

NEED FOR MEANINGFUL MECHANIZATION STRATEGIES TO ENHANCE SUSTAINABLE AGRICULTURAL PRODUCTION IN BENUE STATE-NIGERIA

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Abstract

This paper briefly introduces mechanization and its application to agriculture. One of the main problems facing agricultural mechanization in Benue State is the adoption of mechanization strategies. These are often done by governments and international agencies that do not pay enough attention to the interest of small farmers and to the process of technology change. Other pertinent problems include prevalence of small fragmented farm holdings, high cost of hiring tractors for land/bush clearing; lack of classified data and information on the suitability; adaptability and performance of commercially available agricultural equipment as related to types and conditions of soils, crops and livestock; poor monitoring; inadequate repair and maintenance facilities; difficulties in obtaining spare parts; insufficient trained machinery operators; inadequate research programmes; poor credit facilities; poor maintenance culture; absence of incentives for indigenous design and manufacture of equipment and inadequate infrastructural facilities such as pipe bore water; poor road networks and electricity. The paper examines the actions of government and collaborating international agencies. The work is a scholarly inquiry using secondary data and personal visits of the researcher to Benue State owned Tractor Hiring Units. The result reveals several inadequacies which have promoted failures and meaningless attempt at mechanization in agriculture. The paper concluded that there is need for proper combination of hand tools technology, animal draught technology and mechanical power technology that are moderate enough to be supported by indigenous design, development and manufacture of the most needed tools, machinery and equipment and their spare parts.

Key words: agricultural production, Benue state, enhanced, mechanization, strategies, sustainable

INTRODUCTION

Mechanization is the art of using machineries to hasten production, accomplished task and reduce fatigue and human labour in order to produce better quality goods and services [1]. Farm mechanization has been defined as the process of development and introduction of mechanized assistance of all forms and at any level of technological sophistication in agricultural production in order to human drudgery, improve timelessness and efficiency of various farm operations, bring more land under cultivation, preserve the quality of produce, improve living conditions and markedly advance the economic growth of rural sector [3]; [5]; [2]; [1]. In other words, agricultural mechanization is said to basically connote the exploitation and management of machines, engines and mechanical aggregates/installations in replacement of

manual and draught animal works in agricultural production. In this way, it includes the efficient selection, operation, repair and maintenance and the replacement of machinery. It is a versatile field embracing the science of farm machinery and sources of power that are used to operate the various machines [14] The benefits of mechanization which have attracted the attention of farmers are timely field operations, higher field efficiencies, higher productivities and reduction in drudgery.

Agricultural mechanization goes beyond the use of tractors (tractorization), it also includes the development, application and management of mechanical aid for field production, water control, material handling as well as post-harvest operations [16]. [7] stated that agricultural mechanization encompasses the use of farm equipment including the power source that are used to operate the various

machines, while another author takes it to be the act of making judicious use of agricultural inputs such as seeds, irrigation water, fertilizer, herbicides or insecticides and farm equipment in order to maximize production with minimum cost [4]. According to [10], the widely and internationally acceptable definition of agricultural mechanization both as a term and concept, embraces the manufacture, marketing, distribution, selection, application, utilization, proper adjustment and operation as well as maintenance of all types of tools and implements, machines and equipment for agricultural land development, animal and crop production, for land preparation, feeds and fibres production including processing, preservation, storage and distribution or marketing while tractorization is the use of tractor to perform activities associated with agriculture.

The merits of agricultural mechanization include accelerated and increased agricultural output since it will enable farmers to cultivate a large area of land than is possible with the traditional farming techniques. It also reduces drudgery in farm work. It improves the quality of field operation providing better soil environment for seed germination and plant growth; it allows for the production of large quantities of food; it maximizes yield by more efficient farm operations; it makes sure that farming operation such as planting is completed in a limited time; it provides more efficient water supply to the farmer through irrigation; it reclaims wastelands through drainage of water logged farms; it provides a higher standard of living for farmers and it facilitates the processing and preservation of farm produce thereby reducing wastes [5]. In summary it facilitates the intensification and expansion of production in agriculture. **Its demerits** include very heavy capital investment in machinery; management of exposed soils in tropical climatic conditions; its requirement of competent hands for adjustments maintenance and repairs of the machinery, etc, hence the agricultural mechanization challenges of peasant farmers in Gboko Local Government Area of Benue State [6]. The merits outweigh the demerits,

thus, Benue State has to embrace it, if it is to be able to feed the teeming population. There is no other way out. **Agricultural mechanization must become a reality, if the state is to become self-reliant in food production and in the production of industrial raw materials.**

The main objective of this paper is to highlight the poor strategies adopted for agricultural mechanization pursuit in Benue State, and to proffer the strategy that will grow and strengthen the application of mechanization to enhance the sustainable development of agriculture and the rural areas in Benue state in particular and Nigeria in general.

