

**ANKARA INTERNATIONAL CONGRESS ON SCIENTIFIC RESEARCH-VIII
held on June 9-11, 2023 / Ankara, Türkiye**

**ADOPTING TECHNOLOGY DEVELOPMENT IN SMALL-SCALE FARMING FOR
FOOD SECURITY IN SOUTH-WEST NIGERIA**

Olugbenga Babajide Soyemi¹ & Jumoke Soyemi²

Department of Civil Engineering, The Federal Polytechnic, Ilaro¹

Department of Computer Science, The Federal Polytechnic, Ilaro²

jidesoyemi@federalpolyilaro.edu.ng; jumoke.soyemi@federalpolyilaro.edu.ng

Abstract

Technology is embraced by virtually every field today ranging from healthcare, education, manufacturing among others. The need to make use of available technology in Agriculture by the small-scale farming populace is still at its infancy. Subsistence farmers account for over 75% food production in Africa and the rate of population increase is such that if care is not taken, there might be food security issues. The introduction of technology at every stage of subsistence agriculture becomes inevitable (from plowing, planting, harvesting, preservation, production, and packaging in the industry) to ensure maximum food production, surplus and affordability by every citizen in Africa. This paper harvested the issues being faced by small-scale farmers within South-west, Nigeria in embracing technology enabled farming, the requirements, and ways the available technology could be utilized to improve farming practices. Farmers were visited in their respective farms to understudy their challenges in farming and food production. Questionnaires were distributed among 120 subsistence farmers cut across three states in the south-west, Nigeria. The results from this study show that the old and traditional implements require hard labour and many man-hours which drives away youth from participating, thus leading to low production. The proposed technology enabled farming if implemented will result in higher yield with lesser man-hours. With the right support and enabling environment from the government, the present farming system can be scaled higher, and that the technology adoption will attract more youth to farming and food security will be ascertained.

Keywords: Agriculture, Farmers, Industry, Food security, Technology

1. Introduction

Nigeria has 92.38 million hectares of land with 34 million hectares for agriculture which is made of 6.5 million hectares for permanent crops, and 28.6 million hectares on fields and grasslands with a growing population of over 200 million people. In the last five years, agriculture has been a major contributor to the Nigeria Gross Domestic Product (GDP), contributing between 21.09% to 24.17% to nominal GDP (NBS 2022) and about 70% of the country's energetic population rely on it for occupation, vocation and for their livelihoods (Sabo, *et. al.*, 2017; Mustapha, *et. al.*, 2018). Cassava, palm oil, yam, beans, Maize, cocoa, pineapple, and guinea corn are the key crops farmed in Nigeria. The agriculture industry served as the foundation of the economy and was a major source of export for the nation pre-independence. According to available data, agriculture accounted for 64.2% of 1960's exports. A decade after, agriculture's share of exports dropped to 30.2%, a decrease of more than half. This declining trend persisted until 2000, when the sector's contribution was just 0.5%, when it reached its lowest point. (CBN, 2015). Subsistence and small-scale farming dominated Nigeria's agriculture which is driven by traditional low input farming methods, age-long farming implements and depend on natural rainfall. Crop yield failures have been faced in many localities, caused by old traditional farming tools (Mustapha, *et al.*, 2018),

**ANKARA INTERNATIONAL CONGRESS ON SCIENTIFIC RESEARCH-VIII
held on June 9-11, 2023 / Ankara, Türkiye**

change in climate (Adejuwon, 2005, Azare, *et al.*, 2020), insurgency (Alao, *et al.*, 2012), oil spillage (Ahmadu, & Egbodion, 2013), loss of youth interest in agriculture (Ng'atigwa, *et al.*, 2020), communal clashes (Ogebe, *et al.*, 2019) and many more. thus, raising the risk of food insecurity for many people.

