



Sustainable Agricultural Mechanization in Nigeria in Context of COVID-19

O. K. Fadele^{1*}, T. O. Amusan², C. O. Ariyo¹, A. O. Afolabi¹, N. E. Onwuegbunam¹ and B. O. Oni¹

¹Federal College of Forestry Mechanisation, Afaka Kaduna, Forestry Research Institute of Nigeria, Nigeria.

²Air Force Institute of Technology, Kaduna, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. Author OKF initiated and wrote the first draft of the manuscript. Authors TOA, COA, AOA, NEO and BOO provided all the necessary supports for this review paper. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JSRR/2020/v26i730284

Editor(s):

(1) Dr. Magdalena Valšíková, Slovak University of Agriculture, Slovakia.

(2) Dr. Suleyman Korkut, Duzce University, Turkey.

(3) Dr. Narayan Thapa, Cameron University, USA.

Reviewers:

(1) Santosh Jabaji Lagad, Dada Patil Mahavidyalaya, India.

(2) Lovely Gupta, University of Delhi, India.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/60256>

Review Article

Received 01 August 2020
Accepted 24 August 2020
Published 01 September 2020

ABSTRACT

Post-harvest losses and food shortage has remained endemic to most Sub-Saharan African communities. The reality of COVID-19 in these countries has unfurled the weakness of agricultural sector in containing long lasting effect of such natural disaster. In most developed countries, the impact of COVID-19 is minimal on the agricultural sector because of their functional robust food supply chain structure unlike most developing countries. The effort of most African countries in this sector is yet to come to fruition; this will not happen without sustainable agricultural mechanization. This would further enhance food supply chain mechanism in the agricultural sector. In this paper, the impact of COVID-19 on food supply in Nigeria was discussed, as well as the proffered approaches in combating similar future disaster.

Keywords: COVID-19; impact; mechanization; sustainable agricultural production.

*Corresponding author: E-mail: fadeleseyi@yahoo.com;

1. INTRODUCTION

Sustainable agricultural mechanization refers to perpetual maintenance of commercial food supply system through improved and appropriate technologies over a very long period of time in order to guarantee food security [1,2]. Most developing countries in Africa are bedeviled with undependable food supply chain which is ineffective in ensuring steady food production in the event of global natural disaster such as COVID-19 pandemic. The spread of COVID-19 to all the continents of the World is a threat to food security especially in developing ones. COVID-19 (a new corona virus strain) is a deadly lower tract respiratory infection that could be transmitted from animals to human beings and likewise from human beings to human beings [3]. At the moment there is no known treatment for COVID-19. The global population of confirmed cases of this pandemic is over four million and not less than three hundred thousand deaths as at mid May 2020 has been reported. The impact of this dreaded disease is lesser on food supply chain especially in developed countries while most underdeveloped and developing countries are struggling to contain the aftermath on food security. It is time for developing countries to come up with measures and mechanism which can sustain food security in event of natural disasters such as COVID-19. It is with this view that this paper was put up to discuss extensively on the need for sustainable agricultural mechanization as an actuator for agricultural revolution in developing countries.

2. COVID-19 PANDEMIC

A number of publications have established the origin of COVID-19 pandemic to originate from China. There have been similar pathogenic diseases in the past within the same region. China being the most populated country in the world with about population of 1.428 billion and having 23 provinces was able to contain this pandemic to a large extent. The outbreak of COVID-19 was first reported in Wuhan city, Hubei province late December, 2019 [4]. About 27 human cases of viral pneumonia were reported on 12th December, 2019 by the Wuhan Municipal Health Commission (WMHC) in the People's Republic of China. All these people had a shared exposure in the Huanan Seafood Wholesale Market, where farm animals, bats, and snakes were sold [5,6]. It has been established from findings that COVID-19 could have been as a result of consumption of some

seafood in the city of Wuhan [4]. The pandemic has spread from China to other parts of the world with United State of America being the epicentre as at May, 2020. There are over four million confirmed cases of COVID-19 and three hundred thousand deaths as at the time of this report. There would be certainly more cases of COVID-19 infection. The impact of this deadly pandemic on agricultural production and food supply chain is unprecedented mostly in underdeveloped and developing countries.