MATERIALS AND METHODS

Study Area

The study area is Benue state. It is in the middle belt region of Nigeria. It lies within Latitudes $6^{\circ} 15'$ and 8° North of the Equator and Longitudes $7^{\circ} 45'$ and 10° East of Greenwich Meridian as shown in Fig. 1 below.

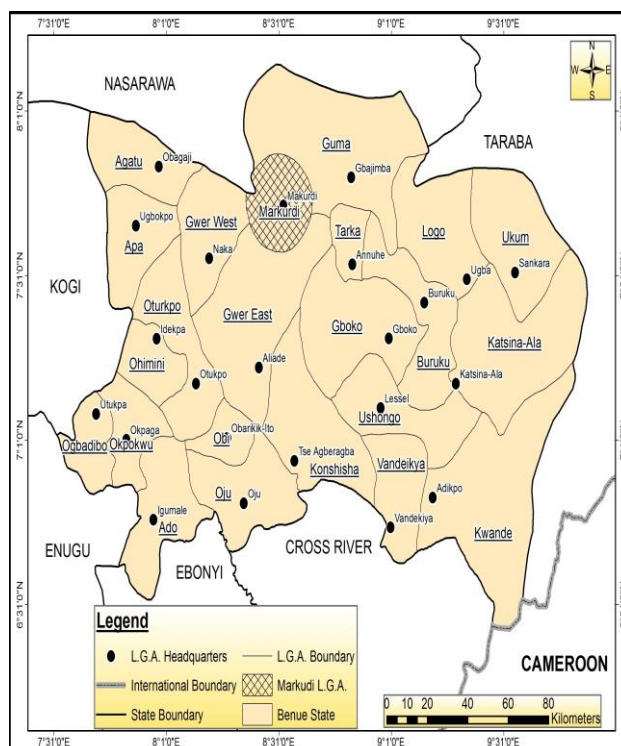


Fig. 1. Map of Benue State.

It has a population of about 4, 253,641 [8] and land mass of 34,059 Km². It is inhabited

predominantly by the Tiv and Idoma ethnic groups. With its capital at Makurdi, Benue State has high forest and Guinea savannah vegetations and it is a rich agricultural zone. Some of the crops grown are maize, Potatoes, Cassava, Soya Beans, Guinea corn, Flax, Yams, Sesame, Rice, and Ground nuts.

The study is a scholarly inquiry based on secondary data and personal visits of researchers to Benue State government owned Tractor Hiring Units (THU).

RESULTS AND DISCUSSIONS

The Status of Agricultural Mechanization in Benue State

Benue state agricultural development policy and strategy is built around supporting the rural farmers who work principally with primitive hand tools and the epileptic promotion of simple mechanical aggregates of tractor and plough, tractor and harrow and tractor and broadcasting equipment. The animal draught technology is non-existent. These explain the subsistence level of the state agriculture as a result of the failure of the epileptic “tractorisation” instead of mechanization. Irrigation and drainage infrastructures support is lacking.

The government owned tractor hiring units have collapsed and the rural farmers left to do just what hand tools can do, even as the farming age continue to rise astronomically. The state needs to borrow from the experiences of growing Asian economies like India, Malaysia, Thailand and the grown economy of China. But for now, the state agricultural production is based predominantly on hand tools and it has proved to be inadequate. The hand tools mostly used in Benue State include cutlasses, matchets, shovels, spade, diggers, trowels, hoes, axes, rakes, forks, shear and mattocks. When the overall agricultural production is considered for Benue State, the percentage of human power is up to 87 % yet power output of a human being is a maximum of 0.07 kW [7] or 0.69 kW of energy [16] and this of course varies with environmental conditions and type of nutritional intakes, and it is further limited by stress, especially at the high temperature

and humidity conditions found in Benue State [3]. For these reasons farming using hand power is arduous, inefficient and is characterized by low rate of work. They further stated that an average peasant farmer in Nigeria owns a farm less than two hectares, which is barely enough to produce what is needed to feed his family most especially that fertilizer and other inputs are expensive and not easily accessible to the peasant farmers.

