

ADOPTION OF MECHANIZED FARMING FOR NATIONAL FOOD SECURITY AND ENVIRONMENTAL FRIENDLINESS IN NIGERIA

Grace Johnson ETIM
Department of Agricultural Education,
Akwa Ibom State College of Education,
Afaha Nsit;

Engr. Imaobong Okpongette AKPAN
Department of Mechanical Engineering Technology,
Federal Polytechnic, Ukana

AND

Engr. Eduediuyai Ekerette DAN
Department of Computer Engineering Technology,
Federal Polytechnic, Ukana

ABSTRACT

The paper comprehensively discussed the adoption of mechanized farming for national food security and environmental friendliness in Nigeria. Consequently, it was discovered that mechanized harvesting and mechanized threshing can reduce food loss at smallholder rice farms, which can lead to promising business cases and climate-smart solutions for the farmers. As for food security, a country is considered food-secured when food is not only available in the quantity needed by the population consistent with decent living but also when the consumption of the food should not pose any health hazard to the citizens. It was also established that farm mechanization contributes to increased production in two major ways: firstly, the timeliness of operation and secondly, the good quality of work. Mechanized farming is an important element in the agricultural sector of the Nigerian economy. It would determine food availability and accessibility, as well as food prices. Finally, it was concluded in the study that farm mechanization has replaced simple farm tools with powerful and efficient machines. One of the recommendations made was that in order to enhance agricultural mechanization in Nigeria, agricultural extension officers should be empowered to continue educating farmers on new farming methods and on how to use and maintain farm machines and equipment.

KEYWORDS: Mechanized Farming, National Food Security Environmental Friendliness and Nigeria.

Introduction

In order to enhance agricultural productivity as well as to reduce the cost of production, the introduction of new mechanical technology into the agricultural

production system is inescapable. Therefore, with this aspect in view, the introduction of newly developed agricultural machines and equipment, including horticultural equipment, is needed at a reasonable cost for diversifying Nigeria's economy through agricultural mechanization. According to Danbatta (2016), Nigeria has been a mono-economy for a long time, owing largely to its dependence on crude oil revenues. Due to instability and uncertainty in global crude oil prices, the Nigerian government has recognised the need to diversify the economy so as to attain solid and sustainable economic growth.

Mechanized farming is a priority area requiring urgent and strategic investments by Nigerian governments in order to diversify the economy. Moreover, according to Brian et al. (2016), agricultural mechanisation can contribute significantly to the development of food systems as it has the potential to render post-harvest, processing, and marketing activities and functions more efficient, effective, and environmentally friendly, as shown in the figure. Farm mechanisation would play a vital role in enabling the growth of commercial food systems and increasing the efficiency of post-harvest handling, processing, and marketing operations. Consequently, it would determine food availability and accessibility, as well as food prices. Mechanized farming is an important element in the agricultural sector of the Nigerian economy. It not only allows for the efficient use of various inputs such as seeds, fertilizers, plant protection chemicals, and irrigation water, but it also aids in poverty alleviation by making farming an appealing business, particularly for trained labour from universities, polytechnics, monotechnics, and colleges of education.

Concept of Mechanized Farming

Mechanized farming is the process of using agricultural machinery to mechanise the work of agriculture, thus greatly increasing farm worker productivity. According to Andrew and Charles (2015), mechanisation affects both sources of labour but in slightly different ways. Mechanization tends to expand the reach of owner-operator labor, resulting in larger farms (i.e., exploiting economies of scale). Mechanization that replaces hired labour focuses on replacing labour in high-valued crops such as fruits and vegetables. Effective mechanisation contributes to increased production in two major ways: firstly, the timeliness of operation and secondly, the good quality of work. Farm mechanisation is the application of engineering principles and technology in farm production, storage, and processing on the farm (Iwena 2008). The requirement for power for certain operations like seedbed preparation, cultivation, and harvesting has become so great that the existing human and animal power in the country appears to be inadequate. Similarly, in mechanised harvesting, processing may also begin as part of the actual harvest process, with initial cleaning and sorting performed by the harvesting machinery.