Small-scale farming existed not only in developing countries (Kostov, & Lingard, 2002; Shrestha, & Nepal, 2016) but also in advanced countries (Davidova, *et al.*, 2009; Wharton, 2017). A small-scale farming in Nigeria involves the rearing of livestock or cultivation of crops on a small parcel of land (less than 5 acres) with over 75% Nigerian farmers in the group. This group of farmers plays an influential role in the contribution made by agriculture to Nigeria's GDP. Their efficiency and effectiveness are dependent on the available resources to them which are predominantly old and traditional. Ninety-eight percent of the food consumed in Nigeria, exclusive of wheat, are produced by the small-scale farmer (Mgbenka, *et al.*, 2016). Major factors influencing the productivity of small-scale farmers as identified by Oyewole, & Sennuga, (2020) were age, finance, and farming implements. The traditional method still dominates the farming culture of the people.

The farmers manually prepare the ground by using cutlass to cut the field (bush), then hoes to make ridges (ploughing) before sowing (planting) can commence. Often, manure is applied manually also, overlooking any hazard associated with it. During dry season, the farmers fetch water in cans to manually irrigate their crops. Weeds are removed by manually pulling them with hands, which consume time or sometimes, herbicides are applied using knapsack. During the weeks of harvest, harvesting and storing of farm produce are done concurrently by manual labour (Adeniyi, 2013, Sabo, *et al.*, 2017). This method is laborious, time consuming, limit productivity, discourages youth participation, and eventually leads to low yield. Ironically, the penetration of modern technology among small-scale farmers in Southwest Nigeria is still very low. The traditional methods still reign supreme (Olawuyi, 2019).

Governments in Nigeria and several foreign organisations have made conscious attempts over time to boost agricultural productivity, but these efforts have not produced the desired outcomes. (Mgbenka, *et al.*, 2016). Several policies and programmes aimed at improving agriculture (Iwuchukwu, & Igbokwe, 2012; Familugba, 2016) failed to achieve their target mainly because the actual farmers were not consulted nor interacted with before the drafting of the policies thus making the implementations very difficult and then ending in failure (Matthew, & Olatunji, 2016). The Western Region Farm Settlement Scheme was an important component of the Western Nigeria Policy of Agricultural and Natural Resources of 1959. The program's major goal was to settle recent graduates on a particular area of land and make farming their career, preventing them from moving to urban areas in quest of white-collar jobs. These established farmers were also to act as role models for appropriate farming practices for farmers in neighboring areas. Sadly, this scheme's ideal never came true since some of the settlers were too young and untrained in farming, which led to a high rate of dropouts, funding issues and corruption after the Regional Government gave way to Military's Unity Government (Iwuchukwu, & Igbokwe, 2012).

**ANKARA INTERNATIONAL CONGRESS ON SCIENTIFIC RESEARCH-VIII
held on June 9-11, 2023 / Ankara, Türkiye**

All these challenges have created detrimental effects on agricultural production and are linked to the nation's annual food shortfall thus fueling food insecurity (Matemilola, & Elegbede, 2017) and promoting regular imports of food from other nations (Amolegbe, *et al.*, 2021; Okijie, & Effiong, 2021). According to the 1996 World Food Summit, the definition of food security is that all people always have physical and financial access to an adequate supply of safe, nourishing food that satisfies their dietary needs and food choices for an active and healthy life (World Bank, 2001). And they have also pointed out that to have food security, small-scale farmers must be retrained to adopt technology for farming, have access to funding, be supported by sincere Government regulations and programmes, reduce bottlenecks in accessing fertilizers and other basic farming implements.

This study proposes the adoption of technology in small-scale farming for food security in Southwest Nigeria.

2. Methods

The study area is the Southwest Nigeria depicted in Figure 1. The area is bequeathed with fertile land thus making agriculture to thrive very well in the area. The main food crops grown in the area include cassava, maize, yam, banana, cocoyam and while the cash crops include cocoa, rubber, and different types of fruits. Two hundred and forty (120) subsistence farmers were visited and interviewed within three states in Southwest Nigeria, comprising of Ogun (77), Oyo (17), and Ondo (26) states. The selection of the states is based on the proximity of the researchers and their assistants to the farmers in the states. The number of respondents is shown in Figure 2. With the help of simple well-thought-out questions, primary data were collected from the small-scale farming households.