[9]; [10] reported that engine powered technology (EPT) was introduced in the early sixties through the farm settlement schemes in Nigeria. The level of EPT use in Benue State is relatively very low [6]. The tractorization intensity is about 17 w/ha and about 90 % of tractors and implements in Benue State are not functional. This is further evidenced from the Benue State Agricultural Development Programme (BSADP) and Farm Mechanization Agency (FAMA) that are supposed to hire out tractors and implements to farmers for their farm operations but do not have even a single functional tractor on ground now. What can be seen are obsolete and non-functional tractor and implement scrap frames. It is clear that the extent of field machinery use in Benue State Agriculture is Non-Mechanized (77.97 %) as reported by [6]. In critical situation where tractors must be used, the farmers negotiate with the handful private owners and with neighbouring States like Nasarawa, Cross-river and Enugu for hiring. The situation went so bad in 2014 and 2015 when none of the Tractor Hiring Units (THU) in the state could boast of a viable and functional tractor.

Strategies for Enhancing Sustainable Agricultural Mechanization in Benue State

Engine powered technology (EPT) has helped the developed countries of Europe and America and the fast developing South and South East Asian countries to develop their agriculture such that only a very small percentage of their population is involved in direct food and fibre production. The small percentage has been able to provide enough food for the population with surplus for export, principally, because of the use of machines. Use of appropriate machines has also resulted in the production of abundant

raw materials for their numerous agro-based industries which provide employment for a lot of people. Benue State should emulate this model in preparing for its agricultural industry in the years ahead.

Table 1. Average Utilization of Draught Animal Power (DAP) in Indian Farms

S/No	Location	Average Annual Utilization (Hrs)	Maximum Utilization in
1	North	660	Transport
2	South	230	Tillage and Seeding
3	East	450	Tillage and Seeding
4	West	500	-DO-
5	Central	280	-DO-

Source: [11]

According to [11] the most preferred work rest cycles for the draught Animals were noticed as follows:

- (i)Bullocks: 3hr work + 1hr rest + 3hr work or 4hr work + 2hr rest + 3hr work
- (ii)Buffaloes: 4 hr in the morning + 7 hr rest

- + 4 hr work in the evening.
- (iii)Camels: 2 hr work + 1hr rest + 2 hr work + 1 hr rest + 2 hr work
- (iv)Donkeys: 1 hr work + 1 hr rest + 1 hr work + 1 hr rest and so on up to 6 hr work/day.

Table 2. Availability of Tractors, Draught Animals and Agricultural Workers in India [15]

S/No	State	Tractors 1994	Power tiller 1994	DAP 1987	Agricultural workers 1991
1	All India	10.56	0.669	467	1,312

Note: Agricultural workers: Cultivator + Agricultural Labourers. During 1997, there were 2.10 million tractors on India farms.

For doing proper tillage in time, ideally the farm power availability should be as under:

- Tractors (24 kW) 66/1000ha @ 15 ha/tractor
- Draught Animals 1000/1000ha @ 2 ha/pair

