

THE INTERNATIONAL JOURNAL OF SCIENCE & TECHNOLEDGE

Agricultural Technology: Type, Effect and Constraints on Food Production: A Case of Nigeria Agriculture

Dr. Ettah, Otu Ikoi

Lecturer, Department of Agricultural Economics & Extension, Faculty of Agriculture & Forestry
Cross River University of Technology, Obubra, Cross River State, Nigeria

Ukwuaba, I. C.

Assistant Lecturer, Department of Agricultural Economics,
University of Nigeria, Nsukka, Enugu State, Nigeria

Abstract:

A review of agricultural technology: types, effect and constraints to food production, a case of Nigeria agriculture was carried out. Technology is composed of material objects, scientific knowledge and methodological processes utilized to transform them for individual and social needs. Agricultural technology includes materials and methods by which land is cultivated and crops are harvested and also the way livestock is cared for. They include biotechnology, fertilizers, pesticides, medicines, water Management/Irrigation and chemicals. Agricultural technologies will become even more important as the Nigeria's population rises and declining state of factor inputs. The focus must therefore be on how to produce more food, with agricultural technologies while conserving the factor resources, because of rising concerns that agricultural growth will not be able to keep up with population growth. Several factors have been shown as constraints to the use of agricultural technology for production by small scale farmers, agricultural engineering. Agricultural technology has been seen to have both negative and positive effects on agricultural production. It has improved food production and preservative methods, as well as enables farmers to cultivate surplus food and preserve enough against times of scarcity. This has been achieved through the provision of farm equipment such as tractors, harvesters and chemicals. The negative effects are some areas of risk-assessment considered with our present biotechnology: the potential for genes moving from genetically engineered crops into wild plants; pests eventually developing resistance to pest-resistant crops; introducing allergy-causing compounds or changing the nutritional composition in foods. Among the constraints to use of technology in Nigeria are: high cost of agricultural inputs and services, high risk of uncertainty in agriculture, non-existence/inadequate farmers' co-operative organization, lack of political consensus to commitment and policies by government, poor government commitment to implementation of policies in agriculture and general reluctance on part of the farmers to pay for technology. The study recommended enhanced provision of rural credit to accelerate the use of agricultural technology, government should make available agricultural technologies for the farmers, awareness about the existence of agricultural technologies should be created, cost of the agricultural technologies should be subsidized and access roads should be provided by government for easy movement of agricultural technology implements and extension workers.

Keywords: agriculture, technology, Nigeria's agriculture, food production.

1. Introduction

Nigeria has an estimated 74 million hectares of arable land, but of this figure, only about 30 million hectares are under cultivation, a development widely blamed on lack or insufficient use of agricultural technology (FAO, 2014). It then means that the arable land would need to be increased and managed so as to raise agricultural production and productivity, in other for her to achieve her development goals, especially in the face of her geometric population progression (IITA, 2015). Studies by Esther (2004) shows that one sure way of realizing this goal is the use of agricultural technology. She also noted that agricultural technology has been designed for practically every stage of the agricultural process. They include machines for tilling the soil, planting seeds, irrigating the land, cultivating crops, protecting them from pests and weeds, harvesting, threshing grain, livestock production, caring and feeding, and sorting and packaging agricultural products.

According to Aliou and Ben (2012) agricultural technology is the knowledge applied by man to improve agricultural production, processing and marketing processes; it is seen in hybrid seeds, improved crop varieties, pesticides, machinery, fertilizers etc. they can also be seen as tools or machines that are used primarily or entirely in order to support agricultural enterprise in modern agriculture. Agricultural technology is thus a combination of all management practices for producing or storing crop mixtures, livestock, etc. (Esther, 2004). The objective of technology in agriculture is to provide more output from a given bundle of production inputs. There are two classifications of agricultural technology: hardware technology (embodied in the green revolution model, which promotes

hybridization, use of pesticides, insecticides, herbicides, the use of farm inputs and equipment), and software technology (extension and farming system research) (IITA, 2015). There are a number of barriers towards the realization of the food security goals, one of which is unavailability of agricultural technology and its use. Efforts to increase food production as to alleviate food shortages and high cost of food items in Nigeria cannot be achieved with the traditional agricultural technologies (FAO, 2014).

