Abstract

This paper reports a study on the nature of appropriate technology products for agricultural production in Kano State, Nigeria. The study adopted interview and observation as means of collecting data from the respondents sampled out for the study. The occasional sampling technique was used to include eight (8) participants in the first edition of the Global Agricultural Extension tagged ‘Kano 2009’. The data collected was presented and analyzed in the narrative form. This was followed by the statement of the economic implications of the appropriate technology on the Kano economy, based on inference from the findings of the study. On the nature of the appropriate technology products, the study discovered that most of them are used for processing agricultural products. Their economic implications for the Kano economy is in terms of their usefulness in adding value to the agricultural products, increased efficiency in production and creation of new investment and employment opportunities.

Key words: Appropriate Technology in Kano State, Agriculture in Kano State, Appropriate Technology Products in Kano State, Economic Implications of Appropriate Technology, Agricultural Production, Kano State of Nigeria, Kano Economy.

Introduction

Agriculture is the mainstay of the Kano economy with cotton, guinea-corn, maize, cowpeas, and varieties of vegetables being the main crops produced in the State. There are some solid minerals especially in the southern parts of the State. The minerals include tin, gold, lead, zinc, copper, porochlave, wolfram and bauxite. The State has over 300 large and medium industrial establishments spread across Bompai, Sharada and Challawa Industrial Estates. During the past three decades (1960 to 1990), modern manufacturing enterprises involving the processing of basic raw materials such as groundnut, and other industries like tanning, metal works, confectionery, textile goods and garment-making have been established in the State. In addition to the formal industrial sector, Kano State has thousands of small-scale industrial and commercial activities that form part of its economy (Kano State Government, 2005)

The Kano Chamber of Commerce, Industry, Mines and Agriculture (KACCIMA) had organized the first edition of the Global Agricultural Extension tagged Kano 2009 at the Trade Fair Complex, Zoo Road, Kano, from 16th to 20th April 2009. The theme of the exhibition was “Commercial Agriculture, Food Security for Economic Stability”. The goal of the exhibition was to promote commercial agriculture in four value chains: production, processing, packaging and
marketing. Individuals, businesses, governmental and non-governmental organizations from various states of the federation took part in the exhibition. The occasion provided a forum for undertaking a study on the status of appropriate technology in Nigeria in relation to the agricultural sector. However, the present study was focused on Kano State, Nigeria. So participants coming from the State were included in the study.

The study was specifically meant to determine the nature of appropriate technology for agricultural production and infer its economic implications for the economy of the State.

**The Study Area**

Kano has been in existence for over one thousand years. It has been transformed several times but the transformations that occurred in the nineteenth and twentieth centuries are the most significant. In 1804 Shehu Usman Danfodio led the Jihad that integrated Hausa land and expanded the influence of Hausa Islamic culture in the Sudan. Kano and other parts of the Sokoto Caliphate were overpowered in a military encounter with the British imperialists and were consequently incorporated into the British Empire (Ado-Kurawa, 2003).

The first Habe ruler of Kano was Bagauda, who ruled for about 66 years. Kano witnessed an era of prosperity during the reign of the 11th Habe ruler, Yaji (1359-1385). During this period the Wangara merchants and Islamic scholars introduced Islam into Kano. And during the reign of Muhammadu Rumfa (1463-1499), Islam acquired more strength and the first Kano central mosque was built. With the Fulani Jihad in the early 19th century, the Habe dynasty came to an end with the establishment of the Fulani dynasty. Sulaiman (1805-1819) was the first Fulani Emir of Kano and Alhaji Ado Bayero who came to the throne in 1963, is the 13th. The British, under the command of Col. Morland with about 800 soldiers attacked and occupied Kano on the 2nd of February 1903 when Alu, the 7th Fulani Emir, was away to Sokoto. Modern Kano State was created in 1967 with an area of about 16,630 square miles and four emirates: Kano, Hadejia, Gumel and Kazaure. With the creation of Jigawa State in 1991 out of Kano State, the latter covers an area of 20,760 Sq. Km. (http://www.bukportal.com/node/4)

The people of Kano State are predominantly Hausa-Fulani, but many other ethnic groups that include Nupe, Kanuri, Yoruba, Igbo, Igbara and Igala exist in large number in the State. As centre of commerce, Kano State attracts settlers from diverse ethnic and cultural backgrounds, many of them adopt Kano as their permanent place of abode. This is attributable to the accommodative and liberal attitude of the Kano People to non-indigenous people. Today, Kano has 44 Local Government Areas, the highest in Nigeria. It also has the largest population made up of 4,844,128 males and 4,539,554 females, with the total being 9,383,682 (Danyaro, 2008).

