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Assessment of the Effects of Farm Technologies Input Adopted by Subsistence Farmers' in Kogi State, Nigeria

Enemaku, Lawrence Ebenehi[1], & Ogunlade, Christopher Bamidele[2]

Department of Agricultural and Bio-Environmental Engineering Technology,
The Federal Polytechnic, Ilaro, Ogun State.
[1]lawrence.enemaku@federalpolyilaro.edu.ng; [2]christopher.ogunlade@federalpolyilaro.edu.ng

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Abstract

Modern Agricultural technologies (Agricultural Mechanization) application is a deliberate transition from traditional subsistence agriculture into a sustainably commercialized agricultural production. It involves the application of smart engineering technologies into the practice of all farm production processes, to eliminate drudgery, high cost of inputs and enhances timeliness with high field yields as a return on investments in the field of agriculture. Objectively, this research finding assessed and evaluated the implications for agro-production technologies employed by farmers within Ibaji Local Government Area (ILGA) of Kogi State, Nigeria. In assessing these impacts, the capacity of field yields using machines and manual powers by farmers' operations were analyzed using the descriptive statistical model. The extent to which these technologies are applied by farmers for their various operations was studied as a determinant for their productivity output. From this research analysis, findings revealed that both human and mechanical power sources were variedly used among the male-dominated subsistence farmers within the area under survey. From results, poor mechanical power input of about 23.73% with a low Mechanization Index (MI) average of 0.9659 in the entire ILGA revealed the under-utilization of mechanical power. Hence the low technological farming techniques input undermined by high utilization of manual power for the majority of farming operations which resulted in farmers' low production output in the area.

Keywords: Power, Farmers, Technologies, Productivity, Mechanization.

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1. Introduction

The primary aim of Agricultural Mechanization (AM) is a technological adoption and utilization of skilful techniques to maximize food production using lesser: time, manual labour (eliminating drudgery) and cost of resource input at every production stage. This encompasses every efficient skill with prudent management of all inputted resources. It applies to the use of all mechanical and smart technologies for agri-food production processes for both human and animal consumption benefits. Recently, global technological innovations and advancements such as genetically modified seedlings, hydroponics, fertigation, drones, automated combine harvesters; have played an impactful role that has changed the conventional cultural narratives in the field of agriculture to smart practices. These among others were acknowledged by their ease of continual application as the greatest 21st-century technological achievements for the agricultural sector (Barman *et al.*, 2016). The technological innovations are fast eliminating existing crude and complex traditional practices. To enhance efficient AM practices, assessment

indicators and viable prediction models that reflect the peculiarities and uniqueness of each farmer's must be formulated for utilization.

According to Olaoye & Rotimi, (2010), these assessment indicators and prediction models must not possess unilateral guidelines for all farmers' since it requires an adequate understanding of various farmers' production peculiarities. After the Nigeria agricultural boom years that ended in the early '80s, it was only in the year 2017 that the Nigeria agricultural sector contributed an impactful economic role that revived the ailing national economy. Bello *et al.*, (2015) analysis on Nigeria (NGR) extent of manual power and mechanical power inputs with Latin America Nations (LAN) revealed 59% and 90%; 90% and 2% for LAN and NGR respectively; an outcome that indicated the low extent of Nigeria's application of modern production technologies in this sector's activities.

According to FAO, (2005), it was discovered that since 1960, Nigeria had experienced a successive failure in the advancement of farm mechanization because of the non-implementation of relevant modern production technologies. These bring to an urgent need, a transcend from existing crude and traditional techniques associated with low production capacity for the enormous subsistence farms across the state and Nigeria into a technologically sustainable commercial production. This is achievable when set as a goal towards achieving food security since it encompasses all processes of agro-production output capacity enhancement. More so, this will promote the maximization of available arable land potentials by promoting sustainable innovative production capabilities amongst farmers.

