an agricultural science teacher must possess a technical understanding of animal production and be able to train students in the acquisition of fundamental animal production skills.

Technical talent is the capacity to successfully carry out a task using a variety of methods and techniques. Technical talent is the ability to do a task using specialized knowledge and techniques. Technical skills are the manipulation abilities needed for a person to properly perform a task, according to Anyogo, *et al.* (2019). In order to properly teach animal production to pupils in senior high schools in Delta State, agricultural science teachers require technical skills, often known as manipulative abilities or talents. The technical knowledge of agricultural science instructors in animal production has to be updated and improved. Improvement is the process of making something better than it was previously, according to Anjov, *et al.* (2019). Therefore, in order to improve the secondary school agricultural science curriculum and achieve the desired learning outcome, the programme's content must be updated.

Additionally, according to Asogwa and Uko (2019), improvement refers to the process of helping graduates of agricultural science acquire the practical skills necessary for the commercial production of pigeon pea. This project aims to increase the technical proficiency of agricultural science instructors in animal production so that they can better instruct secondary school students and aid in the development of their foundational understanding of animal production for self-sufficiency and sustainable food production.

Since the administration of the country understood the necessity for sustainable meat and protein production for the expanding population, animal agriculture has been a readily available source of protein in the country. The government intended for the student to get instruction, training, and preparation for a career in animal production following the senior high school curriculum. To accomplish this goal of preparing students for a career in animal production, agricultural science teachers must be well-versed in current technical skills in animal production and ready to instruct students in a way that will spark their interest in the field and help them develop marketable skills.

The majority of secondary school leavers in the study area who were instructed to learn animal production skills and likely pursue a career in it were unable to demonstrate any relevant skills in animal production. Instead, these secondary school leavers constituted a threat to the community through their riotous activities, including stealing, fighting, rapping, yahoo fraud, and kidnapping of innocent bystanders. When several of these secondary school graduates are questioned, it was discovered that the only reason they had been taught about animal production in class was to pass external exams (Iwena, 2015). This information revealed that teachers of agricultural science do not expose these secondary school graduates to the nitty-gritty of animal production while they were in school, probably due to lack of skills in animal production by the teacher or due to the incompetence of the teacher. Therefore, it become imperative and of necessity to determine the technical skill improvement needs of Agricultural Science teachers in animal production with a view to enhancing food security in Delta State, Nigeria.

How to feed more than seven billion people worldwide is one of the most difficult problems facing humanity today. Food security is a complicated, diverse notion that is often impacted by geography, culture, and environment. At five different levels (individual, household, national, regional, and global), the Food and Agriculture Organization of the United Nations (FAO)

provided a precise definition of "food security" as "when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (Perez-Escamilla, *et al.*, 2017).

The Sustainable Development Goals (SDGs) are a set of 17 objectives for sustainable development that were endorsed by the United Nations (UN) in September 2015 during its General Assembly (UN, 2017). To address the significance of food security and nutrition within the larger agenda, SDG Goal 2 (SDG 2), which is one of the food security objectives, calls on member states to "end hunger, achieve food security and improve nutrition, and promote sustainable agriculture" by 2030. SDG 2 comprises three implementation mechanisms and five main aims (Otekunrin, *et al*., 2019). In 2019, it was found that there are thought to be 690 million (8.9% of the world's population) individuals who are undernourished. This demonstrated that, by 2030, there would be 841.4 (9.8%) million people who are food insecure, with 51.5% (433.2 million) of those people living in Africa, the region with the largest number of undernourished people worldwide (FAO, *et al*., 2012). However, the 2020 Food Security Information Network (2020) reported that approximately 135 million people in 55 countries and territories are suffering from acute food insecurity, with 73 million of these individuals coming from 36 countries in Africa (Otekunrin, *et al*., 2020), which is significant given the number of people experiencing food crises globally.

The FAO definition, which was developed following the 1996 World Food Summit and states that "food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life," is the most widely accepted definition of "food security," according to Heady and Ecker (2012). X-raying the definition reveals the multi-dimensional nature of the food security concept. Food sufficiency focuses on the availability and adequate quantities of food of appropriate quality; physical and economic access focuses on individuals' access to sufficient food; the security aspect relates to food utilization by the body, food safety, and risks involved, among other factors; while food stability relates to the time-bound aspect of food availability, access, and utilization. According to Ike, *et al.* (2015), the four main elements of food security are availability, access, use, and stability of food sources. On the other side, the absence of one or more of these elements is referred to as food insecurity. Seasonal food insecurity comes in-between the two categories of chronic and transitory food insecurity in traditional classifications (Jones, *et al*., 2013).

While transitory food insecurity is typically short-term or temporary and refers to brief periods of extreme scarcity of food availability and access, chronic food insecurity is a long-term or persistent situation where people can no longer meet their minimum food requirement over a sustained period of time (Afolabi, *et al.*, 2018). It is widely accepted that a necessary but not sufficient condition for nutrition security is food insecurity. According to Gubert, *et al.* (2016), food insecurity has a significant role in nutrition insecurity as well as poor psychosocial, cognitive, and mental health outcomes. In addition to food security, nutrition security also refers to care, health, and hygiene habits (Jones, *et al.*, 2013). Nutrition security, according to the FAO, is "a situation that exists when secure access to an appropriately nutritious diet is coupled with a sanitary environment, adequate health services and care, in order to ensure a healthy and active life for all household members" (FAO, *et al*., 2012).

Purpose of the Study

The main purpose of the study is to examine the agricultural skill improvement needs of teachers in animal production. Specifically, the study sought to:

i. examine the technical skills improvement needs of teachers of Agricultural Science in pig production for enhanced food security in Delta State;
ii. find out the technological skills improvement needs of teachers of Agricultural Science in poultry production for enhanced food security in Delta State; and
iii. assess the technological skills improvement needs of teachers of Agricultural Science in rabbit production for enhanced food security in Delta State.

Research Questions

The following research questions were raised to guide the study

1. What are the technical skills improvement needs of teachers of Agricultural Science in pig production for enhanced food security in Delta State?
2. What are the technological skills improvement needs of teachers of Agricultural Science in poultry production for enhanced food security in Delta State?
3. What are the technological skills improvement needs of teachers of Agricultural Science in rabbit production for enhanced food security in Delta State?

Methodology

The descriptive survey was adopted as the design for the study on a population comprised of one thousand (1000) Agricultural Science teachers cut across Delta State public secondary schools. Simple random sampling technique by balloting was adopted to select 10% of teachers, which gave a total of one hundred (100) respondents as the sample size for the study. A questionnaire was the instrument for data collection, and it encompasses items on animal production aspects of the Agricultural Science curriculum. The reliability of the instrument was established at 0.89 using the Cronbach alpha approach. Data collected were collated and analyzed using Need-Gap Analysis. This analysis helps to determine areas of animal production where Agricultural Science teachers needed technical skills improvement for effective teaching in secondary schools in Delta State, Nigeria. Also, when Need Gap is positive, it means that improvement is needed; but when negative, it means that improvement is not needed.

Results

Research Question 1

What are the technical skills improvement needs of teachers of agricultural science in pig production for enhanced food security in Delta State?

Table 1

Mean Ratings of the Responses of Teachers of Agricultural Science on the Technical Skills Improvement Needs in Pig Production

S/N	Technical Skills in Pig Production	Mean of Needed Category (n)	Mean of Performed Category (p)	NG ($\bar{x}$n - $\bar{x}$p)	Rmk
1	I am able to spot and clarify the different breeds of pigs	3.56	1.41	2.15	IN
2	I can identify and instruct the categorization of feeds in pig production	3.56	1.51	2.05	IN
3	I have the capability to arrange various rations and state their functions in pig production	2.76	2.40	0.36	IN
4	Identify the causes and symptoms of malnutrition in pig production	3.60	1.47	2.13	IN
5	I have the skill to express and explicate the construction of pig pen (housing)	2.89	2.16	0.76	IN

Key: $\bar{x}$n = mean of needed category; $\bar{x}$p = mean of performed category; NG = Need Gap, IN = Improvement Needed

Table 1 revealed that the need gap value of the 5 items ranged from 0.36 to 2.15 and was positive indicating that teachers of Agricultural Science in the study area needed improvement in these 5 technical skills areas.

Research Question 2

What are the technological skills improvement needs of teachers of agricultural science in poultry production for enhanced food security in Delta State?

Table 2

Mean Ratings of the Responses of Teachers of Agricultural Science on the Improvement Needs in Poultry Production

S/N	Technical skills in Poultry Production	Mean of Needed Category (n)	Mean of Performed Category (p)	NG ($\bar{x}$n - $\bar{x}$p)	Rmk
1	I have the skill to identify and teach various breeds	3.59	1.48	2.11	IN
2	I have the ability to explain digestive and reproductive system	3.60	1.40	2.20	IN
3	I am able to recognize and express how climatic change affects development and egg production.	3.39	1.59	1.80	IN
4	I have the skill to state and illustrate various terminologies	3.47	1.71	1.76	IN
5	I can recognize and explain various poultry diseases	3.08	2.12	0.96	IN

Key: $\bar{x}$n = mean of needed category; $\bar{x}$p = mean of performed category; NG = Need Gap, IN = Improvement Needed

Table 2 showed that the need gap value of the 5 items ranged from 0.96 to 2.20 and was positive, indicating that teachers of Agricultural Science in the study area needed improvement in these 5 technical skills areas in poultry production.

Research Question 3
What are the technological skills improvement needs of teachers of agricultural science in rabbit production for enhanced food security in Delta State?

Table 3
Mean Ratings of the Responses of Teachers of Agricultural Science on the Improvement Needs in Rabbit Production

S/N	Technical Skills in Rabbit Production	Mean of Needed Category (n)	Mean of Performed Category (p)	NG ($\bar{x}$n - $\bar{x}$p)	Rmk
1	I have the capacity to present disease prevention techniques used in rabbit farming.	3.39	1.59	1.80	IN
2	I am able to describe the reproductive, circulatory, and digestive systems of rabbits.	3.60	1.47	2.13	IN
3	I can name and describe how climatic change affects rabbit production in terms of growth and reproduction.	3.56	1.51	2.05	IN
4	I am able to name, explain, and project the challenges of producing rabbits.	3.59	1.48	2.11	IN
5	Identify the causes and signs of malnutrition in the production of rabbits.	3.15	1.91	1.24	IN

Key: $\bar{x}$n = mean of needed category; $\bar{x}$p = mean of performed category; NG = Need Gap, IN = Improvement Needed

Table 3 showed that the need gap value of the 5 items ranged from 1.80 to 2.13 and was positive, indicating that teachers of Agricultural Science in the study area needed improvement in these 5 technical skills areas in rabbit production.

Discussion of Findings

The results of research question 1 were consistent with those of Okuku (2019), who found that teachers of animal husbandry needed training in forty-seven technical skills, including livestock management, animal health, immunization against disease, and formulation of livestock rations, among others.

The results of research question 2 support those of Sallau (2018), who found that serving teachers needed training in 18 poultry production skills items while student teachers needed training in 41 poultry production skills items in order to be entrepreneurially competent in poultry production.

The findings of research question 3 were consistent with those of Isiwu (2019), who discovered that teachers of agricultural science in secondary schools needed to improve in some areas, including lesson planning, effective farm record-keeping techniques, and the contents of farm records and accounting procedures.

Conclusion

The research focuses on techniques for improving food security in Delta State, Nigeria, through the strengthening of teachers' agricultural skills in animal production. The study looked at teachers' abilities in three areas of the Agricultural Science curriculum that deal with raising pigs, poultry, and rabbits, and came to the conclusion that for teachers of Agricultural Science in secondary schools in Delta State to effectively instruct their students, their technical abilities in raising pigs, poultry, and rabbits needed to be improved.

Recommendations

Arising from the study's findings, it was recommended that the Delta State Government should package technical knowledge of animal production into training modules for Agricultural Science teachers in schools, as this will have a multiplicative impact on the State's ability to feed its citizens.

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ADEQUACY AND UTILIZATION OF ICT FACILITIES FOR AGRICULTURAL EDUCATION IN TERTIARY INSTITUTIONS FOR FOOD SECURITY IN CROSS RIVER STATE

NDEM, J. U.
Department of Technology and Vocational Education,
Ebonyi State University, Abakaliki.