**Some Definitions of Appropriate Technology**

The term appropriate technology became popular during environmental movements of the 1970s and the energy crisis of 1973. The term is typically used in two senses, utilizing the most effective technology to meet the needs of developing areas, and using socially and environmentally tolerable technologies in the industrialized countries. The founders of the appropriate technology initiative include Buckminster Fuller, Sen Kafadia, Mahatma Ghandi, E.F Schumacher, Sanousi Diakite, William Moyer, Johan Van Lengen, etc.
Appropriate technology is defined as a technology designed with special consideration to the environmental, ethical, cultural, social and economical aspects of the community it is intended for. Compared to high technology used in industrialized societies, appropriate technology needs fewer resources, has a lower overall cost and less of harmful impact on the environment. It is also easier to maintain. Appropriate technology is not necessarily a "low" technology, in fact it can utilize recent research, for instance, white LED lights are used by the Light Up the World Foundation to replace more traditional forms of lighting used in remote areas of Nepal. Often the type of appropriate technology used in developed countries is "Appropriate and Sustainable Technology" (AST) that is, appropriate technology that is very durable and lasts a long time (http://en.wikipedia.org/wiki/Appropriate_technology).

Appropriate technology has also been defined as

the systematic application of collective human rationality to the solution of problems through assertion of control over nature and all kind of human processes. It is the embodiment and result of systematic, disciplined, cumulative, non-accidental, and non-serendipitous research (Yahaya, 2002).

E. F. Schumacher came up with another term, intermediate technology, which is similar to appropriate technology. It refers to tools and technology that are significantly more effective and expensive than traditional methods, but still cheaper than the technology of the developed world. Intermediate technology can be built and serviced using locally available materials and knowledge, and is friendly with the laws of ecology and moderate in its use of scarce resources. Moreover, intermediate technology is designed to serve the human person instead of making him the servant of machines (http://en.wikipedia.org/wiki/Appropriate_technology).

Some Studies on Appropriate Technology for Agriculture

In a study that examined appropriate agricultural extension technological needs of users in cassava processing activities in Oyo State, Nigeria, Odebode (2008) discovered that 58% of the 320 women included in the study use traditional processing equipments in cassava processing. The findings also indicate that

improved processing technologies used include vibrating sieve, abrasive peeler, motorised grater, drum drier, and screw -jack . Processed cassava products include “gari”, “lafun”, starch, and “fufu”. Significant relationships exist between the use of improved technologies for processing and age (X² = 6.15, p= 0.05), educational status (X²= 5.80, p= 0.05), religion (X²= 12.20, p= 0.05) and type of technology utilized. Significant difference exists between mean adoption scores of participating and nonparticipating users (t= 6.53, p= 0.05) (Odebode, 2008).

The research revealed some reasons for low level of access to and subsequent adoption of technological innovations particularly among users (women), they include lack of access to factors of production- land, labour, capital as well as limited authority for decision making.
Another reason is that users also find such innovations difficult to maintain due to lack of training on maintenance and skill acquisition.

Davies et al (2008) assessed the status of fish processing technologies in Rivers State of Nigeria to determine the level of mechanization and the various techniques available. The study found that traditional methods of fish processing were still dominant (82.4%) while the level of mechanized processing was very low (13%). The traditional technology involved the use of rafter, drum oven and mud oven as stated by 6, 72 and 7 respondents respectively, thus the drum oven was the most popular traditional technology. The traditional methods relied on wood, saw dust and charcoal in processing fish. High incidence of losses, absence of temperature control and exposure of the product to dust, insects, mould spores and bacteria were part of the problems of the traditional method. The mechanized method involved the use of locally produced kilns and dryers, with kerosene stove, butane gas, electricity and wood shaving as the sources of energy. With the mechanization method, losses were very minimal (2-3%), smoking could be controlled and the method was faster than the traditional method. The study also reveals that women used the traditional methods more than men, while men used the mechanized methods more than women. Lastly, the study rightly recommends, among others, the development of appropriate technology for fish processing by research institutes, engineers and equipment manufacturers in Nigeria.