2. Nigeria Agriculture

Nigeria's economy is mainly driven by agriculture and its resources. In terms of employment, agriculture is by far the most important sector of Nigeria's economy, engaging about 70% of the labor force. Agricultural holdings are generally small and scattered; farming is often of the subsistence variety, characterized by simple tools and shifting cultivation. These small farms produce about 80% of the total food, hence the need for the use of agricultural technology, to boost production. Only about 30.7 million hectares (76 million acres) of arable land or 33% of Nigeria's land area, are under cultivation, a development not good enough for a country with over 80% of arable land. Nigeria's diverse climate, from the tropical areas of the coast to the arid zone of the north, makes it possible to produce virtually all agricultural products. The economic benefits of large-scale agriculture are recognized, and the government favors the formation of cooperative societies and settlements to encourage industrial agriculture. Large-scale agriculture, however, is not common, because of low use of agricultural technology. Despite an abundant water supply, a favorable climate, and wide areas of arable land, productivity is restricted owing to low utilization of agriculture technology and inefficient methods of cultivation. Following this, CBN (2015) reported that 62.8% of the population of Nigeria is living in absolute poverty and about 72% living below the poverty line (\$1.25/day).

Nigeria's agriculture sector has undergone major reforms and transformation. The introduction of Agricultural Transformation Agenda (ATA) brought about reforms in the input delivery, agricultural financing, value chain development and farm mechanization have yielded an abundant harvest for farmers (Ania, 2000). Nigerian agriculture needs sustainability through the use of agricultural technology, so that she can rely on a safe domestic supply of food rather than relying on foreign imports which could affect our security if cut-off (Arene and Okpukpara, 2006). Agriculture is unproductive in the low-income areas of Nigeria despite the population engaged in it because it is carried on in an old fashion with obsolete method of production. According to Chet (1998) access to extension services afford the farmers better opportunities to be better informed about production techniques as well as acquire basic training and skills on how best to allocate resources to achieve higher productivity. There is therefore need to incorporate appropriate technologies in agricultural production in Nigeria, especially in the face of climate change problems on agriculture which made this article a timely response. Hence appropriate technological and management innovations should be incorporated to improve productivity.

3. Concepts of Agricultural Technology

According to Chet (1998) technology means a particular kind of knowledge about how to produce desired and intended outcomes, not only "knowing about" but also "knowing how to do". In this view, technology is not only material artifacts, but also social wisdom. Chukwuone, Agwu and Ozor (2006) argued that technology is composed of material objects, and scientific knowledge and methodological processes utilized to transform them for individual and social needs. They said further that in agriculture, technology is the knowledge applied by man to improve production or marketing processes. It is seen in hybrid seeds, improved crop varieties, pesticides, machinery, fertilizers, etc. Agricultural technology is also vital in the economizing process and connotes a way of completing a particular task with less effort, time and with better outcomes (Esther, 2004).

Therefore, agricultural technology is the way agriculture is done and includes materials and methods by which land is cultivated and crops are harvested and also the way livestock is cared for and reproduced (Nnadi, Chikaire, Nnadi, Utazi, Echetama and Okafor, 2012). It includes the seeds, fertilizers, pesticides; medicines, tools and implements the farmers' uses and their source of power. Nnadi, *et. al.*, (2012) stated that agricultural technology is among the most revolutionary and impactful areas of modern technology, driven by the fundamental need for food and for feeding an ever-growing population.

Agricultural technology has opened an era in which powered machinery does the work formerly performed by people and animals (such as oxen and horses), these machines have massively increased farm output and dramatically changed the way people are employed and produce food worldwide (Arene, 2008). What the Malthusian theory did not consider was the power of agricultural technology to break yield barriers.

4. Types of Agricultural Technologies

4.1. Biotechnology

According to Ania (2000), biotechnology is the application of scientific techniques to modify and improve plants, animals, and microorganisms to enhance their value. Agricultural biotechnology is the area of biotechnology applied to agriculture. It has been practiced for a long time, as people have sought to improve agriculturally important organisms by selection and breeding. An example of traditional agricultural biotechnology is the development of disease-resistant wheat varieties by cross-breeding different crop types until the desired disease resistance is present in a resulting new variety (Ania 2000).

4.2. Water Management/Irrigation

Hurst (2011) noted that water management/irrigation is an important area in agricultural technology; it is the technique developed for increasing water use efficiency, to enhance agricultural production, especially in water scarce regions and to ensure agricultural

business all year round. Irrigation is an artificial application of water to the soil, usually to assist with the growth of crops and animals. It is mainly used in dry areas and in periods of rainfall shortfalls, and also to protect plants against frost.

