

## The Role of Agricultural Mechanization in the Economic Development for Small Scale Farms In Adamawa State

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### -----ABSTRACT-----

*The economic situation at agricultural industry has been change rapidly in Adamawa state from 1999-2013, the population in farming areas decreased sharply and the labor demand increased. The farm size and farm rural wage have been increased. These were the driving force of agriculture mechanization industry. It had made off-farm employment opportunity and improves socio economic status of rural farmers. To sustain income status of small scale farmers and Welfare of rural farming communities, the manual power in Adamawa state is gradually replaced by single axle multipurpose machines from land preparation to post-harvest. They should be plan for joint utilization system of agricultural machinery, to improve quality and quantity production of agricultural products. Also the market status of agricultural production should be opened to other foreign countries to boast small scale farmer's income.*

**Keywords:** Agriculture, Economics, Development, small-scale farm

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### I. INTRODUCTION

Human labor is still the main source of power used in agricultural work in developing countries (Jaffrey and O'Neil 2000). It is also responsible for approximately half of the cultivated area in the world (Ramansamy, 1994). In small-scale farms like this agricultural machinery with low cost and technological adequacy make rural farmers easy to operate.

Agricultural mechanism in economic development was adapted in Great Britain by AG engineer, Ferguson, in 1930. He visualized a tractor and implement working together as a single integrated machine rather operating as two units. He reported that "Agricultural is more important to mankind that all other industries put together. In 1974, UK earned at least £1000 (or USD billion) estimated for sales and export of tractors (B.A. May 1988).

By statistical observation, Agriculture provides 80% of the occupation in Nigeria and crude oil about 20% (federal statistical report 2010) Agricultural mechanization is an enterprise that create wealth and youth empowerment in which one liter of palm oil or groundnut oil is more expensive than one liter of petrol or diesel in Nigeria.

The situational changes to Agricultural sector, such as hikes in rural wages, increase in off-farm jobs opportunities, strong demand for improved welfare and lack of government interest to purchase farm machinery had retarded agricultural mechanization in the study zone.

More than 80% of Adamawa state farming population are small-scale farmers, cultivating less than 2ha on quite widely distributed farms. Farming is mostly a rain fed activity in the study zone and operation is critical. If there is no rain; there no business for mechanize service provider.

A range of agricultural machinery such as tractors, harvesters, boom sprayers, planters, Power drillers, slasher, riggers and single axle multipurpose machine are commonly use in the study zone to provide timely and affordable mechanized services to small scale farmers who cannot Alford machinery on their own

II. MATERIALS AND METHODS

This research work uses data from agricultural mechanization practices and small scale farm enterprises. Farmers were interviewed along the agricultural machinery service beneficiaries across the state.

The role of agricultural mechanization in the economic development should be challenge with aid of state government to improved agricultural production in study zone, using the following methodology. Hoffen in (1960) reported, that farmers in developing countries have been using hand tools for thousand years, draught animal for century and mechanization for decades. Stout (2000) stated that, to ensure an adequate and safe food supply for expanding world population tractor is the prime source of power in agriculture mechanization in the developing countries.

The peak demand period of machinery from statistical data spread from May to august in the northern Adamawa state, where a single cropping season dominated as a result of single rainy season. The pattern allows for about 55 days of effective operations

In the southern Adamawa state, two cropping season are possible and the peak demand spreads from April to August during major raining season. Yam production season spreads from October to December allowing 120 days effective operation in total

2.1 Agricultural Mechanization Investment Theory for Business Firm

Mechanization service provision is considered as business run by a firm. Investment theory in Agricultural mechanization services was described by Diao, Yeldon, and Roe (1998), who adopted it from Barro and Salai Martin (1996). It was adapted in Ghana Agricultural mechanization, to maximize profit, taking market prices of tractors, fuel maintenance and laborrate as given in 10years. The goal of farm business is to maximize its net profit.