2. Research Methodology

Location of Study Area

The area understudied for this research work was Ibaji Local Government Area of Kogi state: Latitude 6°52'N 6°48'E and 6.867°N 6.800°E of equator and longitude of the Greenwich meridian. It is situated in the eastern part of Kogi state. It has a wet climate zone with a mean annual precipitation of (1523mm-1,625mm) per annum, a temperature range of 20°C-31.3°C and relatively high humidity of 87%. Topographically, it has an elevation area between 300m to 490m above sea level (Wikipedia.org). It is made up of the following farming settlements: Echeno, Ejule, Obale, Odeke, Onyedega, Uje, Unale, Ogwulugwu, Omabo, Ochuchu, Ten (10) in total. Commonly grown crops are: rice, vegetables, root and tuber

Collation and Analysis of Data

The primary and secondary data sources were used to collate data for this research work in the year 2020 through interactions with farmers' and the use of one-hundred and fifty (150) copies of questionnaires requesting applicable information. Other information was collated from online published journals, presented academic papers. The Descriptive Statistical (DS) tool expressed as percentage and frequency was used to analyze data collated in percentages to obtain a clear description of the impact technology (ies) adopted by the farmers within the farming settlements.

Determining Mechanization Index (MI)

This is expressed as the percentage of total work done by farm machines tractors to total manual power. It is mathematically expressed using E*quation 1* below. The MI expressed the extent of practised mechanization while using different power sources (Bello R.S *et al.*, 2015)

$$MI = \frac{P_M}{M_P + P_M} \times \% \quad (1)$$

Where;

P_M = Machine power used (Kwhr/ha)

M_P = Manual power used (Kwhr/ha)

From the above, M_P was determined using feedbacks from concerned farmers.

Estimating Machine and Human Productivity

The production output of the machine and human power applied was determined using mathematical expression by Bello R.S *et al.,* (2015) as shown below:

$$A_M = \frac{1}{\varepsilon_M} \quad (2)$$

$$A_H = \frac{1}{\varepsilon_H} \quad (3)$$

$$A_T = \frac{1}{\varepsilon_M} + \frac{1}{\varepsilon_H} \quad (4)$$

Where:

A_M = Machine's production output, it is an expression of work done by the machine used in the operation.

A_H = Manual production output, it is the expression of work done by human labour used.

A_T = Overall production output for both manual and machine inputs.

3. Results Analysis

One-hundred and twenty (120) returned questionnaires revealed a 75% male-dominated farming occupation.

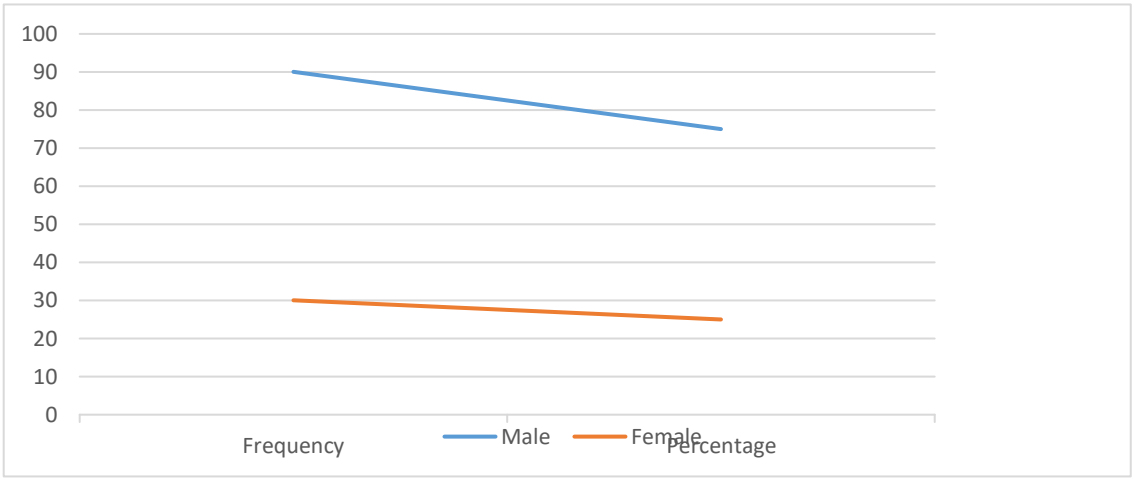

Figure 1. Gender Demography

The male-dominated farmers are non-cooperative scheme farm settlers who had acquired at least the primary school certification. This level of literacy is presumed to be responsible for farmers' inadequate awareness and adaption of modern farming technology for their activities.