3. THE IMPACT OF COVID-19 ON AGRICULTURAL PRODUCTION

The adverse impact of COVID-19 is generic; of which agricultural sector suffers immensely vis a vis other sectors of the economy in most developing countries. There has been a rise in the prices of food commodities in some Sub-Saharan countries such as Nigeria as a result of COVID-19 pandemic. Figs. 1 – 3 show the trends in some food commodities prices in Nigeria for the past 36 months extrapolating into the period of COVID-19 pandemic. It is very obvious that the food prices in Nigeria would increase as the country enters deeply into pandemic period with the prices spiking out. Crop production in developing and underdeveloped countries, is predominantly carried out at family scale level with meagre output. It has been established that subsistence farming is more advantageous in the area of diversification but this practice lacks sustainability due to older age group being involved [7,8]. There has been mass exodus of younger generation to the urban centres leaving the older people who are more vulnerable to COVID-19 pandemic in the rural centres. Demographic trend in developing countries has established migration of young people which has resulted to ageing of the agricultural workforce, urbanization and feminization of farming [9].

The purview of COVID-19 on the ageing rural population actively involved in farming could be devastating in many developing countries at this time. In the lockdown scenario the governments of some of these countries have started to ease out the curfew thereby permitting the farmers to go to their farms. In the event of easing out the lockdown they are exposed to the new corona virus. This might probably lead to a decline in farming population as it occurred in the influenza pandemic of 1918 to 1919; which resulted to massive withdrawal of labor from productive processes causing a noticeable drop in the supply of goods and services. Food became

scarcer in most developing countries [11]. Moreover, in most cases most of crops grown within these regions are seasonal and not grown all year round since they are rain fed; thus limiting the production capacity of the farmer [12]. Farming activities mostly take place during the raining season. Consequently, measures put in place to contain COVID-19 pandemic have halted farming activities; thus precluding planting. Some of the farmers have also been restricted from going to their farms to carry out pre-harvest operation before planting; besides farm input are not within the reach of these farmers. Moreover, with the farming season fast approaching and perpetual lockdown in place; agricultural production might be adversely affected and suffered some setback in many African countries. More so, the supply of feedstock for secondary food processing industries would definitely be strained. In Nigeria, food supply chain is suffering

some setback as result of transit of humans with food commodities; which is not allowed during the interstate lockdown. Similar occurrence happened in some Asian countries during 1944 – 45 famine post-second world war when food supply chain was hampered [13,14]. At the moment COVID-19 is an unseen war which many countries are battling with; it has tremendous impact on import and transportation of food commodities even inter-continental. There have also been cases of miscreants attacking food trucks by taking advantage of the lockdown. Defiance to order has culminated to extrajudicial killing by law enforcement agencies; thus resulting to more casualties than number of deaths recorded for COVID-19. This could have been prevented and abated if a sustainable and functional food supply chain that could revolutionize agricultural production has been put in place.

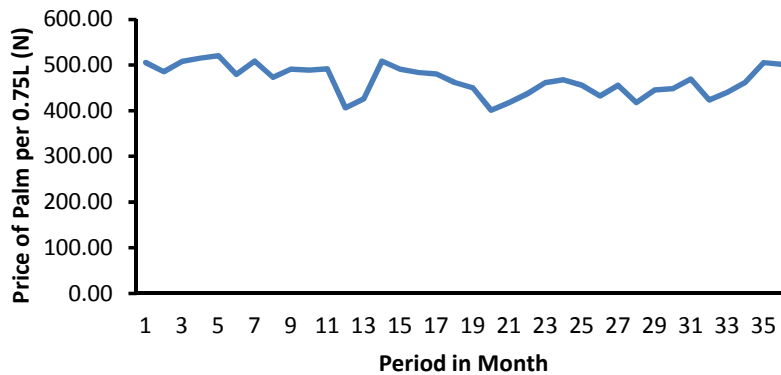


Fig. 1. Price of palm oil from April 2017 to March 2020 [10]