A recent study was carried out to determine the requirements for the establishment and management of small scale rice milling business in Kano State through interviews with rice millers located at Kwanar Dawaki in Dawakin Kudu local government area, Dawanau Market in Dawakin Tofa local government area and Gezawa Market in Gezawa local government area. The study discovered that most of the rice millers were using the abrasive mill and vertical cone-desk, while very few of them use higher technology machines. Other equipment needed for rice milling, which most of the millers use included power generators, drum for soaking rice, mat or tarpaulin for drying rice, scale for measurement of weight, brooms, and shovels. Others are sewing machine, polythene bags for packaging, and a mudu (a local container for measurement). However, only 20% of the millers interviewed used rice polishing machines and modern destoners because of their high cost (Zakirai, 2010). These findings indicate the need for the fabrication of appropriate technology which the rice millers can easily afford compared to high technology.

Methodology

This study adopted interviews and observation in collecting data from the sampled respondents comprising eight (8) participants in the first edition of the Global Agricultural Extension tagged ‘Kano 2009’. Though many participants from various parts of Nigeria took part in the exhibition, only those from Kano State were selected for the study. Furthermore eight participants that displayed appropriate technology products were selected, using the occasional sampling technique, to represent the population of producers of similar or same appropriate technology products who did not attend the exhibition. The occasional sampling technique refers to

the use of participants that attend an occasion such as farmers at an agricultural exhibition, or academics at a national conference, as sample of a population they represent (Sulaiman, 2009).
The occasional sampling technique, like other techniques has its merits and demerits. It saves time and money as research subjects are found in a single place, the respondents easily cooperate to take part in a study because they seek recognition and attention during occasions, among others. One of the demerits of the technique is that only experienced researchers can design and conduct studies at a short notice as some occasions are made known to the public 3 to 7 seven days to their occurrence, so a researcher that needs to be guided by a supervisor could not be able to use such occasions to conduct a study. Secondly, occasions are not suitable for the use of interviews or questionnaires loaded with many questions as people in attendance have many things to attend to \((ibid)\).

The data collected was presented in narrative form. This is followed by the statement of the economic implications of the appropriate technology products for the Kano economy based on an inference from the findings of the study.

**Results**

This section contains a narration of what was found through interviews and discussions with the people representing the sampled organizations that attended the exhibition, and through personal observation of the displayed appropriate technology products.

1. The Kano Agricultural and Rural Development Agency (KNARDA) was one of the participants during the five-day exhibition. The Agency displayed a number of products which include a groundnut thresher and a groundnut milling machine. The first machine is used to remove the shell of groundnut while the second one is used to extract oil from groundnut.

2. The Technology Incubation Center located at the Farm Centre, Kano, also participated in the exhibition. It displayed a number of appropriate technology products that include a filling machine for bottling juice and pharmaceutical products, a machine for cooking yoghurt and another one for mixing it. The centre also displayed a destoner for removing stones when processing rice. Other machines displayed by the Center were two categories of egg hatching machines (incubators). One category uses electricity while the other uses kerosene as a source of energy.

3. Tadco Nigeria Limited located at Bampai, Kano was among the companies that attended the exhibition. The company produced and displayed different types of appropriate technology products, some related to agriculture and others to other areas of human endeavour. The products related to agriculture include a machine for producing custard powder and a boiler for producing fruit juice or pharmaceutical products. The company also undertakes rice processing and had produced and displayed a large boiler for boiling rice. It had devised a method of destoning rice without the use of a machine. Tadco Nigeria Limited also produced an improved hoe for weeding. The hoe has soft pads placed at the two points where a farmer places his hands when handling it. The metallic part of the hoe that digs soil comes in various sizes that can be fixed with bolts. This gives a farmer wide range of choice from different sizes of hoes to work with. One interesting thing discovered about Tadco Nigeria Limited is that it also provides consultancy services through training of people who can undertake rice processing and other trades. The appropriate technology products of the company which bear no
relationship with the agricultural production are machines for making pomade and a tool for producing building blocks from soil instead of cement.

4. Fasaha Technology and Construction Company Ltd located in Gayawa, Ungogo Local Government, also participated in the exhibition and displayed its products. These products include a blender for grinding tomatoes and pepper, and a fountain water distributor that uses electric power. The company also provides training for people interested in learning the fabrication and maintenance of appropriate technology products.