Farm Power Inputs

Results from figure 2 and figure 3 below revealed the extents of mechanical and Human power inputs in the overall farming operations by farmers within the study area. Among other farming operation, while mechanized harvesting

operation was practised by very few farmers, it was ranked the most mechanized input for farming operations by the farmers, while harrowing and planting operations were not mechanized. Prevalent Human power input in the majority of farmers' operations indicated the level of mechanized technology adapted by the farmers. Factors such as high cost of technological inputs (Example; Tractor and its' accompanying equipment), the workability of the available one on the nature of the soil, farmers' low capital investment in subsistence practice indulged and inadequate operational skills that could enhance cost-effectiveness and high return on farmers' investments were amongst others were discovered to be responsible for these outcomes (Mobia *et al.*, 2016). More so, the sizes of farmland under cultivation and the nature of cultural practices by each farmer was a determinant if mechanised technology were to be adopted for all farming operations (Dauda *et al.*, 2012). The utilized farm power as investigated are represented as LM: machines Labour, LH: Manual (human) labour and analyzed is shown in figure 2 and figure 3.

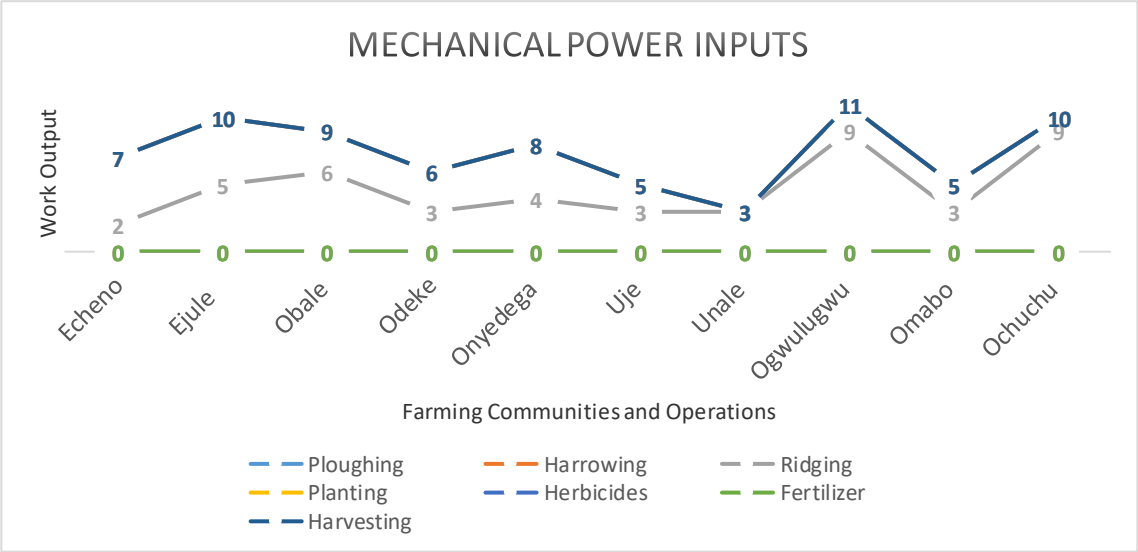

Figure 2. Determination of Mechanical Power Inputs

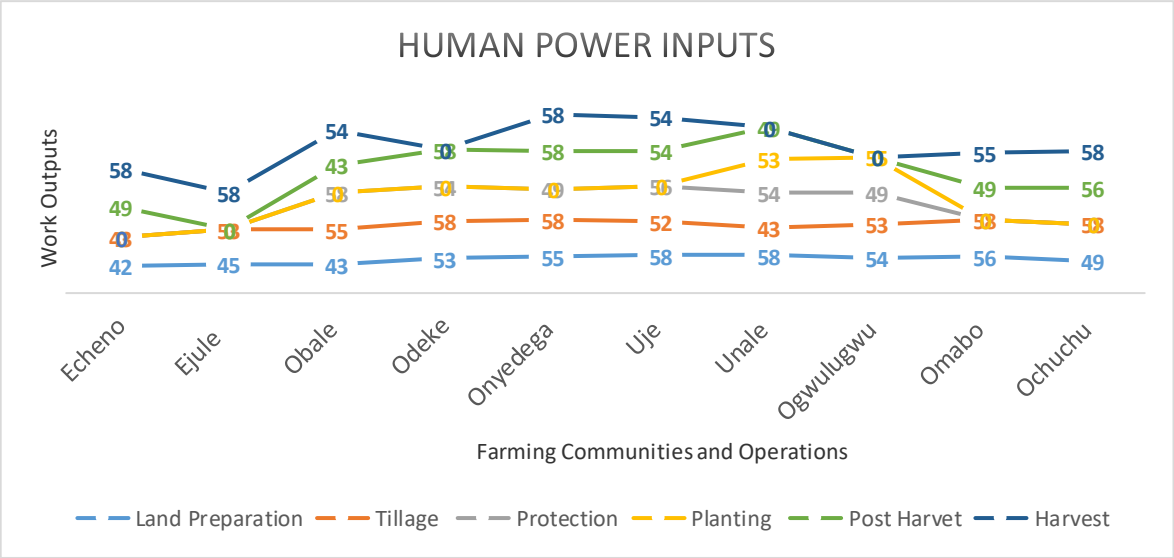

Figure 3. Determination of Manual Power Inputs

Mechanization Effects on Agro-production Output

Figure 4 below shows an increase in farmers' machine power input per decreasing hectare of farmlands under cultivation than manual power inputs. With a degree of mechanization technology input inversely proportional to the size of farmland under cultivation by farmers' is a fact that, mechanize inputs are affordable due to the corresponding capital cost investment for each farming season since farming operations are seasonal in this area under study (Aduba & Manta 2013).

Where:
∑A= Overall land area cultivated (ha)
LOM= Level of Mechanization (%)
MI= Mechanization Index

