The Impact of Cultural Factors on the Sustainability of Agricultural Mechanization in Anambra State, Nigeria

Nwanna, C. C.[1*]; Akwuobi, S.I.[2]; Umobi, C.O.[3]; Umeghalu, I. C. E.[4]; Maduegbuna, J.I.[5]; Anizoba D. C.[6]; Chinwuba, C. J.[7]

Department of Agricultural and Bioresources Engineering, Faculty of Engineering, Nnamdi Azikiwe University, Awka, Nigeria
*Corresponding Author

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Abstract— *Agricultural machines and equipment have become the most effective instruments used extensively to boost agricultural production. Astronomical population increase in the country without corresponding increase in food production has led to massive importation of agricultural machineries by the Federal and State governments with the aim to mechanize agricultural practices and boost agricultural production. However, agricultural machinery whether they are power units, field implements, processing equipment or pumps cannot perform their duties indefinitely. Like any other machines, they break down from time to time. The high frequency of tractor breakdown are caused by environmental factors, unskilled operators, poor repair and maintenance culture, age of the machines and high cost of spare parts. Various researchers had noted that proliferation of tractor in the country makes widespread and high incidence of un-serviceability of farm tractors, gross underutilization of farm tractors, and frequent breakdown of tractors amongst other problems which is the hallmark of tractor hiring services in Nigeria. The study shows that poor maintenance culture of these agricultural machines and implements results to their unavailability for the works they are meant for, which affects timeliness of agricultural operations and mechanization programmes of the sector. It is recommended that preventive repair and maintenance should be adopted to make the machines and implements always available and prolong their useful life. The work aims to study the effect of poor culture of repair and maintenance of agricultural machines and equipment on mechanization of agriculture in Anambra State if Nigeria.*

Keywords— Repair and Maintenance; Mechanization; Agricultural Machines and Equipment.

I. INTRODUCTION

1.1 Repair and Maintenance of Agricultural Machines and Equipment:

Agricultural machines and equipment have become the most effective instruments used extensively to boost agricultural production. Tractors for instance are capable of working long hours under adverse conditions if certain precautions are taken. Tractor is of very important in as it is a major source of power in agricultural operations (Abubakar et al., 2013; Dahab et al., 2016; Gautuam and Shrivasta, 2017). According to Onwualu et al., (2006), agricultural machinery whether they are power units, field implements, processing equipment or pumps cannot perform their duties indefinitely. Like any other machines, they break down from time to time. They canbe used virtually for all agricultural operations ranging from land clearing operations to land preparations, harvesting, transportation and processing of agricultural products. However, tractor ownership demands considerable amount of capital investment; quite unlike using hand tools and animal drawn implements. Tractors require special management ability and skills as well as adequate service support facilities. Various authors including Onwualu *et al.*(2006) and Umeghalu (2022) have noted that the use of farm machines has increased in Nigeria without corresponding programme for training technicians on their repair and maintenance culture. There are insufficient repair and maintenance facilities to support efficient and economic tractor exploitation at farm level. This according to Onwualu *et al.* (2006) has resulted to the average life of agricultural machines and implements to become shorter because farmers find it difficult to maintain or repair as when due.

Odigboh, (2016), pointed out that some of the problems facing tractor and equipment hiring schemes in Nigeria are as follows: adverse environmental factors, improper use of machines, poor maintenance culture, age of the machines, high cost of spare parts, lack of proper record, poorly cleared farm lands, lack of ecological or survey data, size of farm holdings, absence of infrastructural facilities, inadequate training of operators, lack of technical management, absence of local content, untrained repair and maintenance crew. Umeghalu (2022), posited that poor maintenance culture is an attitude or way of life which sadly lacking towards maintenance of anything maintainable whether machinery, equipment, office furniture, building or factory. Thus, poor maintenance culture has become a widely recognized plague that is negatively affecting both public and private facilities in Nigeria.