Mechanization farming is the application of mechanical technology to boost agricultural production. To some people, farm mechanisation is synonymous with tractorization,

while others take it to imply an increase in production per worker and per hectare of land cultivated. For Achebe (2003), it simply means the replacement of the weak, simple farm tools with powerful and efficient machines. It is a means to enhance the productivity of human labour and to achieve results beyond their capacity (FAO/UNIDO, 2008). This includes the use of tractors of various types as well as animal-powered and human-powered implements, tools, internal combustion engines, electric motors, solar power, and other methods of energy conversion. Mechanized farming also includes irrigation systems, food processing, and related technologies and equipment for adding value to agricultural products.

Concept of National Security

The study of national security had its beginnings in the 1940s. National security can be defined as the result of a country's joint purposeful measures that improve internal and external security as well as general abilities and readiness for detecting, preventing, and overcoming threats to national security. Governments rely on a range of measures, including political, economic, and military power, as well as diplomacy, to safeguard the security of a nation-state. National security, or national defense, is the security and defense of a sovereign state, including its citizens, economy, and institutions, which is regarded as a duty of the government. Also, national security is the state of being free from external physical threats. According to Anand (2015), a nation has security when it does not have to sacrifice its legitimate interests to avoid war and is able, if challenged, to maintain them by war. The security of a country is intrinsically tied to its resource position and ecological balance, among other factors.

National security studies at this time focused very squarely upon issues surrounding the use of armed force in international politics. For most of the 20th century, national security was focused on military security, but as a concept, it expanded over time beyond what the armed forces could do (or not do, as the case may be). In 1947, the United States created the National Security Council to "advise the President with respect to the integration of domestic, foreign, and military policies relating to national security." In the wake of total war and at the dawn of the nuclear age, it was well understood that the days of defining national security solely in terms of armies fighting it out in set-piece battles were things of the past. Since then, national security has come to mean different things to different people. Today, there are all kinds of "national security." They include economic security; energy security; environmental security; and even health, women's, and food security.

Concept of Environmental Friendliness

Environment friendliness, also known as environmentally friendly processes, refers to goods and services, laws, guidelines, and policies that claim to reduce, minimize, or eliminate harm to ecosystems or the environment. Environmentally conscious customers, it appears, are competing to protect the environment through activities such as recycling,

emphasising environmental labels on recycled materials, and consuming only green products (Barber, 2010). Similarly, since the issues of public awareness and concern for the environment are growing, corporate environmental responsibility is now becoming the corporate agenda for almost every organisation worldwide (Servaes and Tamayo, 2013; Dimitriadis, 2007). The responsibilities of organisations to society are to respect environmental considerations, ensure public concern and consumer well-being. Organizations, on the other hand, must not abuse production resources; be more responsive and alert to pollution, noise, waste disposal effects, and potential hazards; and use only eco-friendly substances.

Despite the serious current of environmental problems, many people still believe that the government is the main body that should be responsible for protecting the environment. For decades, the government has played a role in upholding social interests through laws and regulations, preserving the environment, and developing sustainable consumption through policy and regulation implementation (Tan & Lau, 2010; Wang, 2010). Yet, it is still not enough, as tougher regulations and a variety of environmental policies are needed in order to increase environmental awareness in order to enable behavioural changes among the public. Public awareness is the most significant factor affecting environmental problems (Yahya and Che Ha, 2013). Actually, the environmental problems come from the population and its consumption patterns, although some put the blame on the government, commercial agriculture businesses, or oil organisations (Oskamp and Saunders, 2003). Therefore, one of the challenging tasks is to stimulate the citizens' knowledge and awareness towards environmental protection.

Concept of Postharvest

In agriculture, postharvest is referred to as the stage of crop production immediately following harvest, including cooling, cleaning, sorting, and packing. The instant a crop is removed from the ground, or separated from its parent plant, it begins to deteriorate. Postharvest treatment largely determines final quality, whether a crop is sold for fresh consumption, or used as an ingredient in a processed food product. According to Janet and Richard (2010), the most important goals of post-harvest are keeping the product cool to avoid moisture loss and slow down undesirable chemical changes; and avoiding physical damage such as bruising to delay spoilage. In the field, post-harvest processing is usually continued in a packing house. This can be a simple shed, providing shade and running water, or a large-scale, sophisticated, mechanised facility, with conveyor belts and automated sorting and packing stations.