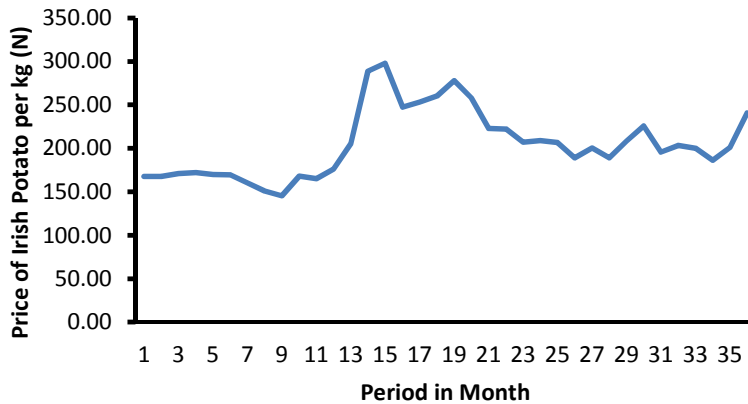


Fig. 2. Price of Irish potato from April 2017 to March 2020 [10]

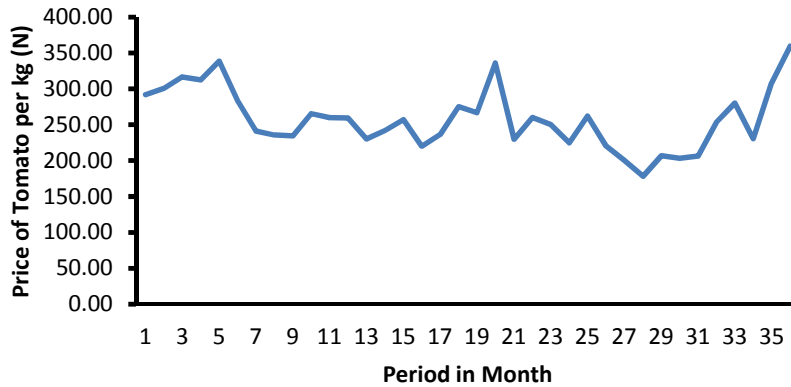


Fig. 3. Price of tomato from April 2017 to March 2020 [10]

4. SUSTAINABLE AGRICULTURAL MECHANIZATION: PANACEA TO FOOD CRISIS

In times of food crisis such as it is being experienced in some developing countries; the way forward is to adopt sustainable means to tackle the backwash of COVID-19. The various sources of power in the African continent is shown in Fig. 4; indicating the state of agricultural mechanization. In Africa about 64.75% farming activities is carried with human power using traditional farm tools and 14.25 % with animal traction while only 21% is mechanized. The governments of these developing countries should not subscribe to any measure that would bring temporary solution. In this case they have to look inward and identify

some of the gaps and loopholes within the agricultural production line as proffered by some researchers [15,16]. Technology transfer in the aspect of agricultural mechanization would play a vital role in averting looming food crisis.

Moreover, fundamental infrastructures such as good road network, uninterrupted electricity and pipe borne water have to be put in place. In line with this, Handaka [18] reported that availability of infrastructure, technology and political will of the government as some of the factors that contributed to food security in Indonesia. It has been established that agriculture can work with other sectors of the economy to achieve faster development, poverty reduction and environmental sustainability [19,20,21].

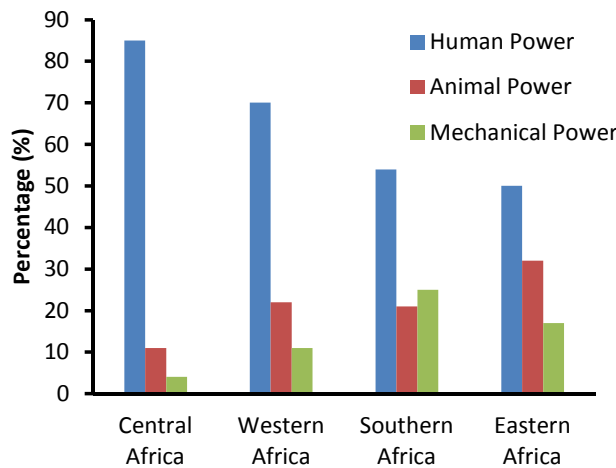


Fig. 4. Sources of power on the farm in Africa [17]

Furthermore, with basic infrastructure in place agricultural mechanization is much more easily attainable. The utilization of agricultural machineries is key to sustainable agriculture and food security. Sustainable agricultural mechanization should encompass manufacturing, sales, repairs, distribution and operation of all types of machines that are used in all facets of crop production [22]. It also involves improvement of agricultural techniques as well as efficient use of natural resources without disrupting the ecosystem to enhance the sustainability of the entire agricultural system [23]. Sustainable agricultural mechanization in developing countries is achievable by identifying resource-friendly methods that could boost food production in a particular location. This might require the development of new mechanization technology [18,24].