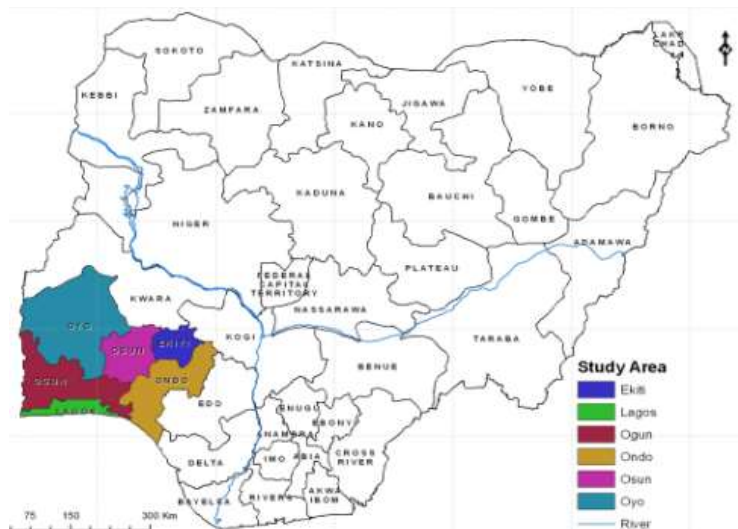


Figure 1: States in Southwest Nigeria © Faleyimu, *et. al.*, (2013)

**ANKARA INTERNATIONAL CONGRESS ON SCIENTIFIC RESEARCH-VIII
held on June 9-11, 2023 / Ankara, Türkiye**

The participants were selected randomly within the three states without any preference to the size and location of their farms within each state. All the respondents are subsistent farmers. Some basic questions were asked of the participants: Are you the owner of the land you are farming on? How many hectares of land are you cultivating? What is the age range of workers on the farm? What is their highest educational qualification? How easy do you source for workers on the farm? Which implements are you using for farming? Do you have access to modern tools? What is the main reason for not using modern tools? Do you have access to finance? How do you apply your herbicide?

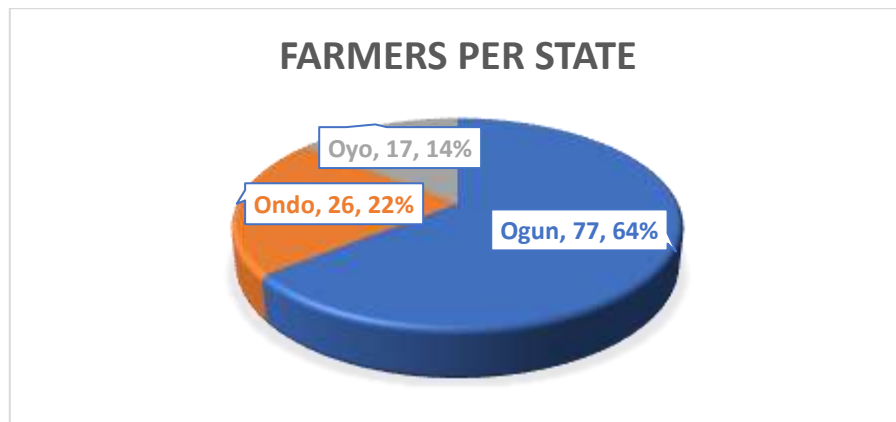


Figure 2: Number of Farmers Interviewed Per State

Means, Frequencies, tables, percentages, and charts were utilized in descriptive statistics to profile the impact of the old traditional farming methods and the level of adaptation of improved modern tools among small-scale farmers.

3. Results

The results and analysis of the interviews are presented and discussed in this section. In some instances, the discussion and analysis are done on state-by-state basis while in some, the three states are combined for a bigger interpretation.

Are you the owner of the land you are farming on?

The question of ownership of land is very imperative as it most times determines the direction of activities on the farmland. 61% of the farmers in Ogun State, 88.2% in Oyo and 73.1% in Ondo own their land. On the average for the three states, 67.5% farmers own their land.