EZE, M. O.
Federal College of Education, Asaba.

OTOZI, E. I.
Alex Ekwueme Federal University, Ndufu-Alike Ikwo.

NWOVU, C.
Ebonyi State College of Education, Ikwo.

Abstract
This study investigated the adequacy and utilization of ICT facilities for Agricultural Education in Tertiary Institutions for food security in Cross River State. The study was guided by two (2) purposes, two research questions and one hypothesis. A descriptive survey research design was used in carrying out the study. The population of the study was 160 students and Agricultural education lecturers. The instrument for data collection was a structured questionnaire which was validated by 3 senior lecturers in agricultural education. The reliability of the instrument was determined by the use of Cronbach Alpha technique which yielded reliability co-efficient of 0.83. The data collected were analysed using percentages for research question one, mean and standard deviation for research question two. The hypothesis was tested with t-test statistics at 0.05 level of significance. Based on the analysis of the data, it was found that basic and intermediate ICT facilities were adequate for Agricultural Education at the tertiary institutions for achieving food security in Cross River State. It was recommended that the Cross River government should always ensure that the basic and intermediate ICT facilities should be provided in the schools and the teachers should continue to utilize them.

Keywords: Adequacy, Utilization, ICT, Agricultural Education

Introduction

Agricultural Education is part of total educational process that provides knowledge, develops skills and inculcates attitudes necessary for entry and progress in an agric-business. At higher levels, agricultural education is primarily undertaken to prepare students for employment in the agricultural sector. Agriculture-related disciplines including agricultural communications, agricultural leadership, and extension education are closely related. Applying the knowledge and abilities acquired in a variety of fields to agricultural education, however, is one of the main goals of agricultural education (Abraham, 2013). Agricultural education goes beyond the acquisition of knowledge and skills because it enables students to comprehend the value of agriculture in a global society and specifically in Nigerian society.

The requirements of individuals and groups are prioritized in agricultural education development of social responsibility, knowledge skill acquisition, and occupational values (Ryder, 2010). Agricultural education offers opportunity to gain fundamental agricultural information and skills as well as career advancement and retraining (Fink, 2010). Agricultural education concentrates on three main areas in a vocational education programme: formal classroom instruction, professional experience programmes, and leadership

development. A competency-based curriculum is used to deliver these elements in the context of agricultural education.

The teaching of Agricultural education has an immense impact to humanity in terms of global food supplies, hunger alleviation, economic development and provision of employment (Yusuf, 2007). The focus of Agricultural Education is on man's total existence hence, it is not sufficient to make one-sentence definition of agricultural education. The world book encyclopedia states that "agricultural education deals with instruction in agriculture, useful to farmers, to those engaged in non-farm agricultural occupations and to all persons as parts of their general education. It is the training of learners in the processes of agricultural productivity, as well as in the techniques for the teaching of agriculture. It is teacher preparation in agricultural production and in pedagogical skills in agricultural subject matter areas" (Egbule, 2004).

Agricultural Education therefore is the type of Education that is employed in training learners in the improved agricultural production processes, as well as in the techniques for the teaching of agriculture.

In Nigeria, students are taught agricultural education at tertiary levels to develop self-reliance in food production, to demonstrate that farming is a dignified and profitable occupation and to enhance skills needed in carrying out agricultural practices. This is to develop occupational outlook in agriculture and to enable schools to take an active part in National development through agricultural activities (Vandenbosch, 2006). The educational objectives of teaching Agricultural education at the tertiary institutions in Nigeria are spelt out in the syllabus as follows; to promote an interest in agriculture as an industry and create awareness of opportunities existing in agriculture and related sectors, enhance skills needed in carrying out agricultural practices, provide background for further studies in agriculture, develop self-reliance, resourcefulness and problem solving abilities in agriculture, enable schools to take an active part in national development through agricultural activities and promote agricultural activities which enhance environmental conservation and empowers people, by increasing their self-confidence, their capacity to improve their livelihoods and their participation in wider process of social and economic change (Adu, *et al*., 2014).

The teaching activities in agricultural education at all level especially at tertiary level could be enhanced with the use of Information and Communication Technology (ICT) facilities since ICT has proved to facilitate and improve the production of goods and services in other sectors of the economy.

Information and Communication Technology (ICT) is an indispensable part of the contemporary world, it is an important factor in the global socio-economic development. In fact, culture and society have to be adjusted to meet the challenges of the knowledge age. Hence, it has become so important that every country, organization or institution, no matter how highly or lowly placed want to identify and embrace it. The pervasiveness of ICT has brought about rapid technological, political and economic transformation which has eventuated in the network of society. Information and Communication Technology (ICT) can be seen as the bedrock for national survival and development of a country in a rapidly changing environment. It challenges education planners, and curriculum designers to address a host of vital socio-economic issues such as reliable infrastructure, skilled human resources and other essential issues of capacity building.

ICT is fundamental for the preparation of students in meeting the innovations in the global arena (Adu, 2014). The power of information and communication technology has also had an impact on the sector of education. ICT has undoubtedly had an impact on teaching quality. The use of information and communication technology has the potential

to strengthen instruction, improve learning outcomes for students, and provide chances for connection between the school and the outside world (Krischner & Woperies, 2003; Nwosu, 2009).

Information and communication technology (ICT) is an electronic based system of information transmission, reception, processing and retrieval, which has drastically changed the way people live and the environment in which people live (Ogunsola, 2005). Yusuf (2007), stated that ICT includes electronic technologies used for accessing, processing, gathering, manipulating, presenting and communicating information. Computer -based tools used by people to work with the information and communication processing needs of an organization. He further stated that it encompasses the computer hardware and software, the network and several other devices that convert information (text), images, sound, motion and so on into common digital form (Goliath, 2008).

ICT, according to Ryder (2010), is any technology that permits the exchange and transfer of information. Beebe (2004) stated that ICT is a catch all term for computers, software, networks, satellite links and related systems that enable people to access, analyze, produce, share and use data, information and knowledge in ways that were virtually unthinkable only a short time ago. She suggested that ICT and "internet" can be used interchangeably and that using it to teach agriculture students could be beneficial. ICT is referred to as necessary information analysis, manipulation, storage and distribution as well as the design and deployment of tools and software for these uses (De Watteville and Gilbert, 2000). ICT is defined by Iloanusi and Osuagwu (2010) as the management and processing of information, as well as the use of all computer, communication network and mobile technologies.

ICT facilities are basically technological devices used for the promotion of technological advancement in education (Akawu, 2009). ICT facilities are divided into three (3) categories namely; Basic ICT facilities, intermediate ICT facilities and Advanced ICT facilities.

Basic ICT or constructive facilities is a term used for different types of software and online services that allow people to work together on common projects, regardless of their physical location. It can be something as simple as email and as complex as sophisticated project management software.

Intermediate ICT facilities are communicative facilities which are systems that allow easy communication between teachers and students or between student and teacher to transmit, process, store, create, display, share or exchange information by electronic means.

Advanced ICT facilities are collaboration facilities that make online collaborative projects for distributed group work. There are different types of software and online services that allow people to work together on common projects, regardless of their physical location using sophisticated project management software.

Utilization of available ICT facilities for teaching is therefore a sine-qua-non for qualitative teaching in tertiary institutions. According to Adu, *et al.* (2014), many tertiary institutions around the world are turning to the utilization of ICT in operating diverse systems for man's progress. Since ICT has become key facilities in educational methodology and curriculum delivery globally, it has been identified as an indispensable tool for the development of quality teaching in education system.

Resource utilization is the use of instructional resource. It is the ratio of the working hours at an educational facility to the whole time the facility is open. According to Uwaifo (2009) using instructional materials entails improving the relevance and efficiency of subject training. Furthermore, he revealed that the extent of using educational facilities includes using classrooms, laboratories, school farms, flower garden, school garden, agricultural produce, agricultural machineries, and other resources. According to Uguru and Abdullahi

(2017) functional education aims to equip its students with the necessary skills to integrate successfully into society, make a significant contribution to society's advancement, and lead fulfilling lives operationally. According to Thomas (2016), resource utilization involves the process of managing and structuring resources. Such school's resources should be used in a way that helps pupils develop the learning skills they need. Utilizing resources during teaching results in effective learning because it engages students' sense, inspire them, and accurately represents abstract concepts, which clarifies their meanings. In order to improve efficiency, profitability and the acquisition of necessary skills in the agricultural sector, technology applications in forms that support agricultural education teaching in tertiary institutions primarily involve the use of technology devices for effective agriculture teaching. Services or applications derived from agriculture that enhance various input/output processes are referred to as agricultural technology. In order to achieve security, utilization of ICT facilities is very essential.

The innovations in ICT have affected every aspect of human endeavor including education. The Nigerian education system has now integrated into the curriculum, the utilization of technology tools in teaching. All the sectors of the economy require ICTs skills, but it is commonly observed that many graduates from the higher institutions of learning in the study area lack ICT skills for employment in relevant fields. Again, there is no empirical records on the availability, adequacy and utilization of ICT tools for Teaching and Learning of Agricultural Education in these institutions. The problem and questions which this research study seeks to answer are: Do these institutions have sufficient ICT resources to provide agricultural education? Are available facilities being utilized for effective teaching? It is against this background that this study is designed to determine the Adequacy and utilization of information and Communication technology (ICT) facilities for Agricultural Education in tertiary institutions in Cross River State.

Purpose of the Study

The main purpose of this study was to determine the Adequacy and Utilization of Information and Communication Technology (ICT) Facilities for Agricultural Education in Tertiary Institutions for food security in Cross River State Nigeria. Specifically, the study determined:

i. the adequacy of basic and intermediate ICT facilities for Agricultural Education in tertiary institutions for food security in Cross River State; and
ii. the extent of utilization of basic and intermediate ICT facilities for Agricultural Education in tertiary institutions for food security in Cross River State.

Research Questions

The following research questions guided the study:

1. How adequate are basic and intermediate ICT facilities for Agricultural Education in tertiary institutions for food security in Cross River State?
2. What is the extent of utilization of basic and intermediate ICT facilities for Agricultural Education in tertiary institutions for food security in Cross River State?

Hypotheses

The following null hypothesis was tested at 0.05 level of significance:

Ho_1: There is no significant difference in the mean ratings of lecturers and students on the extent of utilization of basic and intermediate ICT facilities for Agricultural Education in tertiary institutions in Cross River State.

Methodology

This study used survey research design. The population of the study was 160 subjects made up of 109 students and 51 lecturers. The whole population was used for the study. The instrument used for data

collection was checklist and structured questionnaire. The instrument was validated by 3 experts in Agricultural Education. The reliability of the instrument was determined by the use of Cronbach Alpha which yielded a reliability coefficient of 0.83. One hundred and sixty (160) copies of questionnaire were distributed to the respondents and checklist for data collection. The data collected were analysed using percentages for research questions 1 while mean and standard deviation was used to analyse questions 2. The hypothesis was tested using t-test statistics at 0.05 level of significant. In taking decision 50% was used as bench mark, for research questions one (1), while 2.50 was used as cut-off point for decision for research questions two (2). The hypothesis was accepted when the t-calculated was less than the t-table and was not accepted when the t-calculated was greater than t-table.

Results

The results of the analysis of the data collected is presented in the tables below.

Research Question 1

How adequate are basic and intermediate ICT facilities for Agricultural Education in tertiary institution for achieving food security in Cross River State?