Initial post-harvest storage conditions are critical to maintaining quality. Each crop has an optimum range of storage temperatures and humidity. Also, certain crops cannot be effectively stored together, as unwanted chemical interactions can result. Various methods of high-speed cooling, and sophisticated refrigerated and atmosphere-controlled environments, are employed to prolong freshness, particularly in large-scale operations.

Concept of Processing Activities

Processing activities mean any operation or set of operations that are performed on personal data. This includes, but is not limited to, obtaining, developing, producing, organizing, structuring, accessing, using, adapting, modifying, retrieving, consulting, copying, reproducing, analyzing, disclosing, disseminating, making available, aligning, combining, blocking, restricting, transmitting, transferring, selling, renting, and storing, retaining, destroying, deleting, or erasing personal data. Special attention to the research and development activities of students is an index of understanding the significance of personnel potential development, which increases the capability to conduct critical analysis, research activities, and rational use of national resources.

In other words, Processing Activities means any operation or set of operations that is performed on Personal Data, whether or not by automatic means, including, but not limited to, obtaining, developing, producing, collecting, organizing, structuring, accessing, using, adapting, modifying, retrieving, consulting, copying, reproducing, analyzing, disclosing, disseminating, making available, aligning, combining, blocking, restricting, transmitting, transferring, selling, renting, storing, retaining, destroying, deleting, or erasing such Personal Data.

Concept of Marketing Activities

Marketing activities are tactics and strategies that a business employs to encourage customers to buy goods or services. Marketing activities can also include initiatives to better understand consumers, such as market research. According to Daniel (2022), marketing activities are the methods companies use to sell and promote their products or services to returning and new customers. Companies use different marketing activities—such as email campaigns, paid advertisements, or search engine optimization—to reach returning and potential customers. An effective marketing plan includes various marketing tools and tactics and tracks marketing metrics to gauge efficacy and results. Marketing's arbitrary nature stems from the constantly shifting perspectives in socio-cultural and technological contexts, with marketing today considered to be a dynamic rather than a static subject (Groucutt, 2005, Kyle 2011).

There are many marketing activities that small business owners or e-commerce companies can use to increase brand awareness and reach their target audience.

- ♣ **Content marketing:** This marketing strategy includes coordinated content creation that provides potential customers with relevant text, video, and audio content. Examples of pieces of content used for this type of marketing include advertising memes, entertaining videos, podcasts, and blog entries (Daniel 2022). You can promote this content on your landing page or other marketing channels like your newsletter or social media.

- ♣ **Digital ad marketing:** This category covers many marketing tactics. Digital ad marketing includes web ads, podcast ads, email marketing, and webinars. Unlike content marketing, digital marketing focuses on actual ads rather than website content that may or may not contain information about your business.
- ♣ **Market research:** By gathering information about the behaviour of potential and existing customers and analysing and interpreting that information, businesses can make informed decisions about the development of a new product or service (Daniel 2022). Implementing marketing research can also help companies improve their customer experience by better understanding the needs and demographics of their customer base. You can use market research to find new customers, identify your ideal customer or target market, or research market trends.
- ♣ **Search engine optimization (SEO):** This tactic focuses on attracting targeted traffic to a website through organic or nonpaid rankings on a search engine results page (SERP). Unlike paid results such as pay-per-click advertisements, search engine optimization involves the creation of organic content that answers user queries and features relevant keywords.
- ♣ **Social media marketing:** This digital marketing method engages new customers on social media platforms. Social media marketing campaigns include video ads, in-feed static ads, or paid partnerships with influencers.

Mechanized Farming Tools

Farm tools and equipment are some of the things that make farming possible. There are numerous implements that are used for various purposes at different stages of farming, from soil preparation to planting and harvesting. Examples of some mechanized farming tools includes:

Cultivator. This can be used to carry out secondary tillage on the farm land. In most cases this machine is equipped with rotary motion.



Source: <https://www.legit.ng/>

Seed Drill. This machine is used for sowing seeds. It is used for planting seeds at equal distance and proper depth.