(I) Revenue  $G_t = P \cdot A_c - A_c (F \cdot L) - M$ ----- (1)

where  
 $G_t$ = annual service provision revenue minus variable cost  
 $P$ = market plowing charges /Acre  
 $A_c$ = acres plowed  
 $F$ = fuel and lubrication cost per acre  
 $L$ = labor cost per acre  
 $M$ = maintenance cost and fixed cost per year.  
Fixed operating cost per year  
(P, F, L, & M)

(II) Net profit  $N = P \cdot A_c - A_c (F + L) - m - (r + \delta) I$ \_\_\_\_\_ (2)

Where  $N$ =net profit

$r$  =annual saving interest  
 $\delta$ = capital depreciate rate

(III)  $N = G_t - (r + \delta) I$ \_\_\_\_\_ (3)

Define the annual net profit from investment in tractor,

2.2 Agricultural mechanization working environment should be improved

The youths in the study zone do not actively take to farming because of difficulties and dirty working environment characterized of using hand tools. The user of hoes and machetes for farm work demands a lot of energy. The effect on the health is better imagining than experience.

With method of introducing machines in figures 2-6 the suffering is transferred to a machine. The advantage of removing the drudgery in farm work is that anybody, young or old, male or female can work in the farm. When small –scale farm are mechanized, production level increase from subsistence to commercial level to improve the socio- economic status of rural community.

**2.3 Agricultural Mechanization Requirement in the Study Zone**

The requirement of mechanized agriculture in the developed world is still labor- intensive. Human labor accounts for 2/3 of the power input in agriculture, draft animals ¼ and machines power is less than 1/10.

Thus, basic farm mechanization methodology requirement include:

- 1) Suitability of single axle – multipurpose machine for small – scale farm as shown in fig 1-5
- 2) Simple design and easy to operate in rural areas.
- 3) Versatility for using in different farm operation.
- 4) Affordability in terms of cost to small – scale farmers.
- 5) Supply of low powered and multipurpose machine.
- 6) Solar paned energy water pumps for small – scale irrigation should be developed.
- 7) Locally available materials must be incorporated is design and fabrication of machines to reduce the manufacturing cost.

**2.4 Agricultural enterprise and marketing**

The picture of agricultural mechanization in the study zone will not be completed without method of marketing agricultural products, Livestock and fisheries. Domestic market predominant, but there are many market where high value commodities such as flowers, fruits, forest product, vegetable, animal product and plantation crops will be important value added. Processing of commodities should be encouraged to reduce losses and enhance profit in the study zone as shown in table 2

Table2 :Market Status Of Agricultural Product And Estimation Of Income In Adamawa State-Nigeria

s/no	size of agric enterprise	Duration of production in months	Estimated income in million Naira(N)
1	1000 cat fish	8	N60
2	1000 layers of bird	24	N100
3	1000 head of cattle	24	N50
4	1000 swine	24	N30-40
5	1000 bags of rice	3-4	N3-4
6	5000 liters of honey	24	N15-20
7	1000 bags of cowpea	3-5	N10

Source: Agricultural Enterprise A key to youth empowerment and wealth creation 2013 Ganye -Nigeria

**III. RESULT AND DISCUSSION**

The result of experimental data obtained from different source is presented in tables. Assessing the profitability in equation 1, based on field survey and theoretical net profit Or various cost and revenue assumption.. In a theoretical model the tractor operational efficiency is assumed to be the same.

**3.1 Calibrate the model to Adamawa state situation.**

$$N=P *A -A- (F*L) -M-(r-\delta) L$$

To calibrate equation 1 using actual data and information from parameters P,F,L with assumption of  $\delta=0.1$  and  $r=0.07$ , parameters were estimated using field survey conducted in the study zone on plowed cost /acre, price of tractor with regard to L .