Table 1

Adequacy of Basic and Intermediate ICT Facilities for Agricultural Education in Tertiary Institutions for Achieving Food Security in Cross River State

S/N	Items	Bench Mark on Usage	No. of User	No. Available	Percentage of Adequacy	Remark
1	Desktop Computer	1.5	20	34	170	Adequate
2	Note taking app	1.2	20	38	190	Adequate
3	Projector/power point	1.5	20	10	50	Inadequate
4	Tablet/laptop	1.5	20	35	175	Adequate
5	Internet	1.5	20	15	75	Inadequate
6	Smart board	1.2	20	33	165	Adequate
7	Inadequate	1.5	20	05	25	Inadequate
8	Email	1.5	20	33	165	
9	Multimedia accessories	1.5	20	40	200	Adequate
10	Blogs	1.5	20	10	50	Inadequate
11	Word processing	1.2	20	18	90	Inadequate
12	WIKI	1.5	20	10	50	Inadequate
13	Zoom App	1.5	20	15	75	Inadequate
14	whatsApp	1.5	20	12	60	Inadequate
15	Skype	1.5	20	05	25	Inadequate
16	Educational games	1.5	20	06	30	Inadequate
17	Google drop box	1.5	20	07	35	Inadequate
18	E-book	1.5	20	08	45	Inadequate
19	Geographic information system	1.5	20	05	25	Inadequate
20	Remote sensing	1.5	20	05	25	Inadequate

Table 1 revealed that facilities in items 1, 2, 4, 6 and 9 were adequate for Agricultural Education for achieving food security, while facilities in items 3, 5, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and 20 were all found to be inadequate for Agricultural Education at the tertiary institutions for achieving food security in Cross River State.

Research Question 2

What is the extent of utilization of basic and intermediate ICT facilities for Agricultural

education in tertiary institution for food security in Cross River State?

Table 2

Extent of Utilization of Basic and Intermediate ICT Facilities for Agricultural Education in Tertiary Institutions for Achieving Food Security in Cross River State

S/N	Items	Mean	SD	Remark
1	Computer is used in teaching agricultural students in class room	2.58	0.96	Often
2	Recording Software's, is use for recording tap, cassette/video to recording agricultural products in the farm	3.10	0.80	Very often
3	Overhead Projector, it help for easy presentation of lesson in classroom.	2.75	1.13	Often
4	Television/radio Projectors, is use to informed agricultural students about the resumption of school or practical work.	2.86	1.04	Often
5	Power point software, is use for presentation of lesson in the class room sector	2.85	1.11	Often
6	Internet, we use internet facilities for browsing and sending information online.	2.58	1.09	Often
7	Interaction White Board, the teachers uses it to teach and demonstrate in the classroom	3.02	1.05	Very often
8	Scanners, it is to scan document and print	2.88	1.12	Often
9	Printing machine, is use to print paper material work.	2.56	1.10	Often
10	Multi-media projectors, is using in teaching and giving several different ways of information.	2.90	1.09	Often
	Grand Mean	**2.80**		

The results in the Table 2, showed that all the items had their mean scores above 2.50 which is often utilized while items 2 and 7 are in the region of 3.1 – 4.0, which means that they are utilized. However, the grand mean of 2.80 is in the region of 2.5 – 3.0. Therefore, the respondents agreed that basic and intermediate ICT facilities are utilized for Agricultural Education in tertiary institutions for food security in Cross River State.

Hypothesis 1

There is no significant difference between the mean rating of lecturers and students on the extent of utilization of basic and intermediate ICT facilities for Agricultural Education in Tertiary Institutions for food security in Cross River State?

Table 3

Summary of t-test Analysis on Extent of Utilization of Basic and Intermediate ICT for Agricultural Education in Tertiary Institutions for Food Security in Cross River State

S/N	Items	Lecturers N1	Students N2	$\bar{x}$	SD	Df	t-cal	t-crit	Decision
1	Desktop Computer	51	109	3.01	0.95	158	1.42	1.960	NSD
2	Note taking app	51	109	2.64	0.91	158	1.74	1.960	NSD
3	Projector/power point	51	109	3.29	0.68	158	0.20	1.960	NSD
4	Tablet/laptop	51	109	3.30	0.88	158	0.33	1.960	NSD
5	Internet	51	109	3.29	0.88	158	0.57	1.960	NSD
6	Smart board	51	109	3.29	0.86	158	6.88	1.960	NSD
7	Inadequate	51	109	2.77	0.75	158	2.88	1.960	NSD
8	Email	51	109	2.43	1.01	158	2.31	1.960	SD
9	Multimedia accessories	51	109	2.96	0.75	158	0.60	1.960	NSD
10	Blogs	51	109	3.31	1.10	158	0.26	1.960	NSD
11	Word processing	51	109	2.87	1.02	158	8.46	1.960	SD

The result in Table 3 showed that all the items had their t-cal value less than the table value except items 6, 7, 8 and 11. This indicates that the null hypothesis was accepted except on items 6, 7, 8 and 11.

Discussion of Findings

The findings of the study are discussed as follows:

One of the findings was that the basic and intermediate ICT facilities, including computers, note-taking apps, projector/power point internet facilities and others were adequate for Agricultural Education in tertiary institution in Cross River State. This finding is consistent with Eriba and Adejoh (2004) who reported that one of the biggest barriers to the use of ICT was the shortage of some basic ICT. They further stated that adequacy of facilities helps to promote teaching of agricultural education, and further explained that adequate provision of ICT facilities promotes teaching and learning.

Fernandez and Luftglass (2003) observed that the current generation of learners has grown up being overloaded with auditory and visual information through television, the Internet, and smart phones. As a result, many students find that playing on computer-related equipment quickly becomes their preferred method of learning.

Thomas (2016) reported that when the ICT facilities are adequately provided in the school, students are likely to be more progressive in their studies because of the numerous benefits of ICT. For instance, the internet facilities helps students to source information. Lecturers also can source information from the internet for their lecturing and research activities. Students and lecturers can share knowledge and information with others nationally and internationally.

The work also revealed that basic ICT facilities utilization for teaching and learning of Agricultural Education in tertiary institution in Cross River State were properly utilized. This finding agrees with Forsyth (1995) who stated that at the tertiary institutions, the students and lecturers make use of computers, internet facilities, laptops, smartphones, digital camera, email services and power points for the presentation of their seminars. He further explained that effective utilization of ICT facilities promotes the academic performance of the students.

The study also showed that advanced ICT facilities were used for agricultural education teaching and learning in tertiary institutions in Cross River State. This is in line with the findings of Gikas and Grant (2013), and Bannon and Thomas (2014), who found that lecturers utilize basic and

intermediate ICT facilities for teaching and research. They further stated that most high school students utilize the facilities, which has favourable impact on their academic progress. The propensity to use smartphones for learning is expanding as more digital natives enter teaching profession.

The non-significant difference in the hypotheses could be attributed to the fact that teaching and learning involves lecturers and students. The utilization of ICT facilities in teaching and learning in the school, therefore this might have been the basis of the uniformity in opinions.

Conclusion

The importance of ICT in the modern education is something to be encouraged. The study concluded that the basic and intermediate ICT facilities were adequately utilized for Agricultural Education in tertiary institution for achieving food security in Cross River State. It is hoped that ICT facilities and equipment should always be adequately supplied by the Cross River State government for effective utilization by the lecturers in tertiary institutions in Cross River State.

The Cross River State government should provide adequate computer, tablets/ laptop, smart board, smart phone, projector/ power point and interactive video and the lecturers should continue to utilize the facilities for teaching and learning of Agricultural Education. The government of Cross River State should provide adequate slide projectors, film projectors, interactive boards and other multimedia facilities and the lecturers should continue to utilized these facilities for teaching and learning of Agricultural Education in tertiary institutions for achieving food security in Cross River State.

Recommendations

1. The government of Cross River State should always ensure that the basic and intermediate ICT facilities should be provided to the schools for the utilization by the lecturers.
2. The lecturers of Agricultural education at the tertiary institutions in Cross River state should continue to utilize the basic and intermediate ICT facilities for agricultural education for achieving food security.

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ASSESSMENT OF THE ATTITUDE OF CASSAVA FARMER BENEFICIARIES INVOLVED IN THE ROOT AND TUBER EXPANSION PROGRAMME IN OGUN STATE, NIGERIA

ADEOKUN, A. A.
BANJO, J. O. S.
KASSIM, H. K.
AKINNAGBE, O. S.
ABIALA, A. A.
OPEIFA, D. A.
College of Vocational and Technology Education,
Tai Solarin University of Education, Ijagun, Ogun State.

Abstract
Many agricultural technologies have been introduced towards improving the efficiency of crop production systems. Most, if not all of these interventions have not yielded desired result. It is in the light of this that this paper examined attitude of participating farmers towards the Root and Tuber Expansion Programme (RTEP) technologies in Ogun State. Multi-stage sampling technique was used to select two hundred farmers from four blocks in Ogun State ADP. Interview schedule was administered on 50 farmers who were randomly selected from each block to make a total of 200. Descriptive and inferential statistics such as means, chi-square and ANOVA were used to analyse the data collected. The result revealed that 67.3% of the respondents had formal education, which has a great influence on technologies used and 24.6% were below 40 years of age. Majority (86.43%) were married while there were more males than females in root and tuber crop production. Chi-square results indicate no significant relationship between age (χ^2=2.35; p>0.05), marital Status (χ^2=2.23; p>0.05), experience (χ^2=2.42; p>0.05) and attitude of the cassava farmer beneficiaries towards RTEP. However, the Chi-square results revealed significant relationship between sex (χ^2= 1.23; p< 0.05), education (χ^2= 1.87; p<0.05) and attitude of the farmers towards RTEP. The ANOVA results indicate significant difference in the attitude of the cassava farmer beneficiaries towards RTEP in the study area. Based on the results of this study, It is therefore recommended that agricultural extension services to the RTEP beneficiaries should be enhanced to assist the farmers benefit maximally from the RTEP technologies.

Keywords: Root and Tuber Expansion Programme, RTEP technologies, Root and Tuber Crops, Productivity, Nigeria.

Introduction
Over the years, the Nigerian government with support from the Food and Agriculture Organisation (FAO) of the United Nations and other development agencies have made various efforts towards addressing the problems of low production and its related elements in many ways. In order to address the problems of agricultural production and recognizing the role of developmental programme in the overall agricultural development of the nation, the Federal Government introduced several programmes aimed at reversing the decline in food and fibre production, one of such programmes is the Root and Tubers Expansion Programme (RTEP). The RTEP was embarked upon in realization of the important roles of these classes of agricultural produce. The major root and tuber crops such as Cassava, Irish potatoes, sweet potatoes and yam play a significant role in the global food system through their contributions to the energy and nutrition requirements of more than 2 billion people in developing countries, and this will continue over the next two decades. Root and tuber crops produced are consumed by many of the World's poorest and food insecure households (Gregory, *et al*., 2000).

RTEP (as a National Agricultural initiative) is a major key player in the institutional framework for cassava production in Nigeria. The framework follows the procedure of the National Root Crops Research Institute (NRCRI), Umudike and International Institute for Tropical Agriculture (IITA), Ibadan (Phillip *et al.*, 2009). RTEP funded by a loan from International fund for Agricultural Development (IFAD) was established mainly for multiplication and distribution of planting materials. RTEP is an IFAD-assisted project with counterpart contributions from Federal and participating State Governments including Ogun State as well as the beneficiary community groups. At inception in 2003, RTEP was conceived as a root and tuber multiplication scheme but later included a post-harvest component as a result of anticipated production expansion. The program was implemented in 27 cassava-producing states and was recently recommended to include processing and marketing components (Presidential Research and Communication Units [PRCU], 2006).

Low crop productivity and crop failures have continued to persist in the rural areas of Ogun State. Inhabitants of these State are faced with exorbitant prices of Agricultural products in spite of several developmental programmes that abound in the study area. Notwithstanding the availability of agricultural expertise and developmental programmes, majority of members of the farming communities still practice agriculture using the old methods due to spatial and temporal constraints as the technologies and scientific advice do not reach the needy farmers in a timely manner. In addition, most of the farmers are illiterates or with little education. There is therefore a wide gap between agricultural technologies generation and use, resulting in backwardness and economic and social stagnation in these farming communities due to low crop yield (Gregory, *et al*., 2000). RTEP involves the use of improved varieties, certified seed control, seed quality control, and fabricator database etc. Appropriate use of technologies is needed to ensure environmentally sustainable production practices of a diversified range of high quality root and tuber products for foods, feed and industry to help eradicate poverty, ensure access to adequate food and improve incomes. It is against this background that the study assessed the attitude of cassava farmer beneficiaries towards RTEP. Specifically, the study: (i) identified the personal characteristics of farmers in the study area; and (ii) determined the attitude of farmers towards the RTEP.