4.3. Chemicals

Agricultural production relies heavily on man-made chemicals to protect and regulate plant growth. The benefits of their use in terms of economic returns and of improved human health and well-being cannot be overemphasized and have led to the rapid world-wide adoption of this chemical technology. However, their use in most countries is often regulated and monitored because of potential problems associated with their misuse (IITA, 2015).

4.4. Fertilizers

Fertilizers according to Layton (2004) are compounds given to plants to promote growth. Fertilizers can be organic (composed of organic matter), or inorganic (made of simple, inorganic chemicals or minerals). He further stated that fertilizers typically are provided in varying proportions: the three major plant nutrients (nitrogen, phosphorus and potassium), the secondary plant nutrients (calcium, sulphur, magnesium), and sometimes trace elements (or micronutrients) with a role in plant nutrition: iron, zinc, boron, etc.

4.5. Pesticides

United States. Environmental Protection Agency (EPA), (2007), defines a pesticide as "any substance or mixture of substances intended for preventing, destroying, repelling, or lessening the damage of any pest". A pesticide may be a chemical substance, biological agent (such as a virus or bacteria), antimicrobial, disinfectant or device used against pests including insects, plant pathogens, weeds, molluscs, birds, mammals, fish, nematodes (roundworms) and microbes that compete with humans for food, destroy property, spread or are a vector for disease or are a nuisance (EPA, 2007).

4.6. Agricultural Engineering

According to (Kimenju, 2015) agricultural engineering deals with mechanization through efficient use of inputs to increase farm productivity, conserving natural resources, reduce crop losses; improve quality of agro-produce, etc. Mechanization is one of the measures of modernization in agriculture.

4.7. Agricultural Extension

Agricultural Extension workers focus on imparting key messages to farmers on new innovations in agriculture. messages aimed at improving basic production techniques, with attention being focused on land preparation, the timeliness of operations, crop spacing, plant population sizes, the use of better seed varieties and on weeding, fertilizer use and pest control measures (IITA, 2015). The primary duties of extension agents are to transfer agricultural information to farmers and to report farmers' problems to higher levels of the system. Access to extension services afford the farmers the opportunity to be better informed about production techniques as well as acquire basic training and skills on how best to allocate resources to achieve higher productivity.

4.8. Farming Systems Research (FSR)

Farming system research is system approaches that incorporate all types of inquiry, as considered appropriate by participants. It is participatory and involves cycles of observation, diagnosis, planning, action and evaluation (Kimenju, 2015). The goal of FSR is to improve the benefits of farm families and/or communities, through improving the performance of their farming system.

5. Effects of the use of Agricultural Technology

Agricultural technology has been seen to have both negative and positive effects on agricultural production. According to Hurst (2010), technology has improved food production and preservative methods, also it enables farmers to cultivate surplus food and preserve enough against times of scarcity. It has also improved agricultural production through the provision of farm equipment such as tractors, harvesters and chemicals like herbicides and insecticides which help to increase crop yield and make mass production possible.

Use of agricultural technology has also brought negative effects to agricultural development. For instance, EPA (2007) stated that some areas of risk-assessment considered with our present biotechnology crops include the potential for genes moving from genetically engineered crops into wild plants; pest eventually developing resistance to pest-resistant crops; introducing allergy-causing compounds or changing the nutritional composition in foods. Also, the availability of nutrient responsive high yielding varieties of crops leads to intensive nutrient application, this develop negative consequences on the long run, in form of soil health and pollution hazards (Ania, 2000). Application of herbicides has been discovered to affect the flora and fauna of the agriculture environment as well s exposes the soil to erosion. Use of heavy farm implements have caused compartment of the soil and pollution, which adversely affects plants' growth and development.

6. Constraints to the use of Agricultural Technologies

Several factors have been shown to constraints the use of agricultural technology for food production by small scale farmers. Studies carried out by Layton (2004) noted that some of the constraints to the use of agricultural technologies for efficient production were;

- i. high cost of agricultural inputs and services.
- ii. high risk of uncertainty in agriculture.

- iii. non-existence/inadequate farmer's co-operative organization.
- iv. lack of political consensus to commitment and policies by government.
- v. poor government commitment to implementation of policies in agriculture.
- vi. general reluctance on part of the farmers to pay for services.
- vii. poor economic status of farmers (poverty).
- viii. lack of ready market to sell increased output as a result of improved extension services.
- ix. high level of illiteracy among farmers etc.

