SURVEY OF OPERATORS KNOWLEDGE OF OPERATION AND MAINTENANCE OF FARM MACHINERY IN EBONYI STATE, NIGERIA

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ABSTRACT

A survey was carried out to access the operators' knowledge of operation and maintenance of farm machinery for sustainable agricultural mechanisation in Ebonyi State, Nigeria. The questionnaires, oral interviews/interactions and field investigations were used to ascertain the operators' educational background, experience on machine operation and maintenance in the government and private agricultural organisation in the study area. The survey revealed that 44.6% of the operator had both primary education and trade test; 26.9% had primary education only. 19.3% had trade test certificate only and 9.2% had post-primary education and trade test certificate. All the respondents were licensed to operate machines. The mean age and year of experienced of the operators were 41.05 and 19.8 years respectively. The statutory result on the machines indicated that 64.9% of the available machines were functional, 21.9% were non-functional but serviceable while 14.5% were non-functional but unserviceable. 50.4 to 79.8% of the operators examined from both government and private agricultural organisations could competently handle preventive and corrective maintenances while 17 to 20% had little knowledge of maintenance and about 2 to 10% had no knowledge of maintenance. Result showed that the machine failures encountered during operations were as a result of poor management, inadequate maintenance practices, and lack of spare parts, obsoleteness, overloading, careless operations and poor storage of machine after use. Recommendations were therefore given to improve the operation and maintenance of machinery in the area.

Keywords: machinery operation, operator's knowledge, maintenance, farm mechanization, Ebonyi state.

1. INTRODUCTION

Farm machinery can be defined as a general term used to describe tractors, combines, implements, machines and other devices more sophisticated than hand tools which may be animal or mechanically powered at the farm level [1]. According to [2], they include ploughs, harrows, rotovators, ridgers, seeders/seed drills and planters, cultivators, harvesters; haying machines, processing machines such as silage cutter, feed grinders, cotton gins, threshers, trucks and tractors. As these machines are engaged in tasks or field operations, they are subjected to a very high force in order to perform the job/tasks. The vibrations of the various parts of the machines during operation lead to wear, tear and/or loosening of some parts that are in contact and are rubbing themselves and as such

demand some human attention to extend the useful life of the machine. The production efficiency of farm machinery depends on the attention paid to its maintenance. It is the surest way to minimize production cost and reduce breakdown time [3]. The effectiveness of a machine working system depends not only on the innate properties built into it, in the designing and production stages but also on the quality of its operation, maintenance and repair [4]. Maintainability of any farm machinery/equipment is a parameter that minimises the down time of such machinery or equipment [5]. According to [6] it was stated that maintenance of equipment and machinery in any form is a nuisance demanding enormous resources of manpower and materials. They maintained that, it is absolutely essential if plant,

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machinery and equipment are to remain in good working conditions and ready for use when they are required. The decision is never whether maintenance should take place, but the form it should take to make it economically effective. Thus, maintenance nowadays, like any other economic activities is subjected to management policy, consideration and decision.

Different authors have different definitions for maintenance; [7] defines maintenance as concerned with day-to-day problems of keeping the physical plant in good operating condition according to standard set by management. [8] sees maintenance as any activity designed to keep equipment, or other assets in working condition. Also [9] defines maintenance as activities undertaken in order to keep or restore every facility to an acceptable standard and may be planned or unplanned. One thing common among all the definitions is that they all imply that maintenance in the broad sense can be taken as a combination of all technical and associated administrative actions intended to retain an item in or restore it to, a state in which it can perform its required function [6]. Every machine will require maintenance even if it is best designed; hence, the maintenance must be done at such a time when it may have least disruptions in its operation [10]. Machines may be thoroughly tested and inspected by the manufactures before selling it and by the purchaser before it is put to use. When it is used, it will be subjected to wear and tear as earlier stated, hence proper attention should be given to protect the machine and its components from undue wear and failure. To achieve this, machines have to be handled by trained operators who have adequate knowledge and skills in machine operation and maintenance, in order to minimize the frequency of its breakdown. Effective machinery maintenance involves proper equipment handling, cleaning and oil lubrications, bearing greasing, replacement of worn out parts with new ones and repairs [11]. Farm machineries such as tractors are very costly machines that worth millions of naira hence need to be operated by trained operators as tractor operation with different implements requires special knowledge, skill and training. Poor operational knowledge, skill and inadequate facilities to maintain farm machineries among other factors hinder agricultural mechanization in Nigeria. Ebonyi State is an agrarian area, hence, the name salt of the nation is traceable from her agricultural activities; one major reason for