Hypotheses

The hypotheses of the study are

1. There is no significant relationship between selected personal socio-economic characteristics of cassava farmer beneficiaries and their attitude towards RTEP.
2. There is no significant difference in the attitude of the farmers in Ogun state towards the use of technologies provided through the Root and Tuber Expansion Programme.

Methodology

The study was conducted in Ogun State, Southwestern Nigeria. The target population of the study comprise the root and tuber crop farmers in Ogun State. Root and Tuber Expansion Programme cover four ADP zones in Ogun State (Abeokuta, Ilaro, Ijebu-Ode and Ikenne). The states were purposively selected from the South Western Nigeria because of high volume of production of root and tuber crops. Multistage sampling procedure was used. In all a total of 200 respondents were sampled from Ogun State, however only 199 farmers responded fully to all the items in the schedule. The respondents comprised farmers using root and tuber expansion programmes.

The data for the study were collected through the use of Structured Interview Schedule to obtain information from the cassava crop farmers. Since some of the farmers have little or no formal education, the

items in the interview guide were verbally translated into their local languages but their responses were recorded in English. Data collected were subjected to both descriptive and inferential statistics such as percentages, means, chi-square and Analysis of Variance (ANOVA).

Results and Discussion

Table 1

Distribution of Respondents' Personal Characteristics (n = 199)

Age (yrs)	**Frequency**	**Percentages (%)**
Below 30	19	9.55
30-39	30	15.08
40-49	53	26.63
50-59	60	30.15
60 and above	39	18.59
Sex		
Male	150	75.4
Female	49	24.6
Marital status		
Single	10	5.03
Married	172	86.43
Divorced	8	4.02
Widowed	9	4.52
Educational Status		
No formal Education	65	32.66
Primary education	85	42.71
Secondary education	46	23.12
Tertiary education	3	1.51
Farming Experience (yrs)		
5 and below	19	9.55
6-10	31	18.09
11-15	29	14.57
16-20	46	23.17
21 and above	69	34.67
Total	**199**	**100.00**

Source: Field Survey (2023)

Table 1 shows that most (32.2%) of the respondents were between age 50-59 years, while 26.6 were between the ages 40-49 years. From the distribution, it could be inferred that a simple majority of the sampled respondents are aged. This category shows that these age ranges who would have been interested in technological change are not many among the respondents and farming families at large. According to Taylor and Walker, (1994), older people do not learn as quickly as their younger counterparts. They are hard to train, lack creativity, cannot adapt to new technological change and cannot do heavy physical work. All these attributes could affect their productivity level. Also, few percentages (24.6%) of the respondents were females. In most rural societies in Nigeria, the main source of farm labour is from the family. Thus, there is the belief that women are weak and cannot be exposed to heavy, physical work. According to Hellerstein and Neumark, (1999), sex determination of labour markets may generate a wage gap between men and women that exceed any gap in marginal productivity. The authors further stated that there is, a statistically significant negative relationship between marginal product and the proportion of females. Table 1 reveals that majority (85.9%) of the respondents are married and still living together as a family,

while 4.07 percent are divorced. In rural areas of Africa, the family is a respected institution; they make use of their family as their major source of farm labour. Family structure in most cases greatly affects the productivity level of that family. It is also indicated that substantial number (32.7%) of the respondents had no formal education, close to half (42.7%) had primary education while 23.1 percent had secondary school education. In this modern day world, level of illiteracy is one of the strong determinants of farmers' productivity level. According to Mahmood and Sheikh, (2005), most of the farmers in the rural areas are illiterate or with little education creating a large gap between RTEP and its use and resulting in continuous suffering in farming community due to low crops yield. At least primary level education is required to improve productivity of small farmers and take advantage of "packages" of technology through agricultural extension services. These packages are essentially combination of practices and inputs tailored to specific crops and to land, water and climatic conditions. Farmers need quality basic education to use these extension services (Tariq, 2005). The result as presented in Table 1 shows that 34.67% had more than 21 years of experience in farming. About 23.12% had between 16 and 20 years of experiences in farming. Only 9.5% of the respondents had less than 5 years farming experience. This result supports the position that high productive industries are characterized by high general experience (Hannu *et al.,* 1999). In general, from the results concerning personal socio-economic characteristics, increase in productivity level as a result of adoption of new technologies will have positive influence on the cassava farmer beneficiaries developing positive attitude towards the use of technologies introduced to them through the Root and Tuber Expansion Programme (RTEP).

Table 2

Distribution of Respondents Attitude towards RTEP

S/N	Attitudinal Statements	SA	A	U	D	SD
1.	Farmers can exploit market easily as a result of RTEP	13.6	72.9	6.5	-	7.0
2.	Use of RTEP ensure high productivity level for farmers	19.6	71.4	3.5	5.0	0.5
3.	RTEP are not timely for farming activities	0.5	21.6	26.1	49.7	2.1
4.	Handling of equipment in RTEP is very dangerous	1.0	1.5	10.6	72.4	14.6
5.	Cost of RTEP do of enlarge farmers	-	22.6	6.0	58.8	12.6
6.	Use Of RTEP Are Highly Risky	-	1.5	7.0	71.9	19.6
7.	My level of utilization of RTEP technologies are high	4.0	63.4	4.5	24.6	3.5
8.	I have low technical know-how of RTEP technologies	2.5	44.2	0.5	37.6	15.2
9.	RTEP technologies predisposes to diseases sickness	4.0	2.0	6.5	62.3	25.2
10.	More training is required for the sue of RTEP	12.0	75.0	5.5	6.0	1.5
11.	Seasonability is a great problem for the use of RTEP	3.5	66.3	13.1	15.1	2.0
12.	RTEP technologies are not timely for farming activities	0.5	22.1	26.1	49.3	2.0
13.	Use of RTEP technologies ensure high level of food security	19.6	68.3	3.5	6.1	2.5
		80.2	**532.4**	**119.4**	**458.8**	**108.3**

SA: Strongly Agreed, A: Agreed, U: Undecided; D: Disagreed, SD: Strongly Disagreed
Source: Field Survey (2023)

The results shown in Table 2 reveals that a majority of the farmers (72.9%) agreed that root and tuber expansion programme has really helped them in terms of marketing their produce. Very few percentages (6.1%) disagreed that use of root and tuber expansion programme technologies ensures high level of food security for them and their families, 22.1 percent agreed that root and tuber expansion programme technologies are not

timely for their farming activities. While 26.1 percent of the respondents were undecided about this statement. However, 44.2% agreed that there is low technical- know-how of RTEP technologies among farmers and this is supported when almost all the farmers agreed that there is need for more training in the case of RTEP technologies. The results support the position that seminars, workshops, discussion or any other mode of communication can be sought according to situations for creating awareness regarding agricultural production technologies (Mahmood and Sheikh, 2005). From the results, since high percentages agreed that RTEP helped them in gainfully marketing their produce (72%) and also ensured food security (94%), it could be inferred that the respondents demonstrated positive attitude towards the Root and Tuber Expansion Programme.

Hypothesis 1

There is no significant relationship between selected personal socio-economic characteristics and the attitude of cassava farmer beneficiaries towards RTEP programmes.

Table 3

Chi Square Results Showing Relationship Between Some Socio-Economic Characteristics of the Farmers and Attitude of the Farmers towards RTEP

Variables	χ^2	P-Value	Decision
Age	2.38	0.052	Not Significant
Sex	1.25	0.041	Significant
Marital Status	2.23	0.061	Not Significant
Farming Experience	2.42	0.058	Not Significant
Educational Status	1.87	0.032	Significant

Sources: Field Survey (2023)

Age: The Chi-Square result in Table3[χ^2=2.35; P>0.05] indicate no significant relationship between age and attitude of the farmer towards RTEP. This shows that whether young or old, age does not influence the attitude of the farmer towards the use of RTEP technologies in the study area.

Sex: From the chi-square analysis revealed in table3, there is significant relationship between sex and attitude formed towards RTEP (χ^2=1.23; p<0.05). This implies that the sex of the farmers had influence on the attitude formed towards RTEP.

Marital Status and Experience: The marital status (χ^2=2.23; p>0.05) and experience of the farmers (2.42; p>0.05) are both not significant showing that these variables did not inform the attitude of the farmers towards RTEP Programmes.

Educational Level: The educational status of the farmers indicates significant relationship [χ^2=1.87 P<0.05]. This implies that the educational level attained by the farmers influence the attitude formed towards RTEP in the study area [table 3].

Hypothesis 2

There is no significant difference in the attitude of cassava farmer beneficiaries towards RTEP in Ogun State.

Table 4
ANOVA Showing Difference in the Attitude among the Cassava Farmer Beneficiaries towards RTEP in Ogun State

Variable	Sum of Squares	DF	Mean Square	Fcal	Ftab	Decision
Between Groups	141.28	40	243.45	3.7	2.4	Significant
Within Groups	252.54	159	187.37			
Total	**393.82**	**199**				

Source: Field Survey (2023)

Table 4 indicates significant difference in the attitude of the farmers in Ogun State towards RTEP. The difference could be as a result of the location and cosmopolitanism of the state and the respondents.

Conclusion and Recommendation

Rural farming communities face a multitude of problems towards maximizing crop productivity. In spite of successful researches on new agricultural practices with respect to crop cultivation, majority of the farmers do not get near the upper-limit yield due to several reasons. One of the reasons is expert advice regarding crop cultivation which does not reach farming communities in a timely manner due to several reasons, such as the low ratio of extension agent to farmers (1-2000). The current agricultural extension system is not able to deliver effective advice to all the rural farming communities in a personalized manner. The traditional way of technology dissemination is not meeting the expectation of the farmers due to lack of coverage, fund and lack of personalized advice. This was evident in the attitude of the cassava farmer beneficiaries towards acceptance of RTEP initiatives. It is therefore recommended that agricultural extension services to the RTEP beneficiaries should be enhanced professionally to influence farmers towards developing positive attitude to improved technologies that could promote their production level.

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ANALYSIS OF THE HEAVY METALS CONTENT OF OKPAI-OLUCHI NDOKWA EAST DELTA SOIL FOR EARTH POND AQUACULTURE IN SECONDARY SCHOOLS FOR FOOD SECURITY IN NIGERIA

OGWU, C., *Ph.D.*
Department of Environmental Management and Toxicology,
Delta State University of Science and Technology, Ozoro, Delta State.

AWOWEDE, N. A.
Department of Vocational Education (Home Economics Unit),
Delta State University, Abraka.

ALOAMAKA, T.
OGUNE, P.
Department of Vocational Education (Agriculture Unit),
Delta State University, Abraka.

ONUELU, J. E.
Department of Pharmacology,
Delta State University, Abraka.

Abstract
This study investigated the concentrations of heavy metals in Okpai soil for its suitability for earth pond aquaculture in secondary schools. It was an ex-post facto research that answered 3 research questions and tested a hypothesis. To accomplish these, the research area Okpai Oluchi was mapped out into 5 soil sampling grids (A, B, C, D, E). Soil samples were collected with soil sampling auger from 5 spots in each grid at 15cm depth, bulked, composites drawn, fixed with HNO_3 and wrapped in foil papers for analysis. The analytical standard adopted was USEPA 200.8 and the instrument of determination used for the metals was Agilent inductively coupled plasma optical mass spectroscopy (ICP-MS) model 7850. The mean results obtained were Cd; 0.6±0.12 mg/kg, Cu; 36±0.11mg/kg, Pb, 81.7±0.21 mg/kg, Ni; 30.4±0.13 mg/kg and Cr, 93.5±0.13 mg/kg. The mean concentrations of the heavy metals measured were subjected to test of significance with ANOVA using SPSS model 29 at 0.05 level of significance. The p value was 0.61 thus accepting Ho. The study concludes that Okpai soil is not contaminated by the heavy metals investigated above acceptable limits. It thus recommends that earth ponds aquaculture can be practiced in Okpai Oluchi and its environs. The oil company in Okpai is advised to continue to adopt the world best practices in its operations while the monitoring agencies NESREA and NOSDRA are encouraged to continue with their pace of surveillance on the operations of the oil company in Okpai.