Onwualu et al. (2006) pointed out that agricultural machine, whether they are power units, field implements, processing equipment, or pumps, cannot perform their duties indefinitely. Like other machines, they breakdown from time to time. Although introduction of tractor hiring programme in Nigeria was laudable however, the desired result was far from being achieved because of bad operational management, absence of financial autonomy, frequent change of policy by government amongst others. Anazodo (1987) had noted that proliferation of tractor in the country makes widespread and high incidence of un-serviceability of farm tractors, gross underutilization of farm tractors, frequent breakdown of tractors amongst other problems the hallmark of tractor hiring services in Nigeria. These tractors were imported into the country for a wide range of farm operations; from land preparation to planting, harvesting, on-farm processing, haulage of agricultural products for storage and to the markets (Kienzle *et al.*, 2013; Umeghalu *et al.*, 2012; Yakubu and Enaboifo, 2010).

1.2 Repair of Agricultural Machineries and Equipment:

Repair is a set of operations performed to eliminate defects to ensure safe operation before scheduled overhaul. Repair can be divided into minor and major repairs. While minor repair refers to small jobs such as brake problem, servicing of engine, tyre replacement, etc; major repairs refer to jobs such as replacement of sleeves or reboring cylinders, replacement of crankshaft etc.

1.3 Maintenance of Agricultural Machinery:

A set of compulsory operations specified in the relevant documents, which are carried out to keep the machine available throughout the machine or equipment's service life is often referred to as maintenance (Onwualu, 2005; Spiridanov, 1990). However, many authors have given several definitions of maintenance. Omofehinshe *et al*. (2015a) defined maintenance as an action taken to prevent a device or component from failing or to repair normal equipment degradation experienced with the operation of the device to keep it in proper working order.

Caring for agricultural machines and equipment is necessary to prevent wear and tear and reduce the time lost due to machine breakdowns. Satisfactory performance is the rule rather than the exception. Also, when agricultural machine or equipment is well maintained, its useful life will fully be realized. The effective use of agricultural machine is considerably dependent on its maintenance management culture. Maintenance is imperative to retain an item or restore it to acceptable condition or standard (Oni, 1999; Kutucuoglu *et al*., 2001; Cholasuke *et al*., 2004). What sometimes makes organizations fail is bad planning by the management. Onwualu (2005) reported that every strategic plan needs to be kept in place based on mission, vision and goals of the organization. In Nigeria, maintenance management practices are not effectively carried out. Agricultural machines and equipment have a lot of mechanical and electrical component and besides this; they work in hash environment and therefore needed to be subjected to regular maintenance to prolong their useful life (Odigbo, 1986; Onwualu, 1997). There is therefore need to have budgetary plan for maintenance of these machines and equipment (Odusanya, 1996). A system of scheduled preventive maintenance and repair must be established for farm machines and equipment to ensure their highly productive work, prevent premature wear and failure. This system involves a number of measures necessary to keep machines constantly available.

1.3.1 Classification of Maintenance:

Maintenance can further be classified as breakdown maintenance and preventive maintenance. Breakdown maintenance is the steps taken to rectify a faulty machine or a broken down machine with intention to bring it back to normalcy. It can occur due to the unpredictable failures of components, which cannot be prevented or gradual wear and tear of machine or equipment parts, which can be eliminated to a large extent by regular inspections. Breakdown maintenance is carried out only when the machine cannot carry out its function any longer.

1.3.2 Preventive Maintenance:

Preventive maintenance is any step taken to prevent troubles before they occur (Onwualu,1996; Dodson 1994; Nkakin and Etenero, 2016). The key to preventive maintenance is the tractor operator. There is a great deal of difference between an operator and a person who merely operates a tractor. A tractor operator is one who is familiar with the tractor.

A careful tractor operator needs correct information, experience, and desire to succeed with preventive maintenance. The practice of preventive maintenance usually comes about as a result of experience gained in operating and maintaining the tractor. These experiences are often costly because of the high cost involved in unnecessary repairs.