Table 3. System and Component Technology Change Occurring in Asian Agriculture

Function or Operation	Hand tool	Draft animals	Mechanical power
Land Clearing	Brush hook, hand saw, motor chain saw	Buffalo and elephant for skidding and loading	Track-type tractor for clearing, skidders for log transport
Land development	Spade, hoe, basket, wheelbarrow	Earth scoop, levelling scraper, bund former	Wheel tractor, track-type dozer, motor scraper
Land preparation	Hoe, spade	Wooden plow, steel plow, spike harrow, disk harrow	Single-axle tractor, power tiller, two-axle tractor with various implements
Planting and seeding	Seed distribution by hand, plant stick, jabber, row marker, hand-pushed seeder	Furrow opener, marker wheel for dibbling, seed drill, seed-cum-fertilizer drill	Tractor seed drill, seeding with aircraft
Transplanting	Hand-operated paddy transplanter		Motorized paddy transplanter
Harvesting	Finger-held knife, sickle, scythe, threshing table, pedal thresher	Peanut lifter, cutter-bar mower, reaper, reaper-binder, treading (threshing)	Power reaper, power reaper-binder, power thresher, combine harvester
Crop husbandry	Hoe, weeding hoe, hand sprayer, water can, irrigation scoop	Wooden interrow weeder, walking-type tool, carrier, riding-type tool, carrier, spraying machine, Persian water wheel	Interrow weeder, motor knapsack sprayer, tractor boom sprayer spraying with aircraft, diesel of electric irrigation pumps.
On-farm processing	Mortar and pestle, flour-grinding stone, hand-operated paddy husker	Animal powered sugar-cane crusher, power gear for driving processing machinery	Single-pass rice mill, rubber-roll rice mill hammer mill
Crop storage	Sun-drying, bag storage		Artificial drying, bulk storage, elevator, fork lift
Handing	Carrying, wheelbarrow, push cart.		
Rural transport	Porter, push cart, rickshaw	Sled pack harness, bullock cart trailer, track	Power tiller with trailer, two-axle tractor with trailer

*within each operation the level of sophistication increases vertically

Source: [12]

According to [13], in Europe, China, India, etc their methods of farming is more scientific, therefore more productive. In these countries, mechanization brought about growth in the use of agricultural chemicals (herbicides, insecticides, fungicides and fertilizers) though along with their hazards.

They also develop high yielding species that leads to intensive farming on land with sufficient rearing of cattle and poultry. They went further into genetic engineering method for hybridization and embarked on pests control by use of chemicals. These can not happen in Benue State until the

government begins to realise/resolve the following issues:

-Ensuring internal peace and security of the rural communities from external threats and attacks by destructive persons or group of persons in whatsoever disguise.

-Construction of small dams for electricity and irrigation water provision including the construction of dams across large erosion gullies.

-Declaration of vocational/technical education (that will produce technicians) a top priority and transformation from theoretical education to practical training of its youth, through variety of programmes.

-Encouragement and attraction of foreign based farm machinery manufacturers to establish factories in the state.

-The rural farmers and their communities must be placed at the centres of strategies and policies geared towards agricultural development, and thus economic advancement of the state.

-Promotion of exploitational and management conglomeration or consolidation of land holdings and discouragement of land fragmentation into very small scattered holdings that can make mechanization, irrigation and drainage works difficult.

- Conscientious building of an efficient farm gates purchase of farm outputs at economic prices from farmers, value addition, strategic storage and marketing to give both farmers and consumers the economic leverage that can promote rise in production as well as consumption.

-Encouragement of foreign experts to establish draught animals farm and training centre in the state, and this should include the production of the machines/implements attachment kits.

-Energetic education to conservation agriculture awareness to farmers, including the encouragement of use of organic manure, green manure and mulching in soil management.

-Creation of leadership by example by the top hierarchy of government that will re-orientate the workforce from greed and avarice to statesmanship and awakening of societal development consciousness. This must lead

to:

a.Reduction of corruption to barest minimum.
b.Abolition of flagrant display of stolen wealth.

c.Payment of workers as at when due.

d.Promotion of workers as at when due.

e.Provision of working tools for the workforce.

f.Merit and competence as the yardstick for engagement, most especially in all the technical areas as well as policies/plans/strategies development areas.

g.General improvement in the education sector, currently value/standard must change positively and quick too.

h.Proper monitoring and coordination of the implementation of projects, policies and strategies adopted for socio-economic progress of the state.

CONCLUSIONS

Benue State agricultural production can be classified into hand tool technology and epileptic engine powered technology. For Benue State to achieve its main objective of being self-sufficient in food production and production of abundant raw materials for the agro-industries, the use of engine-powered technology and introduction of Draught Animal Technology is very essential. Also very essential is the attraction of foreign Tractor and Machinery manufacturers to establish factories in the State as was done in India after the separation of Pakistan in 1947. The strategies so far implemented by the State Government has not produced the desired results, hence the need for change of the strategies, following the footsteps of emerging great economic powers in Asia.

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