Keywords: Heavy metals, aquaculture, earth pond, secondary schools, and food security

Introduction

The aspiration of nations globally is to ensure that its citizens are food secured. Food security is man's unhindered access to food. It is when all people at all times have physical, social and economic access to sufficient safe and nutritious food which meet their dietary needs and food preference for an active and healthy life (Food and Agricultural Organization, 2015; United Nations Committee on Food Security, 1991). Food security is having unhindered access to good quality food at sufficient quantity (Samuel, 2018, Jones, 2019). It is the measure of one's ability to have access to sufficient and good quality food (Thomson, 2017; Petterson, 2017). Betrand (2019); Spencer (2018); Kissman (2019) see food security as having at all times economic, social and physical access to good quality food at affordable price. This was reiterated by Brackson (2018), Tedwell, (2019) that people are

considered food secured when they have the means to access good quality food that satisfy their taste, social and physiological needs. It is being able to at all times have uninterrupted access to good quality food that is within the economic reach (Richardson, 2019; Jackson, 2019). According to Boss, (2020) food security exists in a household when all the people in the household have economic; social and physical access to nutritious food, in good quality, quantity and at affordable prices.

Alexandra (2019) and Davidson (2020) stated that food security is positively correlated to employment and unemployment rate in a given country. Succinctly put by Shedrack (2020), no country can achieve food security when majority of its citizens are not gainfully employed. Adults and youths unemployment is a threat to food security (Drake, 2021; Dwell, 2020). Nigerians unemployment rate as at the last quarter of 2022 according to National Bureau of Statistics, (2023) is 40.2 percent International Monetary Fund (IMF) (2023) opined that in 2022, 40.5 percent, of Nigeria people were out of jobs while World Bank (2022) puts the percentage of Nigeria citizens who are not gainfully employed at 41.2 percent.

Nigeria government should provide enabling environments for youths' skills acquisition for empowerment, job creation and food security (Abdulrasheed, 2020; Abioye, 2021; Okonkwo, 2022). Youths agriculture such as Youth in Agricultural Enterprise (YAGEP) programme by the government of Delta state is the panacea to empowerment, job and wealth creation and food security in Nigeria (Okowa, 2022). This position is in tandem with Tahir (2019) Asuquo 2020, Obaseki (2022) that the veritable tool for solving youths' unemployment in Nigeria is youths' engagement in agriculture for empowerment, job creation and food security. Ozah (2018); Odede (2018) advised youths to take to aquaculture for its high rate of return on investment, job creation, food security and to save Nigeria foreign exchange.

Nigeria annual fish demand is 1.1 million metric tonnes while it produces 850,000 metric tonnes (NBS, 2022; Ruwani, 2022, Oteriba, 2022). Betiku, (2018) Ajayi, 2019) Ndego (2020) advised Nigeria youths to venture into aquaculture deploying earth pond due to its low capital investment. Earth pond is an aquacultural practice where fish and other aquatic organisms are raised in an excavated pits (ponds) (Njoku, 2016; Adekoya, 2015). Ojo (2012); Abubakar (2015) advised that in deploying earth pond, soil analysis should be conducted for soil physical suitability and possible presence of pollutants to avoid bioaccumulation and biomagnification. Possible soil pollutants as highlighted by United States Environmental Protection Agency (USEPA) (2012) Food and Agricultural Organisation (2015); Ogwu (2022) include microplastics, dioxins, furans, polyaromatic hydrocarbons (PAHs) pesticides residues and heavy metals. Heavy metals are 23 out of 35 known metals with high Atomic Weight (USEPA, 2012, World Health Organisation, 2018). Metals with high Atomic Weights that exist in nature and are toxic to health at above certain critical levels (Atshana & Atshana, 2012).

Bioaccumulation is the tendency of toxicants in aquatic environment to gain entry into the tissue of organisms while biomagnification (biomultiplication) is the propensity of the toxicants to multiply in geometry once in the organism tissues (USEPA, 2019; WHO, 2018; Ogwu, *et al*., 2021a; Ogwu, *et al*., 2021b). Ingestion of heavy metals contaminated food results in health complications such as cancer, cardiovascular diseases, osteoporosis, memory loss, brain damage and death (USEPA, 2012; WHO, 2018). The focus of this study is the assessment of the heavy metals concentration in Okpai Oluchi soil for its suitability for earth pond aquaculture in secondary schools for youths' empowerment, job creation and food security in Nigeria.

The heavy metals investigated are copper (Cu), lead (Pb), nickel (Ni), chromium (Cr) and cadmium (Cd). The study was guided by research questions as below:

1. What are the concentrations of Cd, Cu, Pb, Ni, and Cr in Okpai Oluchi soil?
2. Are the concentrations of the heavy metals within the maximum acceptable limits for the metals in soil as recommended by WHO (2014)?
3. Can earth pond aquaculture be deployed in Okpai Oluchi soil?

Hypothesis

H_o: There is no significant difference between the concentrations of heavy metals in Okpai Oluchi soil and WHO maximum permissible concentrations (MPC) for the metals in soil.

Study Area



Figure 1: Map of Okpai Oluchi
Source: Map Data (2023)

Okpai Oluchi is a wetland community in Ndokwa east local government area Delta state Nigeria. It lies within the geographical coordinates of latitude 5.72300N and longitude 6.59900E with a land area of 4.2Km^2 (Googlemap, 2022) and population of 20,126 people (National Population Census, 2006). Situated at the distributary of River Niger, Okpai Oluchi land experiences annual inundation which leaves fertile alluvial deposits hence Oluchi people are predominantly farmers and fishermen. Some are traders, a few are artisans while very few work as civil servants in primary and secondary schools and in the village health centre. As an oil bearing community, Okpai plays host to Agip Oil Company and gas plant, thus a few Okpai people work in oil industry at varying cadres.

Methodology

Grid soil sampling design as described by Oden, (2020) was employed in this study. Okpai Oluchi was mapped out into 5 sampling grids (SG) and from each of the SG soil samples were collected with soil sampling auger from 5 spots at 15 cm depth. The samples from each SG were bulked and composites drawn fixed with nitric acid, wrapped in foil papers and stored in sample boxes for analysis. The analytical standard adopted for this study is America Environmental Protection Agency (USEPA) method 200.8.

Analysis: The soil samples were oven dried at 105 ^{0}C for 3 hours to expel the moisture. The dried soil samples were crushed with mortar and pestle and sieved with 2mm Agilent sieve. 5g of each sample was weighted out into beakers and digested with 10ml concentrated hydrochloric acid and 3.5 ml nitric acid for 30 minutes. The digests were kept for 12 hours (Overnight) then heated for 1 hours at temperature of 104 degree Celsius. Deionized water was added and the mixture filtered with Agilent 300 filter and made to mark with 100ml double filtered deionized water. The metals investigated were determined using the filtrates, with Agilent Inductively Coupled Plasma Optical Mass Spectroscopy (ICP-MS) Model 7850.

Results

The results of the heavy metals content of Okpai Oluchi soil are as in Table 1.

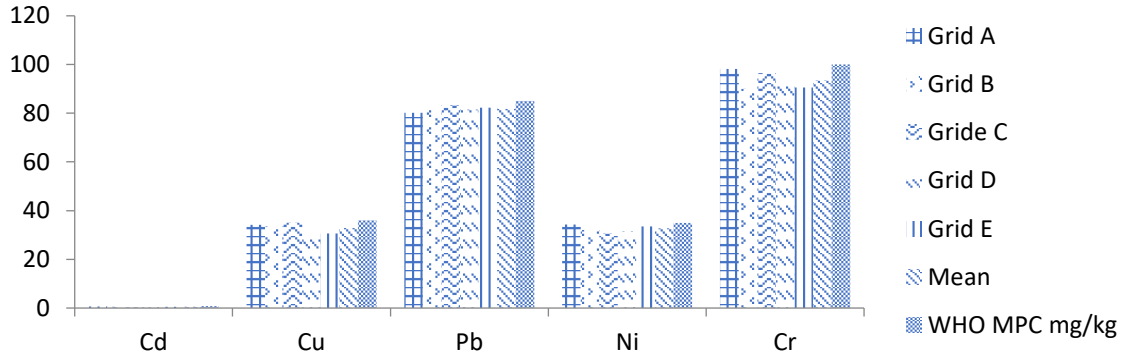
Table 1

Heavy Metals Content of Okpai Oluchi Soil and WHO MPC for Heavy Metals in Soil in mg/kg

Heavy metal	SAMPLE GRID					Mean	WHO MPC mg/kg
	A	B	C	D	E		
Cd	0.6	0.5	0.4	0.6	0.5	0.52	0.8
Cu	34.2	33.5	35.1	31.2	30.6	32.9	36
Pb	80.2	81.4	83.3	81.5	82.3	81.7	85
Ni	34.3	32.1	30.6	31.5	33.5	32.7	35
Cr	98.2	90.1	96.5	92.1	90.5	93.5	100

Figure 2

Result of the Heavy Metals in Okpai Oluchi Soil and WHO MPC in mg/kg



Discussion of Findings

The analysis of the soil samples from the various sampling grids in Okpai Oluchi presented varying concentrations of the heavy metals investigated. The concentrations of Cd was between 0.4 mg/kg in SG "C" to 0.6 mg/kg in SG "D" with a mean content of 0.52 mg/kg. The WHO 2014 maximum permissible concentration for Cd in soil is 0.8 mg/kg. The concentration of Cd in Okpai Oluchi is within the acceptable limit. This result is similar to Omabi, (2018) who reported low Cd content in Usen and Uzebba soils in Edo state Nigeria but at variance with Ogwu (2021), Ogwu *et al*., (2022) who reported high content Of Cd in the soils of Ugiliamai and Umukwata.

The content of Cu in Okpai Oluchi soil the analysis revealed was between 35.1 mg/kg in SG "C" to 30.6 in SG "E" with a mean concentration of 33.0 mg/kg. The WHO recommended critical point for Cu in

soil is 36 mg/kg, thus, the level of Cu in Okpai Oluchi soil is within maximum permissible limit. This result is similar to Ogwu *et al*., (2021); Ogwu *et al*. (2022) who reported high content of Cu in Beneku and Ushie soils respectively. It is however, in disagreement with the result reported by Clarke and Adeyemi (2020) on Igborusun soil Badagry Lagos.

The concentration of Pb in Okpai Oluchi soil was between 80.2 mg/kg in SG "A" to 83.3 mg/kg in SG "E" with a mean concentration of 81.7 mg/kg. WHO MPC for Pb in soil is 85 mg/kg. The Pb in Oluchi soil falls within permissible level. This result is in consonance with Arinze (2018), who reported low Pb content in Onicha-Ukwu Delta state and Akintola (2019) in Omuaran soil, Kwara state but in disagreement with Ogwu *et al*., (2021) who reported high content of Pb at Uzere soil Delta state. Nigeria.

Nickel concentration the analysis of Okpai Oluchi soil showed was between 30.6 mg/kg in SG "C" to 34.3 mg/kg in SG "A" with a mean of 32.4 mg/kg. Maximum permissible concentration for Ni in soil as stipulated by WHO is 35 mg/kg. The concentration of Ni in Okpai Oluchi is within tolerable limit. Ogwu *et al*., (2022) had a similar report of low Ni in Ashaka soil Delta State but loyem (2022); Okosun (2020) reported high Ni content in Katsina Ala in Benue state and Ugoneki in Edo state respectively.

Soil analysis for Cr content in Okpai Oluchi presented different concentrations of Cr metal ranging from 90.1 mg/kg in SG 'B' to 98.2 in SG. 'A'. with a mean concentration of 93.5 mg/kg. The maximum limit acceptable for Cr in soil by WHO is 100 mg/kg. Cr content in Okpai Oluchi soil is within acceptable range. Ogodu and Amusan (2019) recorded similar report of low Cr in Ijebu-lgbo soil Ogun state.

However, the result of Cr in Okpai Olu soil is at variance with Ogwu *et al*., 2020 who reported high content of Cr in Amai soil Delta state Nigeria.