1.4 Effect of Non-availability of Agricultural Machinery on Agricultural Production:

Agricultural operations are time specific. Timeliness is important in all its operations. A faulty agricultural machine is not available to perform its regular operations. This will seriously affect the farmer's operations and eventually his agricultural output. Failures of national policies and programmes on mechanization of agriculture in the country are attributable to absence of strategic plans for agricultural machines and equipment repair and maintenance. Strategic plans have a long-term focus and it addresses issues related to the organization's business objectives. Maintenance strategy is an integrated system that is needed by corporate management to highlight the significance of a particular piece of equipment that impacts on particular types of repair and maintenance work (Adama and Onwualu, 2010; Lahiri *et al*., 2008).

Nigeria is endowed with about 79 million hectares of arable land and less than half of which is under cultivation and highly diversified ecological conditions suitable for the production of a wide range of agricultural products (Eni, 2008). It is estimated that her potential for crops, livestock and fishery remain enormous, especially buoyed by water supply level of about 267 billion cubic meters of underground water: an annual rainfall range of 300mm to 400mm, and potential irrigable area of 3.14 million hectares with only seven percent of which is utilized (Eni, 2008). These enormous numbers of hectares require large number of agricultural machines and implements to be cultivated.

1.5 Mechanization of Agriculture in Nigeria:

1.5.1 Programmes by Governments to boost food production:

Ogbulafor (1999) reported that prior to Nigeria independence in 1960, agriculture contributed more than 70 percent of the Gross Domestic Product (GDP) and was the country's leading foreign exchange earner. Today agriculture's contribution to GDP hovers around 40 percent and was even as low as 20 percent at a point. Thus, agriculture's share of foreign earning, have been crowded out by that of crude oil. Farm settlements were established by the Okpala administration in Eastern Region at Omasi, EhaAmufu, Ikom, Igbariam, Ohaji, and Boli where mechanized farming was practiced. Most of agricultural operations were mechanized. Tractors were employed for tillage, haulage and spraying of chemicals, bulldozers were used for land clearing operations, construction of roads etc. The result of these was that food and agricultural raw materials were surplus both for human and animals' consumption, also raw materials were abundant for the industries and enough remained for exportation.

However, following the oil boom of the 1970's in Nigeria, agricultural industry commenced to witness drastic decline due to heavy investment in developing the infrastructure associated with oil sector (Nwuba, 2008). Also, the youths who are strong and useful for agricultural production in the rural areas where agriculture is practiced started to massively migrate to urban centers for employment; thus leaving the tough agricultural production for the aged who are no stronger enough for agricultural production (Odigboh, 2008; Musa et al., 2011). Other debilitating factors which combined in making Nigeria's agricultural output uncompetitive in both the domestic and international markets significantly reduced the attraction of agriculture as a sustainable source of livelihood and viable business include low output, policy inconsistencies, inefficient and outmoded production techniques, low quality produce, heavy post-harvest losses, absence of access to quality agricultural inputs, limited value addition and facilities for credit, irrigation, processing and storage facilities, inadequate extension services and unskilled labor force (Onwualu *et al.,* 2006; Kienzle *et al.,*2013; Umeghalu *et al.,* 2012; Yakubu and Enaboifo, 2010).

Notwithstanding all these obstacles, Adesina (2011), noted that Nigeria still has the potential for not only, meeting her growing food needs but also to become an agro-powerhouse for the sub region and the world at large. It is arising from the above factors that the agriculture sector's performance is not impressive. Moreover, the steady increase in population of the country has called for urgent measures to increase food supply to avert famine.

Onwualu et al. (2006) defined agricultural mechanization as the development, introduction and use of mechanical assistance of all forms and at any level of technological sophistication in agricultural production (Onwualu et al., 2006; Adama, 2013, Jekayinka et al., 2015). Thus, the governments commenced to formulate policies and programmes at various times to address these challenges militating against agricultural sector such as: the 1975- 79 Operation Feed the Nation (OFN) of the Murtala Mohamed and Olushegun Obasanjo military administration, the Land Use Decree promulgated by the government to enhance land acquisition processes and the (1979-1983) Green Revolution introduced by Shehu Shagari administration. Under these programmes, various models of tractors and implement were imported by the Federal Government and sold to farmers at subsidized prices. However, most of these imported tractors and implement did not suit our local environment which was not taken into consideration during manufacturing. Other reasons include lack of spare parts, poor maintenance culture, age of the tractors and implement.