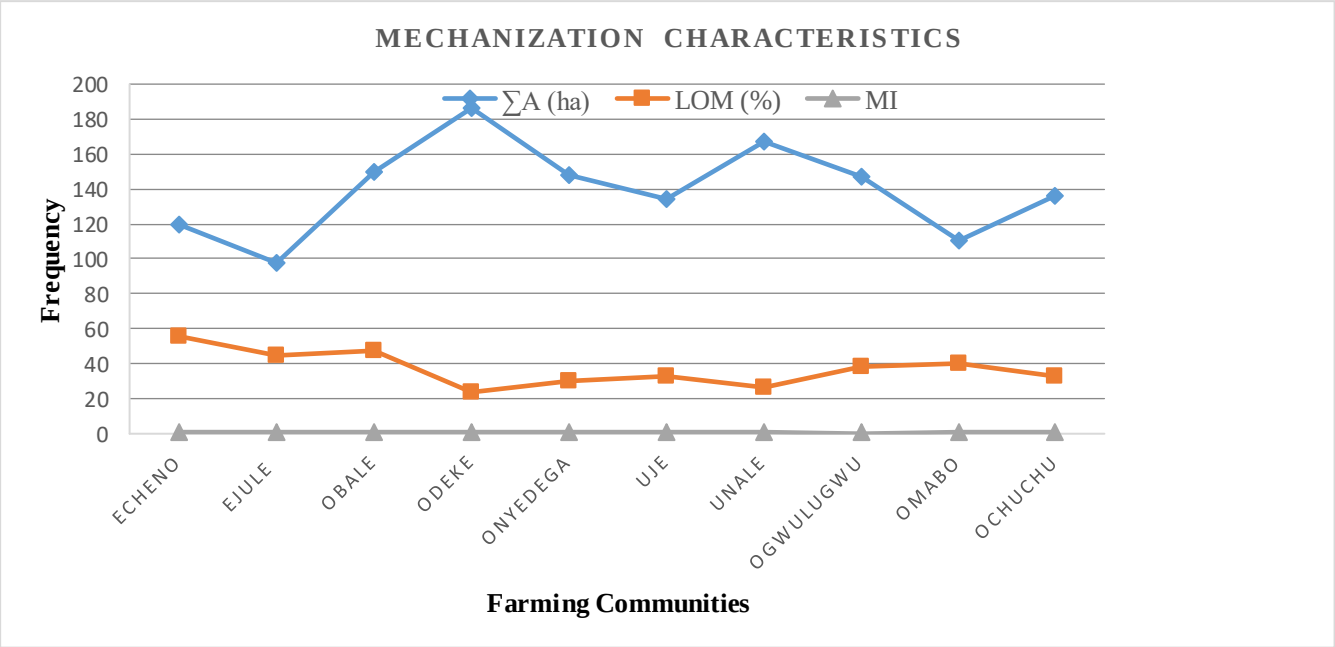

Figure 4. Characteristics of Mechanization Practiced

This indicated extent of farm technologies input (LOM) as a determinant for MI for each given area of farmland cultivated. With a maximum of 55.31%, machine technology application for Echeno and minimum of 23.73% for Odeke; maximum and minimum MI recorded was 0.9822 for Ochuchu and 0.8329 for Ogwulugwu with a maximum of 186ha of farmland cultivated.

Production Output for Power Inputs

Below is a significantly low average production output derived from ΣMP input of 0.0002Ha/Kwh when compared to ΣHP input of 0.014Ha/Kwh. Result confirmed the low extent of mechanization application.

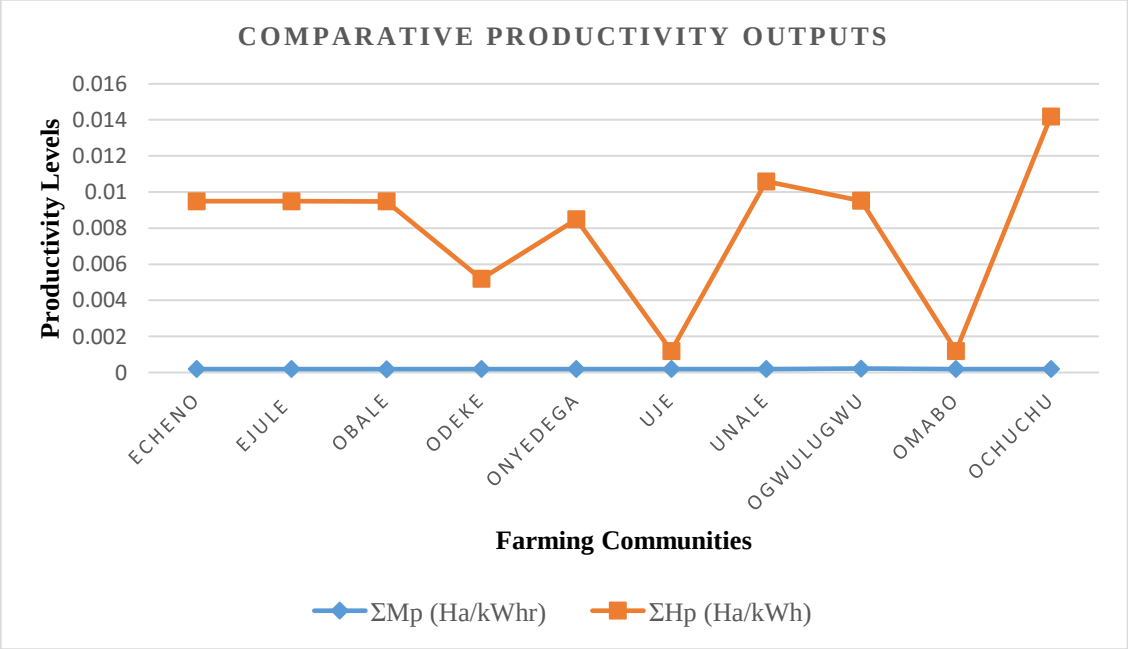

Figure 5. Communities Production Compared

Marginal Gross Analysis

Assessed average crop yields and returns on investment for the agricultural production activities were carried out. Prevalent subsistence farm settlements of (2 – 4ha) encouraged consistent intense cultivation on farmland. This restricted crop rotation practices with consequent soil fertility and micro-structure depletion. Capital input cost for mechanized field operations stood above N97, 720/ha.

4. Conclusion

The majority of farm settlements had low production output efficiency characterized by underutilization of farm machine power and modern farming smart technologies. With the highest of 55.31% for Echeno and least level of 23.73% for Odeke and an average MI of 0.9659 in the entire ILGA.

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