the low level of their output most times is low level of agricultural mechanization resulting from poor financial background of the farmers to procure farm machineries and poor maintenance practices. Agricultural mechanization according to [12] is the process of development and introduction of mechanized assistance of all forms and at any level of sophistication in agricultural production in order to reduce human drudgery, improve timeless and efficiency of various farm operations, bring more lands under cultivation, provide better rural living conditions and markedly advance the economic growth of the rural sectors. A sustainable agricultural mechanization among other things involves the application of Engineering principles and technology in selecting, testing, operating and maintenance of farm machineries in order to ensure maximum availability and reliability of those machineries.

The objectives of this research work are to investigate the status of the available machines and the extent of their operation for agricultural activities in Ebonyi State. Also to carry out a comprehensive survey of operators' knowledge of operation and maintenance of farm machinery and the possible causes of failures and maintenance practices applicable in the area with a view to recommend the ways that will enhance the farm machinery operation and maintenance for sustainable farm mechanization in Ebonyi State and other areas with similar cases.

2. MATERIALS AND METHODS
2.1. Questionnaire Development and Administration
The questionnaires were developed and distributed to mechanized agricultural organizations (government and private) in the study area to collect the necessary data during the planting season. The questionnaires consisted of three parts: Part 1; sought information on the personal data of the respondents, Part 2; was designed to provide information on the inventory and the status of the farm machinery available in the study area, while Part 3; sought information on the operators knowledge and skills of operation; facilities to maintain machines, causes of machine failures and maintenance practices applicable in the area. The study areas were zoned into five namely: A, B, C, D and E respectively for effective management. The questionnaires were administered to mechanized organizations such as Agricultural Department in the Local Government Secretariats, Ministry of Agriculture and Natural Resources, Ebonyi State Agricultural Development Program (EBADEP), Federal Ministry of

Agriculture, Ebonyi State Chapter and mechanized private organizations/individuals.

The questionnaires were properly explained to the respondents who cannot read and write for them to understand the information while the researcher does the recording following their answers. Those that were able to read and write were allowed to have the copies of the questionnaires and were retrieved later after attending to the questions.

2.2 Data Collection

Data were collected from the information obtained from the structured questionnaires, oral interviews/interactions and field investigations. The data collected were properly studied and analyzed using descriptive statistical tables to reach at meaningful result, conclusion and recommendations.

3. RESULTS AND DISCUSSION

Table 1 revealed that operators within the age range of 30-39 years had the highest members with 56.3%, followed by the operators with the range of 40-49 years which made up 31.1% while 8.4% and 4.2% fall within the age range of 50-59 and 20-29 years respectively. The mean ages of the operators were 38.6, 42.3, 44.2 and 39.1 for local government, state government, federal government and private operators respectively. Their overall mean age was 41.05 years. The result obtained by [13] among Kwara state tractor operators with mean age of 41.51 years was closely related to the mean age of 41.05 years of sampled machinery operators studied.

Table 2 showed the educational status of the operators. 44.6% of the operators had both primary education and trade test. This is very close to half of the sampled operators. This was followed by 26.9% who had primary education only, 19.3% had trade test certificate only and the remaining 9.2% had post primary education with trade test certificate.