1.5.2 Tractor and Equipment Hire Scheme:

In line with tractor and equipment hiring scheme policy guidelines, Anambra State Government established Anambra State Tractor Hire Agency (ASTRAC) to enhance mechanization of agricultural practices in the State as a unit of the Agricultural Services Department in the State Ministry of Agriculture and Natural Resources. The tractor and equipment hiring outfit was laden with the following mandate:

1) To provide tillage operations for mechanized agricultural practices in the state in order to boost agricultural production.
2) To create enabling environment for Public Private Participation (PPP) in tractor and equipment hiring ventures.
3) To procure and maintain tractors and equipment and hire same to farmers in the state at subsidize rates.

All these programmes and policies were aimed at increasing agricultural products through mechanized systems. However, these government agricultural mechanization policies and programmes were fraught with abuses and corruption by the politicians who exploited the chances to enrich themselves. Also the rural component of agricultural production was not considered during the formulation of the policies. Under these policies, various models of tractors and implement were imported by the Federal Government and sold to farmers at subsidized prices. However, most of these imported tractors and implement did not suit our local environment which was not taken into consideration during manufacturing. The success of any policy or programme in agricultural production must take into cognizance the local variables such as soil, vegetation, climate, local farming system, culture, crops etc before coming up with the design for appropriate mechanization of agriculture in Nigeria (Odigbo, 1986).

One of these programmes was the introduction of Tractor and Equipment Hiring Scheme.

II. MATERIALS AND METHODS

2.1 Description of study area:

Anambra State lies approximately between $6^{0}20'$ North and $7^{0}00'$ East (en.m. Wikipedia org.) The State is an agrarian state, and is one of the states in South- East geo-political zone of Nigeria. The state occupies an area of about $4{,}844km^2$, with population estimated at about 11.4 million in 2020 (ANSG). The state is bounded in the North by Kogi and Enugu States and in the East by Imo and Abia States, on the South-East by Delta State. The State is generally low-lying without remarkable hills. The climate of the state is typically equatorial climate with two distinct seasons namely: rainy and dry seasons. The rainy season is often characterized by heavy thunderstorm and lasts between the months of April and October. At times, the wet season arrives as early as March and lasts till November (Oboli, 1975). The mean annual rain fall varies between 2250mm and 1500mm north of the zone. A bimodal rainfall pattern with a brief drop in rain fall known as "August Break" is often noticed in the State. Dry season starts from November and lasts till March. Annual potential evapotranspiration (PET) in the area stands between 1425mm and 1625mm. The State has an average maximum temperature range of $32^{o}c$ and average annual mean temperature of about $27^{o}c$ (Iloeje, 1971; Oboli, 1975).

More than 70 percent of the population in the study areas is resource poor farmers who grow between 0.5 to 5.0 hectares of farm holding in their crop dominated form of agriculture and often keep some livestock such as goats, pigs, sheep and poultry under a free range system.

FIGURE 1: Map of Anambra State showing Anambra West Local Government Area.

2.2 Methods of Data Collection:

Survey trips were made to the six predominant farming local government areas in the State namely: Ogbaru, Ayamelum, Orumba South, Awka South, Anambra East and Anambra West Local Government Areas for primary data collection. These areas are often referred to as the food basket zones of the State. The structured questionnaires were mainly administered to tractor operators in the field who are associated with tractors performance and challenges facing the scheme. Age of respondents and educational status, years of experience, nature and frequency of machinery breakdown, nature of repairs and maintenance, availability of spare parts, annual number of request for tractors services by farmers, cost of each farm operation, accessibility to farm machineries.

Secondary data were obtained from the records kept by the administrative office of Anambra State Agricultural Development Project (ADP) and from the State Ministry of Agriculture at Awka. Both the primary and secondary data collected were analyzed before reaching at the conclusion and suggestion offered in this study.