ANKARA INTERNATIONAL CONGRESS ON SCIENTIFIC RESEARCH-VIII
held on June 9-11, 2023 / Ankara, Türkiye

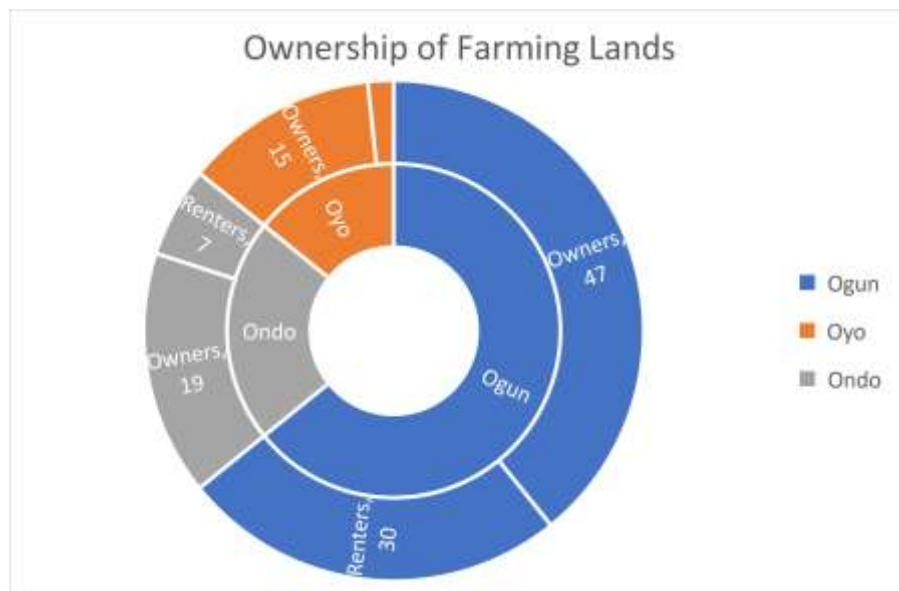


Figure 3: Land Ownership by Farmers

The remaining farmers lend the space for farming. There are limitations experienced by this set of farmers. This also affects their productivity as the landowners do ask them to leave during farming season. Oyo State has the highest number of farmers that are farmland owners.

How many hectares of land are you cultivating?

The farm size plays an important role in determining the amount of produce that will be harvested in the harvest season and thus determines the level of food security status of farmer's household. Table 1 shows the farmland sizes the farmers are working on state basis. It was discovered that though the farmers have such amount of land, in some seasons, not all the lands are cultivated.

Table 1: Farmers Farming Land

State	Farm Size (hectare)				
	< 1	1 - 2	2.1 - 3	3.1 - 4	4.1 -5
Ogun	12	17	11	20	17
Ondo	6	6	5	4	5
Oyo	5	6	2	1	3

What is the age range of workers on the farm?

Most subsistence farmers lived in rural areas and are old. The age range of workers on the farm are 12-17, 18-25, 26-40, 41-50 and above 50. For age 12-17, there were 5% (6) workers which are mainly children or families of the farmers, age 18-25 were 12.5% (15), age 26-40 were 15% (18), age 41-50 had 20% (24) while above 50 years of age were 47.5% (57). The average age of the farmers is 44.5years.

What is their highest educational qualification?

ANKARA INTERNATIONAL CONGRESS ON SCIENTIFIC RESEARCH-VIII
held on June 9-11, 2023 / Ankara, Türkiye

From the responses of the farmers, 61.3% of the farmers have no formal education and are within the age 41 and above. 20.8% passed through primary school, 12.5% attended secondary schools and 8.8% attended post-secondary schools. Most of those with post-primary education are family members while those with post-secondary education purposely make farming their vocation.