Table 3 revealed the working experiences of the operators. The result of this Table indicated that 24.4% of the operators had about 16-20 years of experience. This was followed by 21.0% that had 21-25 years experience. About 19.3% had 11-15 years experience; 14.3% had 6-10 years experience; 12.6% had 26-30 years experience and 8.4% had 1-5 years of experience. The mean years of experience for the overall 119 sampled operators was found to be 19.8 years. The result revealed that for the 25 sampled local government operators, 32 state government 40 federal and 22 private operators, their mean years of

experiences were found to be 19.3; 20.4; 24.7 and 15.6 years respectively; implying that federal operators are most experienced, followed by state operators, the local government operators and the least were the private operators. From the result of the operators working experience, it can also be noticed that the operators experiences were reasonably high which may be attributed to early adoption of agricultural mechanization in the study area though with low advance rate which may be as a result of poor management policies or other factors.

Table 4 showed that all the sampled one hundred and nine (119) operators were licensed. This simply shows that possession of license may be the prerequisite for operators' employment in the area.

Table 5 presents the farm machinery inventory based on ownership in the study area. The result indicated that tractors and implements are mostly used in agricultural operations followed by shellers, mowers, threshers, trucks, sprayers and the least were the decorticators and cotton pickers. Groundnut, Bambara nut and cotton production are drastically low in the area and that may be why the adoption of decorticating and cotton picking machines were very low. The federal government owns the highest number of equipment followed by state government, local government and least was the private organization/individual.

Table 6 indicated the status of the available machinery in the study area. Result of this table showed that federal government shows most concern about maintenance of farm machinery having 30.4%, 4.9% and 3.6% of all the available farm machinery in terms of functional machines, non-functional serviceable and non-functional unserviceable machinery respectively. The least is the private organization/individuals with 3.8%, 3.1% and 2.8% for functional, non-functional serviceable and non-functional unserviceable machineries. The reason for low level of maintenance practices as noticed in the private sector may be as a result of financial constraints and/or poor management policies; despite that, the result of Table 6 generally revealed that there is drastic fall in the number of non-functional serviceable and non-functional unserviceable machineries in the study area, which imply that the extent of preventive and corrective maintenance as practiced in the area is somewhat commendable.

Table 7 presents the operators knowledge of machinery operation. Result from this table showed that 66.8 to 100% of the sampled operators were

found competent in operating various machinery, 46.2% and 47.9% of the operators were detected to be capable to operate decorticators and cotton pickers. Reason may be due to inadequate decorating and cotton picking machines in the sampled organization studied resulting from the fact that the area does not produce such crops like groundnut, bambara nut and cotton in large quantities which will attract purchase of those machines.

Table 8 revealed that 50.4 to 79.8 % of the operators in all the agricultural organisations surveyed can competently handle some of the preventive and corrective maintenances on the available farm machineries. About 17 to 20% have little knowledge about machine maintenance, while 2 to 10% have no knowledge of maintenance.

Finally, Table 9 reviewed the causes of failures of the various sampled farm machineries. Poor management policies accounted for 75.8% of the failures, lack of spare parts had 72.0%, overloading 71.9% obsolete condition was 61.9%, poor storage of equipment had 56% and poor maintenance had least of 31.6%

In the light of foregoing, government (at local level, state or federal) and private agricultural organizations should provide adequate machinery especially those lacking ones to boost the production of such crops that are sparingly produced due to unavailability of such farm machines. This will enhance full mechanization of agricultural operations in Ebonyi State. In addition, workshops, seminars and course programmes on every machine operation and maintenance should be organized regularly to promote the operators knowledge and skills and generally sustain agricultural mechanization in the area.

Table 1: Age distribution of operators

Age (yrs)	Local Govt.	State Govt.	Federal Govt.	Private Org/individuals	Total	Percentage of total (%)
20-29	-	4	-	1	5	4.2
30-39	16	18	26	7	67	56.3
40-49	5	8	11	13	37	31.1
50-59	4	2	3	1	10	8.4
60-69 and above	-	-	-	-	-	-
Total	25	32	40	22	119	100
Mean (Years)	38.6	42.3	44.2	39.1	41.05	-

Table 2: Educational background of the operators

Qualification/certificate	Local Govt.	State Govt.	Federal Govt.	Private Org/Individuals	Total	Percentage of total (%)
Primary Education Cert.	7	10	13	2	32	26.9
Trade Test Cert. Only.	5	6	5	7	23	19.3
Primary Education and Trade Test Cert.	10	14	19	10	53	44.6
Post-Primary Education and Trade Test	3	2	3	3	11	9.2
Total	25	32	40	22	119	100