Agricultural mechanization promotes large scale production which is mostly mechanical and automated. This involves the application of machines which are capital intensive. These machines are not readily within the reach of the farmer besides the fact that they are not affordable. Most farmers in the developing countries resort to traditional farm tools which involves a lot of drudgery. Agricultural production will remain at this same level year in year out if farmers are not encouraged to mechanize farming activities. This could be achieved by providing subventions to the farmers especially in rural settlement. This could come in form of provision of simple and uncomplicated farm machinery with understandable technical know-how [25]. Large scale agricultural production should also be encouraged by the governments of developing countries by bringing in investors in the area of farm machinery manufacturing to meet the needs of existing farms. Loan facilities should be made available to farmers willing to go into large scale farming. Entrepreneurs should be encouraged to go into farming through subventions. The food chain supply should be studied and modeled to better understand its sustainability in containing future disaster that could result to food shortage. This would involve conducting a research on what happens on the farm to the stages of processing, storage and transportation. Doing this would open some of the loop holes in the areas of post harvest losses, ineffective food network, abuse of loan facilities meant for agricultural purposes to mention but a few.

5. AGRICULTURAL POLICIES FOR SUSTAINABLE AGRICULTURAL MECHANIZATION

The purpose of agricultural policy is to develop a favourable and sustainable guidelines for the promotion of efficient agricultural practices that will guarantee food security, provide employment for the citizens, raw material for all agro – based industries as well as to earn foreign exchange. It is the synthesis of the framework and action plans of government designed to achieve overall agricultural growth and development [26]. Many developing countries have good policies which are yet to be adopted. Policy formulation and enactment go together. It is necessary to put viable policy that would fast track agricultural revolution in place to avert food crisis during the COVID-19 pandemic and similar future occurrence.

The government should invite the policy, researcher, farmers, Agricultural Engineers and other stake holders in food production to put together a document on sustainable agricultural production in Nigeria. The document must address the availability and accessibility to loans and subventions by farmers. There should be policy for availability of incentives for prospective willing farmers [1]. The policy on interest rate of loan made availability to farmers should be single digit. The importation of agricultural machines must also be considered and be duty free. The tax paid by farmers should be reduced to barest minimum so as to encourage the farmers in developing countries as well as bringing in investors into that sector of the economy.

6. CONCLUSION

The adverse impact of COVID-19 on the agricultural sector of the economy of developing countries is enormous. It must be addressed by adopting effective and appropriate technology. Sustainable agricultural mechanization is the way forward in containing the impact of COVID-19 on food security. Efforts have been made on the need for the developing countries to shift their focus on agriculture especially in countries with food shortage and wastage. Functional and viable policy that promotes large scale agricultural production should be put in place to contain food crisis in similar future disaster like COVID-19. Agricultural revolution was proffered as the panacea for food crisis in the African continent.