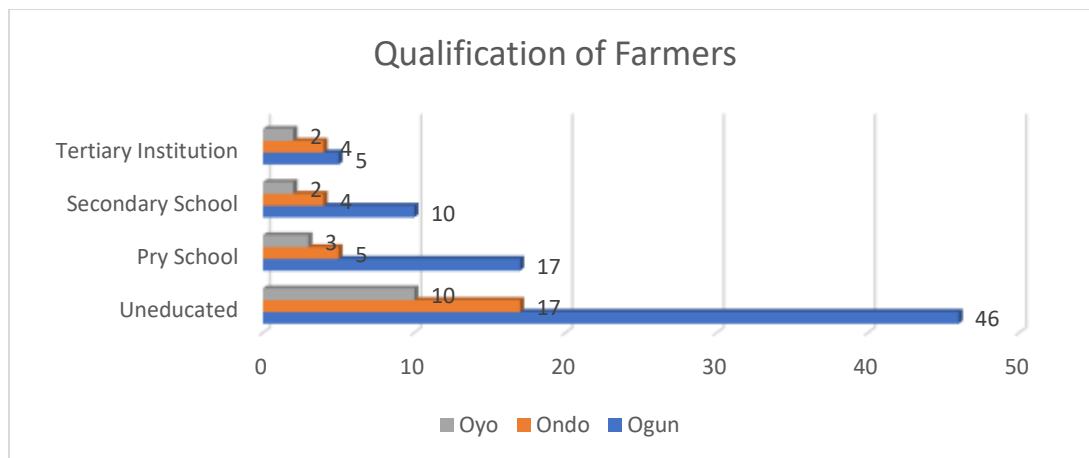


Figure 4: Farmers' Educational Qualifications

How easy do you source for workers on the farm?

Sometimes, the activities on the farms require additional workers. The story is the same in the three states, apart from family members who help on the farm, sourcing of additional workers on the farm is by direct labour. Within the rural farming communities, the farmers help themselves on rotational basis in their farms while those in semi-urban centres hire workers.

Which implements are you using for farming?

All the farmers interviewed are still using the traditional cutlasses for clearing and weeding, garden fork for raking, hoes for making ridges and knapsack sprayer for fumigation and application of herbicides. The cutlasses come in different shapes and sizes. A very common cutlass among the farmers in the study area is shown in Figure 5. The time used for weeding is enormous and the process very strenuous according to the farmers. Often, more hands are needed at the beginning of the planting seasons for clearing and weeding.

For planting, the farmers used hoes, first for making ridges upon which the seeds/stems are planted and thereafter for removing weed while the plants are growing. All the farmers used hoes for making ridges. It also comes in different shapes and sizes. It is for making ridges. Other prominent farming implements are the garden rake, for clearing and packing of weeds and the knapsack deployed for fumigation and application of herbicides.

Do you have access to modern tools?

Over 90% of the farmers said they do not have access to modern tools and implements. The remaining 10% have seen them demonstrated but have not used them (Figure 5). Farmers

**ANKARA INTERNATIONAL CONGRESS ON SCIENTIFIC RESEARCH-VIII
held on June 9-11, 2023 / Ankara, Türkiye**

interviewed in Oyo State said they knew there were tractors in the Local Government, but they don't know how to access them.