5. Institutions of higher learning which participated in the exhibition include the Audu Bako School of Agriculture, Dambatta. The school displayed a modern beehive, a fumigator and a honey extraction machine.

6. The Kano State Polytechnic exhibited a number of appropriate technology products that include a rice planter, a motorized groundnut thresher and an irrigation pump operated with feet. It also displayed an electric dryer that could be used for drying pepper and tomatoes.

7. Local Governments in the state were also not left out in fabricating appropriate technology products. Dawakin Kudu Local Government exhibited a solar dryer for drying pepper, tomatoes, etc.

8. Makoda Local Government produced and displayed an oil extraction machine. The machine could be used to extract oil from *Moringa oleifera*, known as *zogale* in Hausa, and from similar agricultural products.

**Discussion of Results**

From the data provided in the previous section, it could be seen that most of the appropriate technology products fabricated by the sampled participants are those used for processing of agricultural products. These technologies include oil extraction machines, motorized groundnut thresher and a blender for grinding tomatoes and pepper. Others are a device for cooking yoghurt and a machine another one for mixing it, a destoner for removing stones from rice, a solar dryer for drying pepper, tomatoes, a machine for producing custard powder and a boiler for producing fruit juice and pharmaceutical products. These technologies are useful in adding value to the agricultural products.

Appropriate technology products fabricated by the participants used for agricultural production include the modernized hoe, the rice planter, the irrigation pump operated with feet, the fountain water distributor and the incubators for hatching eggs. Others are a beehive and a fumigator. These technologies are useful in boosting agricultural production as they facilitate more efficient use of resources.

One interesting thing about the findings of this study is that the activities of four (4) out of the eight (8) participants in the exhibition could lead to the sustainability and wide spread of the
adoption of appropriate technology products in Kano State and beyond: two companies provide training to interested people and organizations while two participants are institutions of higher learning training students.

Implications of the Appropriate Technology Products for the Kano Economy

From the observation of the appropriate technology products displayed by the respondents during the exhibition and from the interview and discussion the researcher had with them, it is clear that Kano State is endowed with people with talents and abilities to create appropriate technology products for meeting the needs of the populace in the areas of food and cash crops production and adding value to them through processing. This is an indication that goal of the exhibition, which was to promote commercial agriculture in four value chains: production, processing, packaging and marketing, is being achieved to some extent.

One of the economic implications of appropriate technology products fabricated for processing agricultural products is their usefulness in adding value to the agricultural products and providing additional income to people. Another economic implication is that the appropriate technology products fabricated for agricultural production facilitate a more efficient use of resources: time saving, minimal wastages and low production costs. Other economic implications of the appropriate technologies to the Kano economy are the creation of new investment and employment opportunities as a result of the fabrications of appropriate technology products. With the fabrication of the incubator that uses kerosene, for instance, there is an increase in the number of people that ventured into hatching and poultry keeping businesses in the State and also in the availability of poultry products and the income generated from their supply and distribution.

One major problem facing the fabricators of the appropriate technology for agriculture is low patronage from people and governments, which is needed for the commercial production of these products. This implies that the numerous benefits associated with the invention of production techniques and the fabrication of new technologies that will accrue to the Kano economy will not be amply realized unless this trend of low patronage is reversed.

Conclusion

On the nature of appropriate technology products fabricated by the sampled participants, it was discovered that most of them are used for processing agricultural products. The economic implications of appropriate technology products fabricated agricultural activities is their usefulness in adding value to the agricultural products, the creation of new investment, employment opportunities, etc. A major problem facing the fabricators of the appropriate technology for agriculture is low patronage from people and governments, which is needed for the commercial production of these products.

Recommendations
The following recommendations may be useful in supporting and boosting the production of appropriate technology for the agriculture in Kano State in particular and Nigeria in general:

a) The three tiers of government (Local, State and Federal) should patronize companies individuals and organizations that produce appropriate technology products by purchasing what is produced and giving orders for mass production of the products even if they are to be provided to people that need the products free of charge or at subsidized rates.

b) Firms that provide consultancy services should be hired by local, state and federal governments to provide training to youth, especially the unemployed ones. This will go a long way in assisting the trainees as well as supporting the consulting firms.

c) The general public should be mobilized and sensitized on the need to patronize locally made technology products.

d) Finally, stable and sufficient electric power supply also needs to be provided for the effective operation of the appropriate technology products requiring electricity.
References