Conclusion

The yearning of every country is to achieve food security for its citizen for healthy and productive economy. Achieving food security is predicated on having a population of adults and youths who are gainfully employed. Nigeria economy has been saddled with high level of unemployment, thus jeopardizing its quest for achieving food security by 2030. Many models have been suggested for youths' empowerment and job creation for food security and youths' aquaculture has been highly favoured. Good quality water is a factor in aquaculture and that underscores this study. The analysis of the heavy metals content of Okpai Oluchi soil shows that the contents of the heavy metals investigated are within acceptable levels thus making deployment of earth pond for aquaculture for youths' empowerment, job creation and food security feasible.

Recommendations

Consequent upon the results of the analysis of Okpai Oluchi soil for earth ponds aquaculture in schools, the study recommends as follows:

1. Earth ponds should be deployed by schools and youths in Okpai Oluchi and environs.
2. The oil companies operating in Okpai (Agip) is enjoined to continue to operate within the ambit of operational guidelines and in line with world best practices.
3. The monitoring agencies, Nigeria Environmental Standards Regulation and Enforcement Agency (NESREA) and National Oil Spills Detection and Reponses Agency (NOSDRA) are advised to keep up the pace of their surveillance on oil exploitation company, AGIP in Okpai.

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WORK-SKILLS IN CASSAVA PROCESSING AND MARKETING REQUIRED BY AGRICULTURAL EDUCATION STUDENTS OF COLLEGES OF EDUCATION IN SOUTH-WEST, NIGERIA

OLUFEMI A. ADEKUNLE
College of Vocational and Entrepreneur Education,
Department of Agricultural Education,
Lagos State University of Education, Otto/Ijanikin,Lagos State.

JAMES O. S. BANJO, *Professor*
College of Vocational and Technology Education,
Department of Agricultural Science Education,
Tai Solarin University of Education, Ijagun, Ogun State.

Abstract
This study identified works skills required by students of Colleges of Education in the mechanical processing of cassava into garri in South-West, Nigeria. It employed descriptive survey research design. Three research questions guided the researcher. This study was carried out in South-western states of Nigeria. A total population of Eight hundred and eighty-six (886) comprising of one hundred and forty (140) Agricultural education lecturers and seven hundred and forty-six (746) Agricultural extension officers was used for the study while a total of three hundred and sixty-eight respondents were selected using multi-stage sampling techniques. Instrument for data collection was a structured Questionnaire. The internal consistency of the instrument was determined to be 0.99 using the Cronbach. Alpha Model. The SPSS version 26.0 was used to analyse the data using the mean and standard deviation. The findings of the study revealed that N.C.E students required 10 items on work-skills in planning activities for processing cassava into garri, 9 items on work skills were needed in the mechanical processing of cassava into garri and 10 items on work-skills were needed in marketing activities in the processing of cassava into garri. It was recommended by the researchers that the identified work-skills should be incorporated into the curriculum of agricultural education programmes and also the government of south –west states should develop training modules with these identified work-skills to be used in training youths in the different skills acquisition centres, innovative vocational centres etc. located within and outside their geographical region.

Keywords: Work-skills, Students, Colleges of Education, Agricultural Education, Curriculum, South-West.

Introduction

The increasing importance of cassava (*Manihot esculenta*) among crops grown in Nigeria is not only connected to its increasing demand as food but also as food security (FAO, 2018). Cassava (*Manihot esculenta*) is a major root crop in the tropics, particularly in Africa. It is an important staple food for millions of people and has the potential to generate income for small-scale farmers. Nigeria is one of the leading producers of cassava in the world, and the crop is central to the economy of many rural communities in the country.

It is estimated that more than 90% of cassava production is processed into food. But a significant industrial demand exists for cassava, primarily as substitution for imported raw materials and semi-finished products. There is high demand for high quality cassava flour, primarily from 10% replacement in bread flour and for use in bouillon, noodles, and the adhesive industry (dextrins).

Processing cassava into garri is a major enterprise that contributes significantly to the food security and economic growth of Nigeria. Garri is a popular food product in Nigeria, consumed by people of all ages and socio-economic classes. It is a derivative of cassava, which is processed through a series of operations, including peeling, washing,

grinding, sieving, fermenting, and roasting. Cassava processing is prominent in the traditional scale, subjecting the processing to a number of undesirable attributes which are time-consuming, low yields and lack of storage capacities (Olanrewaju, *et al*., 2017).

In Nigeria our rural farmers play cardinal roles in the production of cassava. They are responsible for its processing and marketing as well provides additional income earning opportunities and enhances their ability to contribute to household food security. This is because cassava is seen by many smallholders as a reserve crop and a crop for producing some of the most consumed staples across the countries (FAO, 2018).

There is also dearth of required skills in innovative technologies in processing cassava into garri. There is then the need for mechanized cassava processing technologies which will serve as panacea to the above listed challenges and hence, lead to increased production of garri for the populace. However, despite considerable efforts to improve productivity through the sustained promotion of new and improved cassava varieties, adoption rates have not been well documented (Abdoulaye, *et al*., 2014). The Government is aware of this problem of increasing cassava production and other staple food crops like yam, rice and maize. In achieving this aim, it is of importance therefore to prioritize the educational sector, especially at the colleges of education level through the reviewing of the Agricultural education curriculum to include practical skills needed in the production, processing and marketing of cassava.

Therefore, if the agricultural education students of colleges of education are exposed to the required skills in the processing of cassava into garri, they might graduate with the capability to start production of garri as it provides them with knowledge and skills that are relevant to their future careers in the agricultural sector helping to decrease the rate of unemployment among our teeming youths in the different skill acquisition centres, Innovative Vocational Centres, Agro-Entrepreneurial centres where learners can be taught these identified work skills.

In order to fill these skill gaps amongst the NCE students, the work skills modules when identified in this study may serve as template for the work skills required in the processing of cassava into garri for inclusion into the curriculum of the Agricultural education by the N.C.C.E.

Purpose of the Study

The general purpose of the study was to identify works skills required by students of colleges of education in cassava production and processing enterprise in South-West, Nigeria. Specifically, the study sought to determine the work-skills required in:

i. planning activities in processing cassava into garri by agricultural education students of colleges of education in South-West, Nigeria;
ii. mechanical procedure in processing cassava into garri by agricultural education students of colleges of education in South-West, Nigeria; and
iii. marketing activities in processing cassava into garri by agricultural education students of colleges of education in South-West, Nigeria.

Research Questions

The following research questions guided the researcher in this study:

i. What are the work-skills required in planning activities in processing cassava into garri by agricultural education students of colleges of education in south-west, Nigeria?
ii. What are the work-skills required in mechanical procedure in processing cassava into garri by agricultural education students of colleges of education in south-west, Nigeria?
iii. What are the work-skills required in marketing activities in processing cassava into garri by agricultural education students of colleges of education in south-west, Nigeria?

Methodology

This research work adopted a descriptive survey research design. This design was considered appropriate by the authors since no variable was manipulated in this study. This study was carried out in South-Western states of Nigeria. The population of the study was Eight hundred and eighty-six (886) subjects comprising of one hundred and forty (140) Agricultural education lecturers and seven hundred and forty-six (746) Agricultural extension while a sample of three hundred and sixty-eight respondents were selected using multi-stage sampling technique. A 29-skill items questionnaire titled "Skills Required by students in Colleges of education in the Production of garri Questionnaire (SRSCPOEQ) was developed from literature by the researchers and used for data collection with four point scale of HR, AR, SR and NR (HR - Highly required = 4 points; AR - Averagely required = 3 points; SR - Slightly required = 2 points and NR - Not required = 1 point). The internal consistency of the instrument was determined to be 0.99 using the Cronbach. Alpha Model. The SPSS version 26.0 was used to analyse the research questions one, two and three using the mean and standard deviation. In deciding on the skills needed, the real limits of numbers were utilized for decision making and the decision rule is any item that had a mean value of 3.50 and above was interpreted as Highly Required (HR), 2.50 – 3.49 to mean Averagely Required (AR), 1.50 – 2.49 to mean slightly Required (SR) and 0.50 – 1.49 to mean Not Required (NR).

Results

Research Question 1

What are the work-skills required in planning activities in cassava processing enterprise into garri by agricultural education students of colleges of education in South-West, Nigeria?

Table 1

Mean Ratings of Agricultural Education Lecturers and Agricultural Extension Officers on the Work-Skills Required in Planning Activities in Processing Cassava into Garri by Agricultural Education Students of Colleges of Education in South-West, Nigeria (n = 368)

S/N	Item Statement	Mean	SD	Remark
1.	Formulate the objective of the garri enterprise venture.	3.52	0.75	Highly Required
2.	Identify suitable location for the garri business enterprise venture.	3.60	0.71	Highly Required
3.	Identify source of credit for garri enterprise.	3.51	0.68	Highly Required
4.	Determine the type of range (short or long) to adopt in the business.	3.61	0.59	Highly Required
5.	Select and specify that cassava variety that most suits garri production.	3.52	0.68	Highly Required
6.	Identify appropriate facilities and equipment for garri production enterprise.	3.85	0.42	Highly Required
7.	Employ qualified personnel for garri enterprise.	3.85	0.42	Highly Required
8.	Identify garri processing records to be kept in the enterprise.	3.33	0.87	Averagely Required
9.	Identify suitable market for the processed garri.	3.55	0.65	Highly Required
10.	Craft suitable markets for the processed enterprise.	3.41	0.89	Averagely Required
	Grand Mean	**3.57**	**0.66**	

Source: Field Survey (2022)

The data presented in Table 1 above revealed that 10 items on work-skills required by NCE students in planning activities for cassava processing enterprise have their mean scores ranging from 3.33 to 3.85 which indicates that they fall within the response

category of Highly required (HR) and Averagely Required (AR). This observation implies that all the skills were required as planning activities for cassava processing enterprise in south-west states of Nigeria. The work-skills also had standard deviation ranging from 0.42 to 0.89; this showed that the opinion of the respondents were close to each other and were not too distant from the mean.

Research Question 2

What are the work-skills required in mechanical processing of cassava into garri in the Agricultural education curriculum for students of Colleges of Education in South-West, Nigeria?

Table 2

Mean Ratings of the Responses of Lecturers of Agricultural Education and Agricultural Extension officers on the Work-Skill Required in Mechanical Processing of Cassava into Garri by Agricultural Education Students of Colleges of Education in South-West, Nigeria (n=368)

S/N	Item Statements	Mean	SD	Remarks
1.	Harvest matured cassava tubers with machine.	3.55	0.70	Highly Required
2.	Peel matured cassava tubers using the peeling compartment.	3.52	0.68	Highly Required
3.	Wash peeled cassava tubers in water.	3.50	0.68	Averagely Required
4.	Crush washed cassava tubers using machine into pulp.	3.52	0.72	Highly Required
5.	Press cassava pulp to release water, using the mechanical presser.	3.41	0.82	Highly Required
6.	Sift cassava cake using a machine.	3.82	0.45	Highly Required
7.	Fry sifted cassava cake in the frying using motorized machine.	3.84	0.42	Highly Required
8.	Collect processed garri into pocket of bags using motorized machine.	3.88	0.39	Highly Required
9	Sell processed garri in the factory or market.	3.63	0.78	Highly Required
	Grand Mean	**3.63**	**0.63**	

Source: Field Survey (2022)

Table 2 showed that the 9 items on work skills required by NCE students in mechanical processing of cassava into garri have their mean scores ranging from 3.50 - 3.88 which indicates that they fall within the response of highly required (HR) and averagely required (AR). This observation implies that all the skills were required in mechanical processing in cassava processing enterprise in South-west, Nigeria. The work-skills had standard deviation ranging from 0.42 to 0.82; indicating that the opinion of the respondents were close to each other and were not too distant from the mean.

Research Question 3

What are the work-skills required in marketing activities in cassava processing enterprise into garri by Agricultural education students of Colleges of Education in South-West, Nigeria?