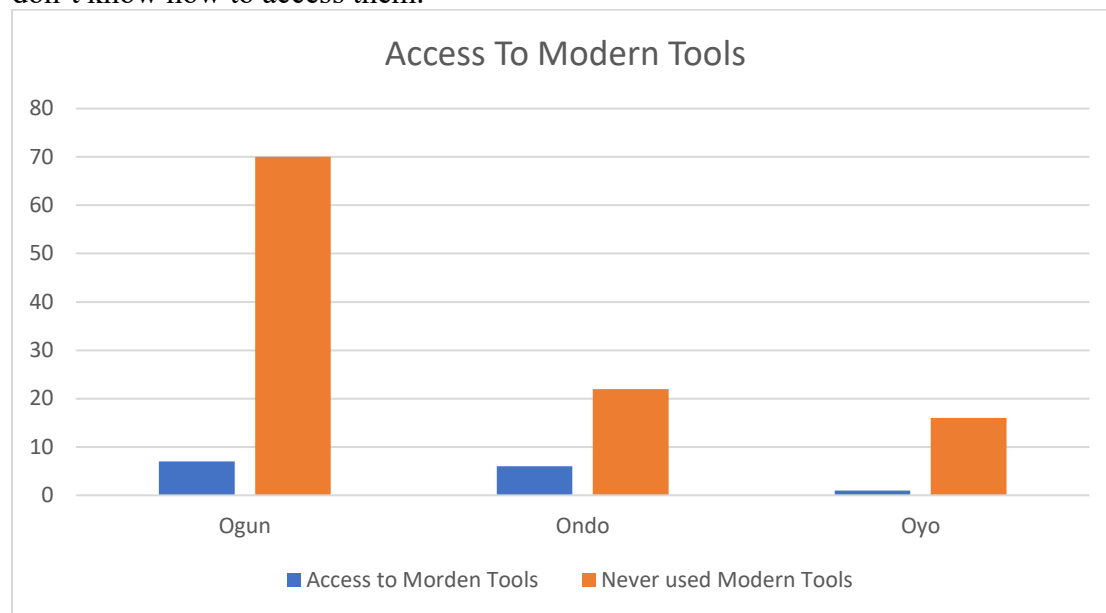


Figure 5: Farmers' Access to Modern Tools

What is the main reason for not using modern tools?

Most of the farmers reported that they do not have access to funding, so they could not afford most of the tools. Most of the available farming implements (automatic harvesters, drones, self-driving tractors, seeding, and weeding) are expensive for these group of farmers. Other factors enumerated by the farmers are level of education, farming experience, land holding size, access to market and membership in village organizations as shown in Figure 6.

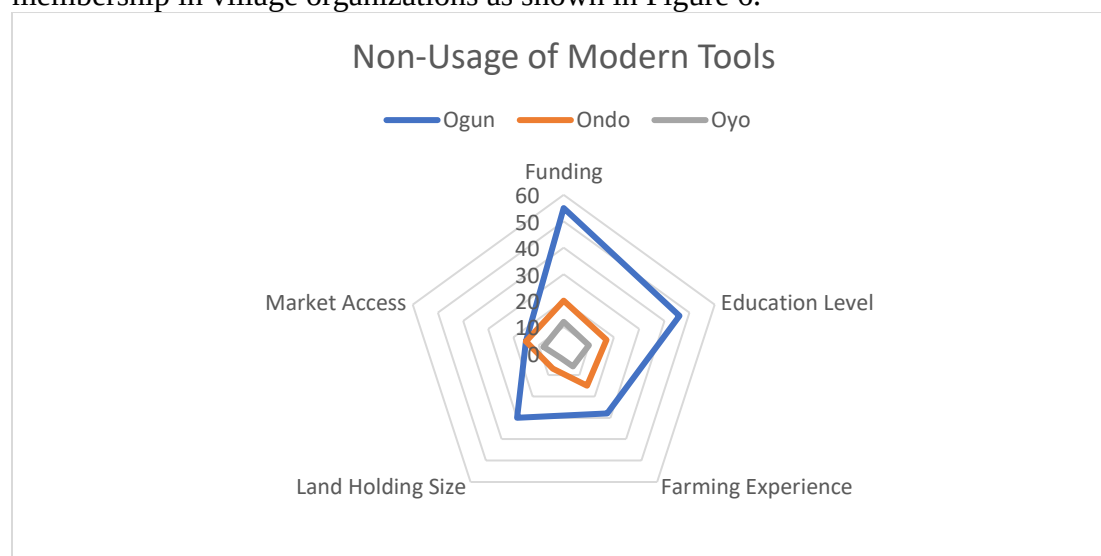


Figure 6: Reasons for Non-Usage of Modern Tools

**ANKARA INTERNATIONAL CONGRESS ON SCIENTIFIC RESEARCH-VIII
held on June 9-11, 2023 / Ankara, Türkiye**

Do you have access to finance?

The farmers in Ogun State said the Government intervention did not reach them on their farms. 18.06% of the farmers said they actually applied for such loans but the demands for documentations were too much that they could not meet up. Similar stories came from Oyo and Ondo States. Loans from other sources have high interest rates that make them not applicable to farming. Commercial banks would rather give the Agric loans to civil servants to giving them to farmers.