Table 3: Operators Working/Operation Experience

Experience (yrs)	Local Govt.	State Govt.	Federal Govt.	Private Org/individuals	Total	Percentage of total (%)
1-5	2	3	4	1	10	8.4
6-10	3	5	4	5	17	14.3
11-15	4	6	7	6	23	19.3
16-20	6	8	1	4	19	24.4
21-25	3	5	9	4	25	21.4
26-30	7	5	5	2	15	12.6
31 and above	-	-	-	-	-	
Total	25	32	40	22	119	100
Mean	19.3	20.4	23.7	15.6	19.8	

Table 4: Acquisition of license

Licensed Acquisition	Local Govt.	State Govt.	Federal Govt.	Private Org/individuals	Total	Percentage of total (%)
Licensed Operators	25	32	40	22	119	100%
Unlicensed Operators	-	-	-	-	-	0%

Table 5: Farm Machinery Inventory Based on Ownership

Machinery	Ownership				
	Local Govt.	State Govt.	Federal Govt.	Private Org/Individuals	Total
Tractors	24	51	68	10	155
Ploughs	40	50	60	10	160
Harrows	33	50	62	10	155
Cultivators	18	35	44	10	106
Ridgers	28	40	50	7	122
Planters	20	33	32	5	92
Seed dills	15	25	40	8	88
Shellers	32	50	65	15	142
Fertilizer Applicator	6	17	37	3	63
Mowers	20	41	30	15	106
Sprayers	24	30	25	15	94
Rice Combine Harvester	20	30	26	2	78
Threshers	20	28	44	9	101
Decorticators	-	3	-	-	3
Trucks	14	27	33	29	103
Cotton Picks	3	-	-	-	3

Table 6: Status of the Available machinery

Machinery	Functional				Non-functional (Serviceable)				Non-functional(unserviceable)				Total
	Local Govt.	State Govt.	Fed Govt	Private org/ind	local govt.	State Govt	Fed Govt	Private org/ind	Local Govt.	State Govt	Fed Govt	Private org/ind	
Tractors	10	24	46	6	8	18	20	3	6	5	2	1	155
Ploughs	26	28	40	8	9	15	10	-	5	7	10	2	160
Harrows	15	25	45	5	12	10	11	-	6	15	4	5	155
Cultivators	12	19	38	3	6	7	6	4	-	9	-	3	106
Ridgers	17	24	46	7	4	11	2	-	7	5	2	3	122
Plants	9	18	28	1	7	9	-	4	4	6	5	-	92
Seed drills	7	15	37	5	5	6	-	2	4	4	3	1	88
Sheller	20	30	46	2	6	12	9	9	6	8	10	4	142
Fertilizer Applicator	5	10	19	-	-	5	10	2	1	2	8	1	63
Mowers	12	21	30	4	3	14	-	4	5	6	-	8	106
Sprayers	15	20	20	5	6	5	3	3	3	5	2	7	94
Decorticators	-	3	-	-	-	-	-	-	-	-	-	-	3
Winnowers	14	14	24	6	3	6	-	2	1	4	5	2	81
Trucks	10	22	27	10	4	3	6	13	-	2	-	6	103
Cotton Pickers	2	-	-	-	1	-	-	-	-	-	-	-	3
Total (%)	12.2	18.5	30.4	3.8	4.9	8.7	4.9	3.1	3.2	5.3	3.6	2.5	100

Table 7: Operators knowledge of machinery operation

Machinery	Frequency	Percentage (%)
Tractors	89	74.8
Ploughs	89	74.8
Cultivators	83	69.7
Ridgers	89	74.8
Harrows	89	74.8
Plants	82	68.9
Seeddrills	87	73.1
Shellers	84	70.6
Fertilizer applicator	91	76.5
Sprayers	119	100
Mowers	79	66.4
Rice Combine harvester	81	68.1
Threshers	86	72.3
Decorticators	55	46.2
Winnowers	86	72.3
Trucks	92	77.3
Cotton pickers	57	47.9