III. RESULTS AND DISCUSSION

3.1 Age of respondents:

TABLE 1

SHOWING AGE BRACKET OF THE RESPONDENTS.

S/No	Age (yrs.).	No. Of respondents	Percentage (%)
1.	20-30	15	15
2.	31-40	39	39
3.	41-55	46	46
		100	100

Table 1, shows that about 15% of tractor operators are within the age limit of between 20 and 30 years; about 39% of the operators are within the age bracket of 31 and 40 years while those between 41 and 55 years old are about 46%. This indicates that majority of the tractor operators are advanced in age and have enough experience as tractor operators.

3.2 Educational status of the respondents:

TABLE 2

SHOWING EDUCATIONAL STATUS OF THE RESPONDENTS.

Education	Educational status	Percentage
None	0	0
Primary	27	27
Secondary	61	61
Tertiary	12	12
Total	**100**	**100**

Table 2, indicates that all the tractor operators are educated. About 27% of the operators obtained primary school education, about 61% of the respondents acquired secondary school education while the remaining 12% of the respondents have tertiary education. This implies that the tractor operators are educated which will enhance their ability to read and understand necessary instructions that can enable them operate agricultural machines and equipment.

3.3 Years of Experience as Tractor Operator:

TABLE 3

SHOWING YEARS OF EXPERIENCE OF THE TRACTOR OPERATORS

S/No	Experience of Tractor Operators (Yrs.)	No. Of respondents.	Percentage of Respondents (%).
1	5– 10	21	21
2	11 – 20	43	43
3	20 – 30	36	36
		100	100

From data obtained during the study as shown in Table 3 above, about 21% of the operators have between 5 and 10 years of experience; about 43% of the respondents have between 11 and 20 years of experience while about 36% of the respondents have between 20 and 30 years of experience as tractor operator. Thus with majority of the operators above 40 years of age, it indicates that most of them have sufficient experience in tractor operating.

3.3.1 Inventory of the ADP tractors and implement between 2015 and 2018:

TABLE 4

SHOWING INVENTORY OF THE ADP TRACTORS AND IMPLEMENT FROM YEAR 2015 TO 2018:

Year	Machineries.	Total number of items purchased.	Functional machines & equipment	Non-functional Machines & Equipment
2015– 2018	Fiat tractors.	30	18	12
	Styr tractors.	50	33	17
	Disc plough	45	25	20
	Disc harrows	45	15	30
	Disc ridgers	24	9	15
	Trailers	14	9	5
	Planters	7	2	5
	Rice Threshers	25	15	10

Source: Administrative Office of ADP, Awka.

The inventory of Anambra State Agricultural Development Project Tractor and Equipment Hiring Service Unit is shown in Table 4 above. The table shows that between 2015 and 2018, the agency had 30 tractors consisting of different brands of Fiat tractors out of which 18of them are functional while 12 are faulty. Eight of the tractors require engine overhaul and four others require replacement of various spare parts and minor maintenance. Also, the Agency acquired 50 Styr tractors of different brands out of which 33 of them are functional while the rest 17 (seventeen) tractors have broken down. Furthermore, a good number of tractors were purchased by the State Government which was sold off to the public in fulfillment of government initiative to cede some tractors to farmers to encourage Public Private Participation (PPP) in the agricultural mechanization programme.

3.3.2 Status of Implement:

Also as shown in Table 4 above, out of 45 disc plough purchased, only 25 are functional while 20 are non-functional. Out of the 45 disc harrows purchased only 15 of them are available while 30 are faulty. The 24 disc ridgers purchased, only 15 are functional while the remaining 9 are faulty. The 7 seed planters owned by the outfit, only 2 of them are functional while 5 are faulty. The establishment had initially 25 rice threshers, however, the study shows that only15 of them are available while the remaining 10 are faulty; also out of the 14 trailers purchased by the outfit to enhance transportation of agricultural produce, only 9 of them are available while the remaining 5 are fault.