4. Discussion

The farmers in Southwest Nigeria from the understudied states are struggling with the aging farmers, farming with ancient implements, lack of access to funding and modern implements, inadequate and inexperienced workforce, low level of education, reluctant youth to take part in farming and thus leading to low output in food production, thereby fueling food insecurity in the region.

Nigeria uses very little contemporary technology in the production and distribution of agricultural goods; hence the industry is more dependent on manual labour for farm tasks. This is due to a lack of technological innovation in the local market, particularly regarding mechanizing agriculture to increase output (Matemilola, & Elegbede, 2017).

Local small-scale farmers can hardly afford imported technologies and where they are able to acquire them, there is no capacity for maintenance. Any efforts toward modernisation would necessitate agricultural modernization in rural areas of Nigeria where most of the population lives and practices agriculture. The proposed technological solutions in this study are those based on indigenous technology with fabrication done with locally available materials.

Some of these locally fabricated equipment are small hand-held power operated weeding and clearing implement. It comprised of a battery-powered motor with a long shaft and blades attached to the end of the shaft. This makes wedding and clearing easy for the farmers. Also, to make ridges, a small plougher was fabricated, which can be attached to a motor bike with ease of use. However, because of the available resources and time, two farmers were selected from each state to demonstrate the use of drones for planting of vegetables and for application of herbicides. This singular demonstration proved to the farmers that technology will go a long way to improve their farming practice. For planting of vegetables over a hectare of land that normally takes 6-man hours from 4 workers, the drone accomplished it in an hour.

5. Conclusion

The small-scale farmers are ever ready to continue to provide food security for the nation, but they require help in all areas of their activities. The government should make access to funding easy for small-scale farmers to ease the burden of approaching commercial banks for loan facilities.

**ANKARA INTERNATIONAL CONGRESS ON SCIENTIFIC RESEARCH-VIII
held on June 9-11, 2023 / Ankara, Türkiye**

Periodic training should be conducted to the farmers to enlighten them on latest developments. Mechanization should be encouraged and invested in. With technology adaptation, there will be renewed interest from the youth. When all these are in place, food security would be a thing of the past to farmers in southwest, Nigeria and by extension to the Nigeria populace at large.

References

- Adejuwon, J. O. (2005). Food crop production in Nigeria. I. Present effects of climate variability. *Climate Research*, 30(1), 53-60.
- Adeniyi, O. R. (2013). Socio-economic Analysis of Subsistence Farming Practices in South-Western Nigeria. *Sustainable Agriculture Research*, 2(1), 104.
- Ahmadu, J., & Egbodion, J. (2013). Effect of oil spillage on cassava production in Niger Delta region of Nigeria. *American Journal of Experimental Agriculture*, 3(4), 914.
- Alao, D. O., Atere, C. O., & Alao, O. (2012). Boko-Haram insurgency in Nigeria: the challenges and lessons. *Singaporean Journal of Business Economics and Management Studies*, 1(4), 1-15.
- Amolegbe, K. B., Upton, J., Bageant, E., & Blom, S. (2021). Food price volatility and household food security: Evidence from Nigeria. *Food Policy*, 102, 102061.
- Azare, I. M., Dantata, I. J., Abdullahi, M. S., Adebayo, A. A., & Aliyu, M. (2020). Effects of climate change on pearl millet (*Pennisetum glaucum* [LR Br.]) production in Nigeria. *Journal of Applied Sciences and Environmental Management*, 24(1), 157-162.
- Central Bank of Nigeria, CBN (2015). Statistical Bulletin. Central Bank of Nigeria.
- Davidova, S., Fredriksson, L., & Bailey, A. (2009). Subsistence and semi-subsistence farming in selected EU new member states. *Agricultural Economics*, 40, 733-744.
- Faleyimu, O. I., Agbeja, B. O., & Akinyemi, O. (2013). State of forest regeneration in Southwest Nigeria. *African Journal of Agricultural Research*, 8(26), 3381-3383.
- Familugba, J. O. (2016). Agricultural policies and rural development, the case of southwestern Nigeria, 1945–1960. *International Journal for Innovation Education and Research*, 4(2), 39-53.
- Iwuchukwu, J. C., & Igbokwe, E. M. (2012). Lessons from agricultural policies and programmes in Nigeria. *JL Pol'y & Globalization*, 5, 11.
- Kostov, P., & Lingard, J. (2002). Subsistence farming in transitional economies: lessons from Bulgaria. *Journal of rural studies*, 18(1), 83-94.