Source: <https://www.legit.ng/>

Tractor. A tractor is one of the most essential farming equipment. It is a vehicle that is specially designed for hauling different types of agricultural machinery.



Source: <https://www.legit.ng/>

Cultipacker. This is the equipment that is used for crushing soil clods. It can be used to eliminate cracks, press small stones, and remove air pockets to form a smooth, firm seedbed.



Source: <https://www.legit.ng/>

Pruning Shears: Pruning shears are also called pruning scissors. They are sharp, heavy-duty scissors that are used for cutting branches of trees and plant stems.



Source: <https://www.legit.ng/>

Bolo: A bolo is mainly used for clearing vegetation, for cutting tall weeds and grasses, and for chopping branches of trees.



Source: <https://www.legit.ng/>

Sprinklers: This is simply a tool for watering plants



Source: <https://www.legit.ng/>

Types of Mechanized Farming

Mechanised farming is the process of using agricultural machinery to mechanise the work of agriculture, greatly increasing farm worker productivity. In modern times, powered machinery has replaced many farm jobs formerly carried out by manual labour or by working animals such as oxen, horses, and mules. In Nigeria, there are three types of agricultural mechanisation that can be identified (Upahi, 2018). They are:

Traditional Agricultural Mechanization Technology: They are the simplest and the most basic technology for agricultural mechanisation in Nigeria. The technology uses man as a source of power. It ranges from traditional cutlasses to hoes and other tools.

Draught Animal Technology: This refers to a range of implements and equipment that are powered by animals as their major energy source. Over 2 million farmers across the 19 states of Nigeria are actively engaged in the use of animal traction, yet less than 10% of the 2 million farmers exploit the animals through the use of limited available implements (Upahi, 2018).

Engine Powered Machinery Technology: In this technology, engines and motors using fuel or electricity are used to power machines such as threshers, mills, irrigation pumps, and grinders for the production, harvesting, processing, and handling of wide varieties of agricultural products.

Effects of Mechanized Farming on National Food Security

Ensuring food security has become an issue of key importance to countries with different degrees of economic development, while the agricultural sector plays a strategic role in improving food availability. In essence, a country should be considered food-secure when food is not only available in the quantity needed by the population to maintain decent living standards, but also when the consumption of the food does not pose any health hazard to the citizens (Davies, 2009). Mechanization is accompanied by changes in the quantity and type of labour required for an activity. Agricultural mechanisation is often touted by policymakers as reducing the drudgery associated with agricultural work and as increasing the productivity of the farming system, especially in contexts where traditional technologies appear to be stagnant. For good or for ill, mechanisation is expected to replace labour in agriculture.

Mechanized harvesting and mechanised threshing can reduce food loss at smallholder rice farms, which can lead to promising business cases and climate-smart solutions for the farmers. Introducing mechanised harvesting and mechanised threshing prevents almost half a tonne (479 kg) of food loss per hectare. Mechanization is also increasing farmers' income by approximately \$200 per hectare. According to Ojo (2014), food security exists when people have access to adequate, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Many believe that mechanisation has largely positive effects, for example, releasing farmers from heavy physical work and enabling higher yields (Sims et al., 2016; Malabo Montpellier Panel, 2018). However, there are also fears of unemployment and land expansion at the cost of forests and savannah, among others (Daum & Birner, 2019). Moreover, the use of tractors may affect the environment. While some of the changes related to mechanisation may be positive, others can be negative.

Conclusion

Farm mechanisation contributes to increased production in two major ways: firstly, the timeliness of operation and secondly, the good quality of work. Mechanized farming is an important element in the agricultural sector of the Nigerian economy. It would determine food availability and accessibility, as well as food prices. Farm mechanisation enables efficient utilisation of various inputs such as seeds, fertilizers, plant protection chemicals, and water for irrigation. It also helps in poverty alleviation by making farming an attractive business, especially to the trained manpower from the universities, polytechnics, monotechnics, and colleges of education. Finally, farm mechanisation has replaced the weak and simple farm tools with powerful and efficient machines.