In table 2 it shows agricultural production and enterprise for small scale farms are model of wealth creation for youth empowerment. If mechanization standard is improved and more supply of multipurpose machines to transfer farmers labor and fatigue to machines will improve agriculture production in future Federal statistics information and data reported in (2010) in Nigeria that agriculture provides 80% of the population occupation and crude oil about 20%, the result of market status in Nigeria challenges us that a liter of ground oil or palm oil is expensive than a liter of petrol or diesel

Agriculture mechanization is an enterprise that creates job opportunity with application of machines as showed in figures 2-5. It reduces drudgery and save time in of routine farm operations. kyu-hong and sukwa kang reported (2000) that, the total population lived in farming area is rapidly decreasing by 58%, demand for off- farm sector is increasing on daily basis. The rural manual farmers population is decreasing by 4,000 every year from 1980-2000. If it continuous what will be the fate of agriculture in future? Thus, mechanized farms should be encouraged in the study zone. The result of the study shows that, conventional production practices in agricultural sector in Adamawa state still dominantly remain to be high doses labor and with relatively small input. Therefore, mechanization emerges as essential for management of economic development.

The implementation of agricultural mechanization has to be done by involving the active participation of agric business society including; consumers/farmers, related industry, producers and financial institution (Hendriadi and Allihasyah (2007).

Mechanization systems are often categorized into man, animal and engine powered technology on the basis of sophisticated capacity to do work and in some cases precision and effectiveness. Table3 shows the geographical variation, reflects environment, historical factors and the stage of Agricultural development.

Table3 Agricultural power by source and geographical region

Region	total Kw /ha	% of available power/ha		
		engine	man	Animal
Asia	0.16	23	26	51
Nigeria	0.08	58	35	7
Land America	0.19	71	9	20

Source; Giles (1975)

Mechanization increase Economic returns to small scale farmers .With mechanization and more *lands under cultivation, the scale of operation of the farmer is increase. If a farmer is using hand tools, he may be restricted to 2 ha, but with mechanization he can cultivate farm land up to 10 ha in size.*

In sufficient tractors and other power unit for farm operation in rural areas is the greatest factor of production in study zone. Agricultural mechanization technology to succeed in the study zone there must be adequate tractors, electric motors, diesel and petrol engines to power the field implement and stationery equipment associated with them. Most of these machines are not found in Nigeria. Single axle multipurpose machines for small scale farmers are shown in figures 1-6

In table 4 the availability of engine power for agriculture is too low in study zone.

Table4: source of power for overall agricultural production.

Soule of power	Africa%	Nigeria%	USA%
Human power	89	90	4
Animal power	10	8	1
Engine power	1	2	95

Source8.Odigbon and Onwuala (1994)

Mechanization systems are often categorized into man, animal and engine powered technology or the basic of sophisticated capacity to do work effectively. whereas 2% of engine power for Agriculture in Nigeria and up to 95% in USA.

Thus, the benefits of power overall in agricultural production as shown in table4 above have helped the developed countries of Europe and North America developed their agriculture, such that only few parentage of farmers involved in farm production.

#### IV. CONCLUSION

The observation in this research paper indicate that the current focus on agriculture Mechanization in study zone had improved the economy status of small scale farmers from 1999-2012, while the demand for mechanizations is increasing in the study zone. Most of the demand concentrates on single axle multipurpose machines for pre- harvest and post- harvest operations. Agricultural mechanizations had played role in transforming small scale holders but with introduction of suited and lower cost multipurpose machines available in the market.,

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Figure1: single axle Tractor, size14.92kw  
Source: college of agriculture, Ganye-Nigeria Workshop



Figure2:sigle axle Tractor, Size2.44.kw  
Source:college of agriculture Ganye- Nigeria Workshop



Figure3:A two row planter/maize seeder  
Source: authors' file [www.sddadi.alibaba.com](http://www.sddadi.alibaba.com)



Figure4: Rice combine harvester  
Source: authors' File [www.nongjitong.com](http://www.nongjitong.com)