Table 3

Mean Ratings of the Responses of Lecturers of Agricultural Education and Agricultural Extension Officers on the Work-Skills Required in Marketing Activities in Cassava Processing Enterprise into Garri by Agricultural Education Students of Colleges of Education in South-West, Nigeria (n=368)

S/N	Item Statements	Mean	SD	Remarks
1.	Advertise the processed garri .	3.55	0.65	Highly Required
2.	Explore available market outlets.	3.55	0.79	Highly Required
3.	Determine when and how to supply garri for high profit.	3.85	0.42	Highly Required
4.	Operate a scale to ascertain the garri weight.	3.85	0.42	Highly Required
5.	Determine the prices for different grades of garri.	3.52	0.68	Highly Required
6.	Transport garri to the market.	3.50	0.68	Highly Required
7.	Sell garri to interested buyers.	3.50	0.59	Highly Required
8.	Reconcile sales and production records of ascertain profit or loss.	3.54	0.65	Highly Required
9	Keep records of event in the enterprise.	3.54	0.62	Highly Required
10	Keep inventory records of all purchases and sales in the enterprise.	3.60	0.71	Highly Required
	Grand Mean	**3.61**	**0.62**	

Source: Field Survey (2022)

Table 3 revealed that 10 items on work-skill required by NCE students in marketing activities in processing cassava into garri have their mean scores ranging from 3.50 to 3.85 which indicates that they fall within the response category of Highly Required (HR) and Averagely Required (AR). This observation implies that all the skills were required in marketing activities in cassava processing enterprise in South-west, Nigeria. The work-skills items had their standard deviation values ranging from 0.42 to 0.79; which shows that the opinions of the respondents were close to each other and were not too distant from the mean.

Discussions of Findings

The findings on the work-skills required in planning activities in cassava processing enterprise into garri by agricultural education students of Colleges of Education in south-west, Nigeria revealed that all the work-skills in the item statements were required. The above findings are in conformity with the findings of Mgbehurike (2001) who said that planning skills involved stating reliable objectives for the enterprise, revising the objectives periodically, determining the scale of production for the enterprise. The findings of this study on planning activities is also in agreement with the study of Alali (2016) which posited that cassava processors need capacity building in the 14 skills on planning skills in cassava processing and marketing enterprise.

The findings on the work-skills required in mechanical processing in cassava processing enterprise into garri by agricultural education students of colleges of education in south-west, Nigeria revealed that all the work-skills in the item statements were required**.** This finding is in support of Maduekwe (2008) who opined that more efficient farming is brought about by new technology and this could lower cost of production and thus enhance the competitive position of agricultural products on the international market.

The findings on the work-skills required in marketing activities in cassava processing enterprise into garri in the agricultural education curriculum for students of colleges of education in south-west, Nigeria revealed that all the work-skills in the item statements were required. The findings of this study on marketing of garri, is also in agreement with the study of Aliu, (2017) who maintains that processing and marketing of agricultural products start from farmers gate to finished products for

distributing, storage, and sales to consumers in retails and wholesales as packaged, graded and ungrated using different price index for each measure in the market. The finding on marketing of garri was in agreement with the opinion of Ebewore and Idoge (2015) who said that marketing activities in garri enterprises involved buying, selling, transporting, storing, grading, financing, risk-taking and market information.

Conclusion

The demand for cassava roots and its products are high and fast rising day by day as it remains one of the staple foods in Nigeria. The increase in demand is not only because of the increasing population of the consumers but the fact that the supply is not proportionate to the demand as its production is mostly in the hands of the old aged peasant farmers who use traditional methods in the processing of the various cassava products.

The findings of this study revealed that cassava processing and marketing skills are required by graduates of College of education for success in a garri production and processing enterprise in south western Nigeria and that the variable under investigation contributes significantly to the increase as a way of alleviating the problem of food insufficiency in the country. Thus, this study was necessitated by the high demand for garri and need to graduate Agricultural education NCE students equipped with the required skills in processing cassava into garri.

Recommendations

Based on the findings of this study, the following recommendations were made for implementation:

1. The identified work-skills in the modules should be incorporated into the curriculum of the Agricultural education programme as well as other institutions like vocational/skills acquisition centres where it could be used for training unemployed youths in cassava processing.
2. The lecturers of Agricultural education should be encouraged to teach these identified work-skills in the modules to their learners in order to inculcate in them the right skills to go for success in cassava production and processing enterprise.
3. The government of the south western states in Nigeria should ensure that these identified skills are packaged as Training Modules of Cassava processing and marketing used in the training of trainees in the different skill acquisition centres, Innovative Vocational Centres, Agro-Entrepreneurial centres located within and outside the region.

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FISH FARMERS' UTILIZATION OF ICT IN PRODUCTION, PROCESSING AND MARKETING FOR FOOD SECURITY IN UGHELLI NORTH LOCAL GOVERNMENT AREA

AGBAVWE EDWIN
CANICE N. IKEOJI, *Professor*
Department of Vocational Education (Agricultural Education Unit),
Faculty of Education,
Delta State University, Abraka.

Abstract
The study was designed to assess fish farmers' utilization of ICT in production, processing and marketing of fish for food security in Ughelli North Local Government Area of Delta State. The population of the study consists of fifty (50) registered fish farmers in the study area. The sample size was made of 25 respondents who were randomly selected. The data collected was subjected to descriptive statistics of simple percentage, frequency distribution and mean. Findings on the awareness of farmers' utilization of ICT in fish production, processing and marketing shows that majority of the respondents were males, which shows their dominant position in the fish farming sector. The result from the findings on awareness of farmers in ICT utilization in fish production, processing and marketing showed that there is a high level of awareness of the use of internet to advertise fish and fish products, the use of ICT facilities in ordering for available fast growing fingerlings, the use of ICT to obtain market prices and the use of ICT to get information on market location for fingerlings and broodstock. ICT devices commonly used includes television, mobile phone, radio, internet and among others. Fish farmers needed information on pond construction, stocking, water management, general management, processing and marketing and many more. Fish farmers source information from extension agents, friends/relatives and fisheries experts, on various fish farming management practices. The challenges facing them include high cost of acquiring ICT devices, unstable power supply, low level of education (illiteracy level), poor accessibility to ICT facilities, high cost of ICT accessories, among others. The study recommended that ICTs should be made available and affordable to all farmers, as this will help to encourage them to develop positive attitude towards seeking information relevant to their needs.

Keywords: Fish Farming, ICT, Fish Production, Processing, Marketing

Introduction

In most developing countries, agriculture is the most important economic activity which provides food, employment, foreign exchange and raw materials for industries. Agriculture provides livelihood for at least 53% of the economically active population of Africa (Ajala & Ononogbo, 2008). Fisheries which is an aspect of agriculture offers a key entry point to reach millions of poor people of Africa, including Nigeria to assist in increasing people's income, improving the nutrition and health of families and becoming active agents of economic development and social change (Bene & Hecks, 2005). Generally, agriculture is an information intensive industry. The sector draws upon infinite sources of widely dispersed, locally contextualized knowledge and a considerable body of research materials. It relies upon continuous flow of information from local, regional and world markets (Rutger, 2000). It involves such sub-sectors as fish farming, crop production and livestock rearing.

Fish farming also known as Pisciculture is an aspect of agriculture that involves the controlled keeping and rearing of fish commercially, in natural and artificial ponds. It is a source of livelihood for millions of small-scale operators in Nigeria. Fish species commonly cultured in the country include *Clarias gariepinus, Heterobranchus bodorsalis, Tilapia spp, Mugie spp, Chrysichthys nigrodigitatus, Ophiocephalus obscure, Cryprinus carpio, Heterotis*

niloticus and Megalo spp. Fish farming has become a common practice to increase the income of practitioners and in the process reduce the wage bill expended on fish importation. Fish farmers thus need information to optimize production. The advent and recent advances in Information and Communication Technologies (ICTs) have had profound impacts on all works of life and aquaculture is ne exception. ICT has increasingly challenged old ways of delivering important services to citizens and transformed traditional societies into knowledge societies in the third world countries (Shana & Marlene, 2015).

ICT tools unlike the traditional agricultural information dissemination methods, have the benefit of offering a cheaper way of communicating and sharing innovative knowledge to fish farmers in the fastest way; delivering training and quality education to farmers, and improving farmers' access to markets and aquaculture credit (Barguma & Ndaghu, 2014). According to Aphunu and Atoma (2011), optimal fish farming production depends on having an edge on information related to the market, efficient allocation of available resources and use of new or innovative farming practices. As such, sustainable development of aquaculture requires fish farmers to have access to ICT infrastructure that is vital to increasing the flow of information. This information is meant to serve as a means of empowering fish farmers to ease the challenges of carrying out fish breeding and rearing effectively. The increasing importance of aquaculture as an alternative source of protein has further emphasized the need to adapt and develop advanced ICT for better management of aquaculture facilities as well as aquaculture development. Hence, appropriate deployment and use of information and communication technologies (ICTs) is pivotal to increasing fish farming production and improving the marketing and distribution strategies of fish production (ljatuyi, *et al*., 2016).

World Bank (2011) stated that the proliferation of adaptable and more affordable technologies and devices has also increased ICTs relevant to small holder agriculture. Innovation has steadily reduced the purchase price of of phones, laptops, scientific instruments and specialized software. 1CT devices like radio, television, cellular phones, computers, tablets and networking hardware and software, satellites systems facilitates farming activities (Pande & Deshmukh, 2015). According to Bhalekar & Pathak (2015), ICT plays an important role in enhancing the impact and performance of agricultural production and by extension, directly alleviate poverty through credit and financial services. Similarly, Yimer (2015) similarly indicated that ICT furnishes up-to-date knowledge and information on agricultural technologies, best practices, markets, price trends and weather conditions.

Fish farming contributes to ensuring nutrition, security and good health of families (Bene & Heck, 2005; Aphunu & Atoma, 2011). It also provides raw materials for industries in the food value chain. The rapid increase in population of Nigeria and the renewed awareness of the nutritional advantages of fish consumption over meat has continued to raise the demand for fish. Jiriko, *et al.* (2015) also blamed the wide gap between the local production and consumption of fish in the country on the poor technological know-how of fish farmers, thereby raising the need for improved fish farming technologies for better fish production, processing and marketing. The role of information in fish farming cannot be overemphasized as farmers need to be updated with various fish farming technologies necessary for high productivity. Ljatuyi, *et al.* (2016) posited that information is pertinent in fish farming for increasing production, improved marketing and distribution strategies for fish products. It has been argued that unlike the traditional information dissemination methods, ICTs have the advantage of presenting a cheaper and faster way of communicating and sharing knowledge 4 and information (Barguma & Ndaghu, 2014; Okello, *et al*., 2014). Studies have shown that applying proven

technologies will increase the production of small-scale operators that constitutes80 percent of global fish farmers (Aphunu & Atoma, 2011). The search for an effective, efficient and lasting strategy for agricultural development; fish farming inclusive, calls for adequate utilization and application of ICTs, especially computers, microcomputer applications and the internet, which are considered the principal drivers of information flow for economic growth and development worldwide (Abubakar & Abdullahi, 2009; Aphunu & Atoma, 2011). Though there is wide use of information technology in social communication and network in Nigeria, there seems to be limited access and utilization of these technologies for agricultural development in terms of production, processing and marketing. Encouragement to ICTs application in agriculture is important as many rural communities still depend on traditional means such as family, neighbors and other farmers for information on agriculture. Omotosho, *et al.* (2019) noted that the level of awareness of innovation has been reported to influence its adoption. Also socio-economic characteristics often determine farmer's attitude and by extension, use of innovation. Thus, it is possible that certain factors impede the farmers' application of 1CTs. Despite the general acceptance of fish farming as an income generating activity, its contribution to total domestic fish production in the country is still below expectation (Jiriko, *et al*., 2015). The reason for this could be traced to lack of information on technological known-how among fish farmers and prospective entrepreneurs (Aphunu & Atoma, 2011). Information is power and power is information, without information there cannot be growth.

Unfortunately, in most fishing communities in Ughelli North, empowerment organizers are not always in the habit of thinking about ICT tools as a pivotal component of bringing about the needed changes. There is dearth of information and data in this important area of agriculture in the study area. Thus, this has necessitated this research work. This is because the encouragement of fish farmers to deploy ICT is important due to the fact that most agricultural communities in developing countries like Nigeria still rely on traditional means such as family, neighbors and farmers in order to be informed on agricultural happenings. Despite the numerous importance and advantages of ICT in agricultural development, fish industry is still backward in its application to expand the industry. The industry has failed to tap into the various opportunities made available by ICT in fish value chain. It is, however, on this basis that this study seeks to assess fish farmers' utilization of ICT in production, processing and marketing of fish for food security in Ughelli North Local Government Area of Delta State.