Recommendations

1. In order to enhance agricultural mechanization in Nigeria, agricultural extension officers should be empowered to continue educating farmers on new farming methods and on how to use and maintain farm machines and equipment.
2. The Nigerian government should involve mechanical and agricultural engineers in setting up agricultural tool fabrication industries for design and manufacturing of necessary spare parts and other farm implements.
3. Effort should be intensified to get small scale farmers to join active cooperative societies in order to access resources for farm mechanization.

REFERENCES

- Achebe, A. (2003). *Agricultural mechanization in Nigeria in science and technology in the society*. Wesh and Solomon Publishing Coy Ltd Onitsha Pp 86-91
- Anand K. S. (2015). Concept of national security: An overview. *Journal of Emerging Technologies and Innovative Research*, 2(12), 2349 – 2359.
- Andrew S. & Charles B. M. (2015). Mechanized agriculture: Machine adoption, farm size, and labor displacement. *University of Florida AgBioForum*, 18(3), 278 – 296.
- Barber, N. (2010). Green wine packaging: Targeting environmental consumers. *International Journal of Wine Business Research*, 22(4), 423 – 444.
- Brian, S., Martin, H., & Josef, K. (2016). Agricultural mechanization: A key input for sub-Saharan African smallholders. *Integrated Crop Management*, 23(16), 9 – 12.
- Danbatta, U. G. (2016). *The national broadband plan as a catalyst for social and economic transformation – The NCC mandate*. Paper Presented to the Academy of Engineering Lecture Series.
- Daniel, P. (2022). *Marketing activities: 5 types of marketing activities*. Retrieved from: <https://www.masterclass.com/>
- Daum & Birner (2019). Agricultural mechanization in Africa: Myths, realities and an emerging research agenda. *Global Food Security*. In Press.
- Davies, A.E. (2009). *Food security initiatives in Nigeria: Prospects and challenges*. monograph, department of political science, University of Ilorin, Nigeria.
- Dimitriades, S.Z. (2007). Business ethics and corporate social responsibility in the economy: A commentary. *Electronic Journal of Business Ethics and Organization Studies*, 12(2).
- FAO/UNIDO. (2008). *Agricultural mechanization in Africa: Time for action*. Food and Agriculture Organization of the United Nations Rome. Pp 1-3.
- Groucutt, J. (2005). *Foundations of marketing*. Houndmills: Palgrave Macmillan
- Iwena, O. A. (2008). *Essential agricultural science for senior secondary schools*. Tonad Publishers Ltd Ogun State, Pp 137
- Janet, B. & Richard, E. (2000). *Postharvest handling of fruits and vegetables*. NCAT.
- Kyle, B. (2011). *The definition of marketing. Has it changed?* Retrieved from: www.websitemarketingplan.com/marketing_management/marketing_change.html

- Malabo Montpellier Panel (2018). *Mechanized: Transforming Africa's agriculture value chains*. Dakar, Senegal: International Food Policy Research Institute (IFPRI) and Malabo Montpellier Panel.
- Ojo, E.O. (2014). Public Opinion and the Conduct of Nigeria's Foreign Policy: Two Selected case studies. *The Nigerian Journal of the Social Sciences*, 3(1), 19 – 25.
- Oskamp, C., & Saunders, C. (2003). The Emerging Field of Conservation Psychology. *Human Ecology Review*, 10, 137 – 149.
- Servaes, H., & Tamayo, A. (2013). The impact of corporate social responsibility on firm value: The role of customer awareness. *Management Science*, 59(5), 1045 – 1061.
- Sims, B.G. Hilmi, M. Kienzle, J. (2016). *Agricultural mechanization: A key input for sub-Saharan Africa smallholders*. Integrated Crop Management 23. FAO, Rome.
- Tan, B.C., and Lau, T.C. (2010). Attitude towards the environment and green products: Consumers Perspective. *Management Science and Engineering*, 4 (2), 27 – 39.
- Upahi, E. J. (2018). Mechanization of agriculture in Nigeria: An overview of local content development. *The Kaduna Engineers*, 4(28), 10 – 11.
- Yahya, W. K., & Che Ha, N. (2013). The relationship between environmental issues and organisational performance. *International Journal of Business and Society*, 14(1), 111 – 134.