ACKNOWLEDGEMENTS

The authors are grateful to the Forestry Research Institute of Nigeria for the encouragement received in preparing this paper.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Itodo IN. Harnessing renewable energy for sustainable agricultural production in Nigeria. Proceedings of the 37th National Conference and Annual General Meeting of the Nigerian Institution of Agricultural Engineers. Agricultural and Bioresources Engineering: Gateway to Diversify Nigeria Oil-Based Economy, Job and Wealth Creation, and Environmental Sustainability; 2016.
2. Wognum PM (Nel), Bremmers H, Trienekens JH, 25 der Vorst JGAJ, Bloemhof JM. Systems for sustainability and transparency of food supply chains Current status and challenges. *Ad25ced Engineering Informatics*. 2011;25:65–76.
3. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: Summary of a Report of 72314 cases from the Chinese Center for Disease Control and Prevention; 2020.
4. Qureshi UUR, Khan SSA, Afzal MS, Ali MS, Ahmed H. Outbreak of novel Corona virus (2019-nCoV); implications for travelers to Pakistan. *Short Communication, Travel Medicine and Infectious Disease*; 2020.
5. Lu H, Stratton CW, Tang YW. Outbreak of pneumonia of unknown etiology in Wuhan China: The mystery and the miracle. *Journal of Medicine and Virology*; 2020.
6. Zhou P, Yang XL, Wang XG, Hu B, Zhang L, Zhang W. Discovery of a novel coronavirus associated with the recent pneumonia outbreak in humans and its potential bat origin; 2020.
7. Aguiar LC, DelGrossi ME, Thomé KM. Short food supply chain: characteristics of a family farm. *Rural Sociology, Ciência Rural, Santa Maria*. 2018;48(5):1–8.
8. Devkota R, Pant LP, Gartaula HN, Patel K, Gauchan D, Hambly-Odame H, Thapa B, Raizada MN. Responsible agricultural mechanization innovation for the sustainable development of Nepal's hillside farming system. *MDPI, Sustainability*. 2020;12:1–24.
9. FAO, Sustainable Agricultural Mechanization: A Framework for Africa; 2018.
10. NBS, National Bureau of Statistics, Selected Food Prices Watch; 2020.
11. Ohadike DC. Diffusion and physiological responses to the influenza pandemic of 1918-19 in Nigeria. *Social Science and Medicine*. 1991;32(12):1393-1399.
12. Shimeles A, Verdier-Chouchane A, Boly A. Introduction: Understanding the Challenges of the Agricultural Sector in Sub-Saharan Africa. In: Shimeles A, Verdier-Chouchane A, Boly A, (eds), *Building a Resilient and Sustainable Agriculture in Sub-Saharan Africa*. Palgrave Macmillan, Cham. 2018;1–12.
13. Huff G. Causes and consequences of the Great Vietnam Famine, 1944–5. *Economic History Review*. 2018;72(1): 286–316.
14. Prasad R. Agricultural sciences in india and struggle against famine, hunger and malnutrition. *IJHS*. 2019;54(3).
15. Akinbamowo RO. A review of government policy on agricultural mechanization in Nigeria. *Journal of Agricultural Extension and Rural Development. Academic Journals*. 2013;5(8):146–153.
16. Iwuchukwu JC, Igbokwe EM. Lessons from agricultural policies and programmes in Nigeria. *Journal of Law, Policy and Globalization*. 2012;5:1–12.
17. FAO & UNIDO. *Agricultural mechanization in Africa: Time for action*. Rome, FAO and Vienna, UNIDO; 2008.
18. Handaka. *Towards sustainable agricultural mechanization in Indonesia: A conceptual model of innovation technology. Sustainable Agriculture*. 2009;:38–43.
19. Emami M, Almassi M, Bakhoda H, Kalantari I. Agricultural mechanization, A key to food security in developing countries: strategy formulating for Iran. *Agriculture and Food Security*. 2018;7(24): 1–12.
20. Negrete JC. Strategies for technology transfer of agricultural mechanization in

- Mexico. International Resource J Adv Agric. 2015;1(1):1–11.
21. Edeme RK, Nkalu NC, Idenyi JC, Arazu WO. Infrastructural development, sustainable agricultural output and employment in ECOWAS countries. Sustainable Futures. 2020;2:1–6.
 22. Simalenga TE. Entrepreneurship in mechanized agriculture and technology-oriented operations. Agric. Mech. J. (AMA). 2000;31(3):61-68.
 23. Mrema G, Soni P, Rolle RS. A regional strategy for sustainable agricultural mechanization: sustainable mechanization across agri-food chains in Asia and the Pacific region. Bangkok: FAO; 2014.
 24. Sims B, Kienzle J. Mechanization of conservation agriculture for smallholders: Issues and options for sustainable intensification. Environments. 2015;2:139–66.
 25. Van Loona J, Wolteringa L, Krupnikb TJ, Baudronc F, Boaa M, Govaertsa B. Scaling agricultural mechanization services in smallholder farming systems: Case studies from sub-Saharan Africa, South Asia, and Latin America. Agricultural Systems. 2020;180:1–13.
 26. FMA. Agricultural policy for Nigeria. Federal Ministry of Agriculture Water Resources and Rural Development, Lagos Reprint, 1989.

© 2020 Fadele et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
<http://www.sdiarticle4.com/review-history/60256>