**ANKARA INTERNATIONAL CONGRESS ON SCIENTIFIC RESEARCH-VIII
held on June 9-11, 2023 / Ankara, Türkiye**

- Matemilola, S. and Elegbede, I. (2017). The challenges of food security in Nigeria. *Open Access Library Journal*, 4(12), 1.
- Matthew, A. O., & Olatunji, O. M. (2016). Policy issues for improving monitoring and evaluation of agricultural extension programmes in Nigeria. *African Evaluation Journal*, 4(1), 1-5.
- Mgbenka, R. N., Mbah, E. N., & Ezeano, C. I. (2016). A review of smallholder farming in Nigeria: Need for transformation. *International Journal of Agricultural Extension and Rural Development Studies*, 3(2), 43-54.
- Mustapha, M., Kamaruddin, R. B., & Dewi, S. (2018). Factors affecting rural farming households food security status in Kano, Nigeria. *International Journal of Management Research and Reviews*, 8(9), 1.
- Naswem, A. A., & Ejembi, S. A. (2017). Reviving agricultural extension for effective transition from subsistence to commercial agriculture in Nigeria. *Journal of Rural Social Sciences*, 32(1), 2.
- National Bureau of Statistics NBS (2022). Nigerian Gross Domestic Product Report Q1 2022
- Ng'atigwa, A. A., Hepelwa, A., Yami, M., & Manyong, V. (2020). Assessment of factors influencing youth involvement in horticulture agribusiness in Tanzania: A case study of Njombe Region. *Agriculture*, 10(7), 287.
- Ogebe, F. O., Abah, D., & Ligom, L. S. (2019). Land use conflict between farmers and herdsmen in Gwer West Local Government area of Benue state, Nigeria. *IOSR Journal of Agriculture and Veterinary Science*, 12(1), 23-31.
- Okijie, S. R., & Effiong, U. E. (2021). Agricultural Development and Food Importation in Nigeria: An Insight towards Achieving Food Security. *International Journal of Humanities and Social Science Invention*, 10(6).
- Olawuyi, S. O. (2019). Effect of adoption of alternative conservation agricultural practices on smallholder farmers' production output in South-West Nigeria. *Cogent social sciences*, 5(1), 1588447.
- Oyewole, S. O., & Sennuga, S. O. (2020). Factors influencing sustainable agricultural practices among smallholder farmers in Ogun state of Nigeria. *Asian Journal of Advances in Agricultural Research*, 14(1), 17-24.
- Sabo, B.B., Isah, S.D., Chamo, A.M., & Rabi, M.A. (2017). Role of smallholder farmers in Nigeria's food security. *Scholarly Journal of Agricultural Science*, 7(1), 1-5.

**ANKARA INTERNATIONAL CONGRESS ON SCIENTIFIC RESEARCH-VIII
held on June 9-11, 2023 / Ankara, Türkiye**

Shrestha, R.P., & Nepal, N. (2016). An assessment by subsistence farmers of the risks to food security attributable to climate change in Makwanpur, Nepal. *Food Security*, 8, 415-425.

Wharton, C. R. (2017). *Subsistence agriculture: concepts and scope*. In Subsistence Agriculture & Economic Development (pp. 12-20). Routledge.

World Bank (2001). World Development Report 2000/2001. *Attacking Poverty*. World Development Report New York: Oxford University Press. © World Bank.

Wu, Z.L. (2011). Research on Harmony Between Agricultural Modernization and Regional Economy Development in China. *Asian Agricultural Research*, 3(3):6–10.