Farmers in Nigeria are constrained to efficient use of agricultural technology because of their peculiar socio economic characteristics and the subsistence way of doing their agricultural business (IITA, 2015). Studies also shows that farmer's decision to use a particular technology is influenced by a number of reasons, some of which are market-driven, level of education, or socio-culturally based, etc.

7. Conclusion and Recommendations

The objective of technology is to provide more output from a given bundle of production inputs and time. This connotes completing a particular task with less effort, time and with better outcomes. To boost agricultural production and productivity, farmers have to use agricultural technologies but are constrained by high cost of agricultural inputs and services, high risk of uncertainty in agriculture, non-existence/inadequate farmers' co-operative organization, general reluctance on part of the farmers to pay for agricultural technologies services, poor economic status of farmers (poverty), high level of illiteracy among farmers, etc. and as a result the use of agricultural technologies is very low. This has been evident in their level of output (low) and efficiency (inefficient) with which production is done. Based on the study, therefore the following are recommended: enhanced provision of rural credit that would accelerate the use of agricultural technology, government should make available and at subsidized rate agricultural technologies for the farmers, awareness about the existence of agricultural technologies should be created and access roads should be provided by government for easy movement of agricultural technology implements and extension workers.

8. References

- i. Aliou, D. and Ben, G. (2012). Understanding the impact of agricultural technology adoption: K-factors, pitfalls and spillovers. A Report Compiled by Federal Ministry of Agriculture and Natural Resources, Nigeria.
- ii. Ania, W. (2000). Use of Biotechnology in Agriculture— Benefits and Risks by the land Grant Colleges and University, the Regents of the University of California. Department of Tropical Plant and Soil Sciences. retrieved from www.agricbiotechnology.info 2015.
- iii. Arene, C. J. (2008). Agricultural Economics: A functional Approach. Published by prize publishers, Enugu.
- iv. Arene, C. J. and Okpukpara, B. C. (2006). Economics of Agricultural Production, Resource use and Development: An Introduction to Micro and Macro Level Perspective. Prize Publishers, Nsukka, Nigeria.
- v. Central Bank of Nigeria (CBN) (2015). Central Bank of Nigeria Annual Reports and Statement of Accounts
- vi. Chet, T. (1998) Technology for Sustainable Agriculture Presented at a Forum on Sustainable Agriculture for Florida Gulf Coast University, <http://members.aol.com/chettown/disc/disc.html>. 2015
- vii. Chukwuone, N., A., Agwu, A. E., and Ozor, N. (2006). Constraints and Strategies Towards Effective Cost-sharing of Agricultural Technology Delivery in Nigeria: Perception of Farmers and Agricultural Extension Personnel. Journal of International Agricultural and Extension Education. 13(1). 29-40.
- viii. Esther, N. (2004). The Gender Variable in Agricultural Technology: A Case of Rural Farmers in Machakos District - Eastern Kenya. M.A. Thesis: University of Nairobi, Institute of African Studies.
- ix. Environmental Protection Agency (EPA), (2007). What is Pesticide? (US EPA definitions). Allerton Research and Educational Trust., Centre of Environmental Studies/
- x. Food and Agricultural Organisation (2014). Statistical Data. <http://faostat.fao.org/faostat/collections?subset=agriculture>.
- xi. Hurst, D. R., (2011). Agricultural Technology in the Twentieth Century. Manhattan Sunflower University Press.
- xii. International Institute for Tropical Agriculture (IITA) (2015). Research on Integrated System for the Humid Tropic CGIAR., Ibadan, Nigeria.
- xiii. Kimenju, S. C. (2015). The Role of Biotechnology in Sustainable Food Supply Cambridge University Press.
- xiv. Layton, E. (2004). Technology as Knowledge, A Hand Book on Technology and Culture, 15(1), (31- 41).
- xv. Mackenzie J. and Wacman M. (2015). Village Technology in East Africa: A Report of a UNICEF Sponsored Regional Seminar on Appropriate Technology for the Rural Farmer held in Nairobi. June 12-17, 2015.
- xvi. Nnadi, F. N., Chikaire, J., Nnadi, C.D., Utazi, C.O., Echetama, J.A. and Okafor, O.E. (2012). Role of Agricultural Technology in Poverty Reduction among Crop Farmers in Ohaji Area of Imo State, Nigeria Journal of Emerging Trends in Engineering and Applied Sciences (JETEAS) 3(5): 754-760