Table 8: Operators knowledge of machinery maintenance

Machinery	Obsolete ness (%)	Carless operators (%)	Lack-of Spare-parts (%)	Over loading (%)	Poor maintenance (%)	Poor Storage (%)	Poor Management (%)
Tractors	71.3	70.4	75.3	65.0	38.3	72.3	82.3
Ploughs	60.4	65.5	75.2	72.3	27.4	72.3	75.2
Harrows	66.3	75.3	82.4	75.0	28.6	73.6	78.8
Ridgers	55.0	65.2	85.4	76.0	39.5	76.4	81.6
Cultivators	50.9	63.5	65.6	79.0	23.0	77.3	82.2
Planters	60.2	54.8	65.3	82.3	33.0	65.9	85.3
Seeddrills	58.3	68.1	75.3	61.4	24.6	63.9	77.3
Shellers	70.3	45.0	75.4	68.8	23.0	72.8	72.8
Fertilizer applicator	60.4	70.6	85.4	65.4	24.1	81.2	73.6
Sprayers	60.8	45.5	75.0	65.8	28.2	65.4	64.3
Mowers	62.4	60.2	66.1	67.6	35.8	72.3	66.2
Combine harvesters	63.0	62.5	72.8	72.4	32.4	72.3	92.1
Threshers	63.2	73.3	72.2	70.8	29.8	78.1	75.2
Decorticators	63.0	52.1	64.3	75.5	26.3	76.2	73.7
Winnowers	52.4	62.6	58.4	68.1	32.4	74.6	74.8
Truckers	66.8	44.9	66.0	69.1	31.9	50.8	75.2
Cotton pickers	63.3	55.8	72.9	72.9	40.1	53.4	77.0
Mean (%)	61.9	60.1	72.0	71.9	31.6	56.0	75.8

Table 9: Causes of Machine failures

Machinery	Adequate knowledge (%)	Little knowledge (%)	No Knowledge (%)
Tractors	79.8	18.0	2.2
Ploughs	75.0	20.0	5.0
Cultivators	78.0	28.0	2.0
Ridgers	75.0	18.0	7.0
Harrows	75.0	17.0	8.0
Planters	70.0	24.0	6.0
Seeddrills	75.0	21.0	4.0
Shellers	50.4	45.0	4.6
Fertilizer applicator	73.0	17.0	10.0
Sprayers	73.0	17.0	10.0
Combine Harvest	75.0	20.0	5.0
Threshers	78.0	18.0	4.0
Decorticators	75.0	20.0	5.0
Winnowers	76.0	20.0	5.0
Trucks	75.0	20.0	5.0
Cotton pickers	75.0	20.0	5.0

4. CONCLUSION AND RECOMMENDATIONS

Results obtained from the survey showed that 66.8 to 100% of the operators in the various agricultural organisations are experienced and competent in operating the farm machineries, 50.4 to 79.8 have good knowledge of machine maintenance. This means good experience of operation and maintenance practices. 64.9% of the available machines are in good working conditions, 21.6% are not functional but are serviceable while 14.5% are out-rightly down and were not serviceable. Most of the failures encountered during operations were as a result of poor management, inadequate maintenance, lack of spare parts, overloading, careless operations and poor storage of the machines after use. The following recommendations should therefore be adhered to, for improved and/or sustainable mechanization of agricultural operation in the area.

❖ The whole engineering systems management should be reorganized in addition to the little effort of the operators to effect proper care and maintenance of machinery and equipment available in the state to increase efficiency and operation of these machineries.

❖ Maintenance facilities should be properly equipped; the efficiency of operation of any farm machine depends highly on the attention given to it to upkeep the service life standard of such equipment and/or machine.

❖ Opportunities should be given to operators for workshops, seminar programmes and courses to update their knowledge of machine operations and maintenance.

❖ Operators should be made to avoid such attitudes like overloading the machine, irregular inspection of machine before and after use, and carelessness that will result to operational failures or breakdown during operation.

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