3.4 Frequency of tractors and equipment breakdown:

Table 5 below shows the frequency of tractors and equipment breakdown. The survey reveals that the frequency of the Agency's machinery breakdown and failure are relatively high and this can be attributed to several factors, such as: poor maintenance culture, unfavourable environmental condition, inadequate training of the operators, lack of spare parts, poorly cleared land on which the machines work, and lack of modern workshop and tools. Most of the imported machineries are refurbished and were not accompanied with their journals specifying their maintenance schedule. Moreover, the maintenance of the tractors are usually delayed or are never carried out at all especially when they are hired out to contractors who are more interested in their profit margin. As such, the machines are only maintained or repaired only when they breakdown. Scheduled periodic maintenance is not carried out on the machines resulting to unavailability of the tractors during most part of cropping period.

TABLE 5

NATURE AND FREQUENCY OF THE AGENCY'S TRACTOR AND EQUIPMENT BREAKDOWN.

Machines component	Frequency of break-down	Causes of breakdown	Average duration of breakdown	Replacement	Source of spare parts	Maintenance Nature	Average cost of repair (N'000)
Tractor steering ram oil leakage, hydraulic system failure	Not frequent	Hose blockage dirt in oil and inadequate maintenance	15-30days	Lack of spare parts	Imported	Break-down	50 and above
Worn out Clutch Plate/ Finger/ Release bearing	As above	Environmental factors.	As above	Lack of specialized tools	As above	As above	As above
Tyres bearing, fuel lift pump	Frequent	Stumps vibration, poor maintenance	As above	As above	As above	As above	As above
Disc plough bearing, disc bolt and blades disc hub	Frequent	Stumps environmental factors, poor maintenance& poorly cleared lands.	As above	As above	As above	As above	As above
Disc harrows, blades, bolts, disc bolts	Frequent	As above	As above	As above	As above	As above	As above
Disc harrows, blades, bolts, disc bolts	Frequent	As above	As above	As above	As above	As above	As above

Source: Administrative Office of ADP, Awka.

IV. CONCLUSION

The study shows that the services of Anambra State Tractor Hire Agency are poised to make positive impact on mechanization of agricultural practices in the state. The percentage of farmers who benefited from the services of the Agency significantly influenced the overall increase of farm output as well as increased farmers' farm holdings and income alike.

However, services like processing, storage and packaging are yet to be adequately addressed which would further boost agricultural productivity in the state.

The slow response to maintenance of tractors and equipment is still weighing down the operational capacity of the hire outfit leading to delay in agricultural operations at the instance of frequent breakdown of its machinery during the cropping season. This has pronounced disruption in the production programme of farmers thus, reducing the farmers overall output. Most agricultural operations are time specific.

V. RECOMMENDATIONS

1) The policy framework on which the Agency was established, like the subsidy regime should be strengthened with better understanding with all the critical stakeholders to provide for better implementation.
2) The existing workshops for repair and maintenance of the machines should be made more functional by adequately providing them with comfortable accommodation, tools, skilled and youthful personnel, spare parts and adequate funding by government.
3) Mobile workshops should be established in all the zones where the tractors are deployed to work. In this way, minor repairs and maintenance can be effected in the field without having to run to the workshops which may be far located. This will put the tractors and equipment in better form to perform more work especially during the cropping season while down time is minimized.
4) A good culture of preventive repairs and maintenance scheduled should be adopted to achieve prolonged machine service life and availability.
5) Government should purchase more tractors and equipment for the Agency to enable it serve more farmers per unit time within the cropping season as agricultural operations are time specific.
6) Government should adopt policies that allow farmers to hire tractors directly from the agency instead of hiring through contractors who are only interested in their profit margin at the expense of the fitness of the tractors.
7) Tractor operators should regularly be trained on the basic repair and maintenance requirement of the tractors they operate especially when new brand of tractors are introduced to the fleet.
8) Local blacksmiths should be trained in the act of forging and fabrication of some of the most frequent damaged implement which could not easily be sourced or supplied by sales agents or the manufacturers.
9) Importation of agricultural tractors and equipment should be based on local environment, availability of spare parts, experience of operators, cost of repair and maintenance.
10) Government should revive the moribund tractor assembly plants in the country for easy and available spare parts.

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