Purpose of the Study

The general purpose of the study was to assess fish farmers' utilization of ICT in production. processing and marketing of fish for food security in Ughelli North Local Government Area of Delta State. The specific objectives were to:

i. determine the socio-economic characteristics of fish farmers involved in fish production, processing and marketing;
ii. assess the awareness of fish farmers on ICTs utilization in fish production, processing and marketing;
iii. identify the sources of information to fish farmers in fish production, processing and marketing;
iv. determine ICT tools in used by fish farmers in updating their knowledge in fish production, processing and marketing; and
v. identify the constraints to ICT utilization by fish farmers in fish production, processing and marketing.

Methodology

This study employed the descriptive survey research design. Using Survey method in the view of Nworgu (2006) is the one in which a group of people is studied by

collecting and analyzing data from few people considered to be representative of the entire group through the use of well-structured questionnaire. The population of this study consists of fifty (50) registered fish farmers in the study area. Simple random sampling technique was used to select a sample size of twenty-five (25) respondents for the study. The instrument used for data collection was a well-structured questionnaire designed in line with the specific research objectives of the study. Thus, the questionnaire consisted of five sections (A, B, C, D, & E). Section E is structured on 4-point response of strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The instrument was face validated by three experts in Agricultural education and educational measurement and evaluation, to help correct ambiguous statements, delete any irrelevant items and add essentials that may be omitted. Their suggestions were used to produce the final instrument that was employed to collect data for the study. The instrument was administered to the respondents with the help of one research assistant that was trained by the researcher on how to help administer the instrument. The analytical tools employed in analyzing data for the study was descriptive statistics, which include frequency distribution, percentage and mean. A cut off mean score of 2.50 was set a priori to ''agree'' with items on the number 5 purpose of the study while a mean score which is below 2.50 as "disagree".

Results and Discussion

Table 1

Socio-Economic Characteristics of Respondents

Characteristics	Response	Percentage
Sex		
Male	22	88
Female	3	12
Age		
25-35	11	44
36-45	9	36
46-55	5	20
Marital status		
Married	13	52
Single	12	48
Education		
No formal education	1	4
Secondary	6	24
Tertiary	18	72
Religion		
Christianity	24	96
Islam	1	4
Experience		
1-10	10	40
11-20	10	40
21-30	5	20

Source: Field Survey Data (2021)

Table 1 at a glance shows the socioeconomic characteristics of the respondents. The table revealed that majority (88%) were males, while 12% were female. The higher number of males shows their dominant position in the fish farming sector and as well as farm family decision making and as heads of families. This corroborate the of Ifejika, Akinbile, & Oladeji (2008) that fish farming is highly dominated by male

gender who have family responsibilities that needed financial commitment. Majority (44%) were within the age bracket of 25-35 years, 36% were within the age of 36-45 years and 20% were within the age of 46-55 years. On marital status of the respondents, 52% were married, and 48% were single. In education of the respondents, more than 90% were literates as shown by 72% that had tertiary education and 24% attended secondary school, while 4% had no formal education. Thus, education helps in socialization, exposure of people and in the adoption of recommended farming practices. Majority (96%) of the respondents are Christians while 4% are Muslims. Religion may play a role in the income generating activities of both rural and urban dwellers (Akinbile & Alabi, 2010). The respondents have put in some years in fish farming. The table revealed that 40% of the respondents had put in 1-10 years; 40% had put in 11-20years an 20% had put in more than 20years in fish farming. This shows that the respondents have a good knowledge of fish farming. Thus, experience is a risk management factor and is considered to be low among new farmers (especially in aquaculture) (Riddler & Hashamunda, 2001).

Table 2

Distribution of Respondents Based on their Awareness of ICT Utilization in Fish Production, Processing and Marketing

S/N	ICT Utilization	Aware F(%)	Not Aware F(%)	Rank
1.	Using ICT facilities to order for available supplementary feeds	23(92)	2(8)	3rd
2.	Use of ICT facilities to order for available fast growing fingerlings	24(90)	1(4)	2nd
3.	Using internet to get weather information before pond impoundment and stocking	12(48)	13(52)	6th
4.	Using ICT to get information on pond water pH level	7(28)	18(72)	9th
5.	Learning about various ways of preventing diseases in fish pond on TV	10(40)	15(60)	7th
6.	Learning about various ways of preventing pests and parasites in fish ponds on TV	9(36)	16(64)	8th
7.	Use of ICT to order for goods from other location	23(92)	2(8)	3rd
8	Use of ICT to study the appropriate fish processing methods and preservation	21(4)	4(10)	4th
9.	Use of ICT to get information on market location for fingerlings & broodstock	23(92)	2(8)	3rd
10.	Use of ICT to obtain Market prices for fingerlings and table size fish	23(92)	2(8)	3rd
11.	Use of internet to advertise fish and fish products	25(100)	0(0)	1st
12.	Using ICT to obtain information on various methods of pond inoculation	13(52)	12(46)	5th

Table 2 reveals that all of the respondents (100%) were aware of the use of internet to advertise fish and fish products. They were also highly aware of the use of ICT facilities in ordering for available fast growing fingerlings. Ijatuyi et al (2016) posited that the deployment and use of ICTs is pivotal in Increasing farming and improving the marketing and distribution strategies of fish production. Very few of the respondents (28%) were aware of the use of ICT in getting information on pond water PH level, 36% were aware of learning about various ways of preventing pests and parasites in fish ponds on TV, 48% were aware of using internet to get weather information before pond impoundment and stocking. The result also indicated that the

awareness level of fish farmers on the use of ICT to obtain market prices for fingerlings and table size fish was high (92%). 92% of the respondents were also aware of the use of ICT to get information on market location for fingerlings and broodstock.

Table 3
Sources of Information of Respondents

S/N	Sources	Pond Const.	Stocking	Water Mgt.	General Mgt.	Processing	Marketing
1.	Fisheries expert	19(76%)	22(88%)	19(76%)	19(76%)	17(68%)	19(76%)
2.	Mass Media	5(20%)	5(20%)	5(20%)	11(44%)	13(52%)	15(60%)
3.	Extension Agents	18(72%)	14(56%)	14(56%)	15(60%)	13(52%)	14(56%)
4.	Friends/relatives	18(72%)	20(80%)	18(72%)	17(68%)	17(68%)	21(84%)
5.	Internet	5(20%)	5(20%)	7(28%)	5(20%)	13(52%)	20(80%)

Table 3 reveals that the respondents sources information from five (5) major sources: fisheries experts, mass media, extension agents, friends/relatives and internet. Majority of the respondents source information from fisheries experts, extension agents and friends/relatives in all the activities involved in fish farming, ranging from pond construction, stocking, water, management, processing and marketing. On pond construction, 76% seek information from fisheries experts, 72% source information from extension agents, 72% source information from friends/relatives while only 20% seek information from mass media and internet respectively. On stocking, 88% seek information from fisheries experts, 56% from extension agents, 80% from friends/relatives while 20% seek information from mass media and internet respectively. On water management, 76% of the respondents' source information from fisheries experts, 56% from extension agents, 72% from friends/relatives while only 16% seek information from mass media and internet respectively. On stocking, 80% seek information from fisheries experts, 56% from extension agents, 80% source from friends/relatives while 20% seek information from mass media and internet respectively. On water management, 76% of the respondents' source information from fisheries experts, 56% from extension agents, 72% from 3 friends/ relatives but only 20% seek information from mass media and 8% from the internet. Also, 76% of the respondents' source information on general management from fisheries experts, 60% from extension agents, 68% from friends/relatives but 44% seek information mass media and 20% from the internet. On fish processing, 68% of the respondents' source information from fisheries experts, 52% from extension agents, 68% from friends/relatives while 52% seek information from mass media and 52% from the internet. On marketing, 76% source information from fisheries experts, 56% from extension agents, 84% from friends/relatives while 60% source information from mass media and 80% from the internet. The result in table 3 suggests that most of the respondents source information on the various fish production, processing, and marketing practices from extension agents, fisheries experts and friend/relatives. This finding corroborates the significance of one-on-one contact of extension agents and other traditional means provides readily accessible source of agricultural information as in the study of Yahaya (2003).

Table 4
ICT Tools for Updating Knowledge by Respondents

ICT In use	Yes (%)	No (%)
Radio	21(84)	4(16)
Television	23(92)	2(8)
Computer	4(16)	21(84)
Internet	12(48)	13(52)
Mobile Telephone	24(96)	1(4)
Fax	4(16)	21(84)
Video	1(92)	8(32)
Newspapers	17(68)	21(84)
Social media	4(36)	8(32)
Personal website	9(3636)	16(64)
Personal mail	10(100)	15(60)
Blogs	9(36)	16(64)

Source: Survey Data (2021)

Table 4 reveals that mobile telephone is the mostly utilized ICTs for updating knowledge on fish production, processing and marketing, as indicated by 96% of the respondents. This is followed by television with 92% and radio with 84% respectively. The least used ICTs were fax, computer and newspapers with 16% each. This confirm the findings of Otitolaye (2006) who reported that the most important factor considered by respondents in the use of communication channels for information dissemination was cost of use and accessibility, as the ICTs that are expensive to acquire are least used by respondents, while cheap one like radio are often used.

Table 5
Constraints to ICT Deployment by the Respondents

S/N	Constraints to ICT Utilization	N	M.S	RANK
1.	High cost of acquiring ICT devices	25	3.64	1st
2.	Low income level of farmers	25	3.12	4th
3.	Low level of education/literacy level	25	3.32	3rd
4.	Poor accessibility to ICT facilities	25	3.32	3rd
5.	Unstable power supply	25	3.56	2nd
6.	Poor connectivity/network problem	25	2.96	7th
7.	High cost of ICTs accessories	25	3.32	3rd
8.	Inadequate skills in operating ICT devices	25	2.80	8th
9.	Lack of confidence to operate ICT tools	25	2.56	9th
10.	High cost of maintenance of ICTs tools	25	3.12	4th
11.	Lack of awareness/knowledge of ICT	25	3.08	5th
12.	Inadequate training on the use of ICT tools/devices	25	3.00	6th
13.	Inadequate implementation of government policy on farmers empowerment	25	3.12	4th

Many problems plague fish farmers' use of ICT in the study area. Table 5 shows that the most severe constraint to the use of ICTs was the high cost of acquiring ICT devices (m.s=3.64), unstable power supply (m.s=3.56) was rated 2nd while low level of education/illiteracy level (3.32), poor accessibility to ICT facilities (m.s=3.32) and high cost of ICTs accessories (m.s=3.32) were rated 3" each, in terms of severity. This corroborate the view of Akinbile (2003) that educational level of respondents enhances their comprehension of technical information and make them able to manipulate the information and hence influences their choice and use of ICTS facilities, especially the

complex 0nes. Nkwocha, et al (2009) stated government's low level of assistance to ICTs infrastructural provision and absence of any policy to encourage farmers gain ICT education pose threat to agricultural development.

Conclusion

This study assessed the fish farmers' utilization of ICT for production, processing and marketing of fish for food security in Ughelli North Local Government Area of Delta State. ICT can play an important role in enhancing the capacity of people especially those in fishing communities. The study concluded that though fish farmers were well aware of the various uses of ICTs in fish farming, their level of use was low. The study also concluded that majority of fish farmers source of information are from extension agents, friends/relative and fisheries experts on various fish farming management practices. ICT device/tools such as television, radio, mobile phones and internet were available to the farmers for updating their knowledge in fish production, processing and marketing. They need information on pond construction, marketing, fingerling, weather/ temperature among others. The problem they face in ICTs use includes high cost of acquiring ICT devices, unstable power supply, high cost of ICTs accessories, poor accessibility (especially those in the rural areas) and low level of education.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. ICTs should be made available and affordable to all farmers. This will help to encourage them to develop positive attitude to seeking information relevant to their need.
2. Farmers should be adequately trained on ICTs application/usage and this should be done through the establishment of ICT training centres in accessible strategic locations.
3. Extension agents should be well trained on ICTs application, so that they would in turn orient farmers about ICTs and the derivables from the use.

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