Evaluation of Tractor Maintenance and Servicing Culture in Borno State Agricultural Mechanization Authority (BOSAMA)

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ABSTRACT

The Project aims at determining how maintenance and servicing of tractor is carried out in Four selected Locations of Borno state. These locations are: BOSAMA (Borno state Agricultural Mechanization Authority), Biu Local Government, Hawul Local Government, Kwaya-Kusar and Bayo Local Government areas of Borno State. Nigeria, the major cause of tractor breakdown in the case study and the new approaches to farm tractor Maintenance and servicing. It overviews the historical evolution of Maintenance; types of Maintenance; Maintenance strategies; effective utilization of Maintenance resources; total Maintenance and information systems support; measurements, measures and human factor management and finally tractor repair cost. The results found that there are total number of ninety six (96) tractor in farm center fifty two (52) are functional and thirty one (31) are non-functional while the percentage analysis shows that 54.16% are functional and 32.29% are non-functional; there are total number of four (4) and all are functional with a percentage analysis of 100%; Hawul with a total number of ten (10) tractors, five (5) are functional and five (5) are non-functional and with a percentage analysis of 50% functional and 50% non-functional; Bayo with a total number of five (5), two (2) are functional and (3) are non-functional with a percentage analysis of 40% functional and 60% non-functional; Kwaya-kusar with a total number of five (5) tractors and all are functional the percentage analysis is 100%. The major causes of tractor brake down are improper use of tractor; rocks; over working with tractor due to inadequate numbers of tractors with no implement shed in the case study. The study also found that there is no established workshop for repairs of faulty tractors with farm center as exception and Maintenance manual is not been used for Maintenance records.

KEY WORDS: *Evaluation, Inventory, Tractor, Maintenance, and Servicing culture*

INTRODUCTION

Agricultural machinery Maintenance play a great role in successful agricultural production. Moreover, it is one major cost for agricultural operations as "sustainability" term remains diverse, particularly in agriculture Usman et al (2022). The increased competition in agricultural production demand maintenance improvement, which aim at the reduction of maintenance expenditures while keeping the safety of operations. Preventive maintenance is an extensive term that consist of a set of activities to improve the overall reliability and availability of system (Tsai et al, 2001).

The introduction of system control has prominent role in the world of agricultural technology. In the past, different processes of agriculture related to agricultural machinery were controlled by human operators, but now an automatic way by low- and high-level system controlled is used (Coen et al, 2007., Craessaerts et al, 2012.,). At a managerial level, human operators still observe the process in order to detect process faults, unusual events and /or sensor failure which can disturb the actions of the controllers and cause severe damage to the whole process. However, this managerial task becomes increasingly difficult for agricultural machinery operators due to the ever-increasing workload and machine complexity they have to deal with (Rohani et al., 2011).

According to (Olaoye et al 2007) saddled with purchase of agricultural equipment is the responsibility to maintain them for the best performance. The frequent breakdown and poor condition of tractors has been caused by a number of factors which includes: handling and laziness on the part of the operators and mechanics, poor maintenance, inadequate supervision and attention, lack of routine servicing and maintenance culture, inferior spare parts, badly prepared land, overloading of tractors and due to some contractors, that are not trustworthy in the maintenance and repair work done because of the consciousness of the money involved.

Transaction costs for a tractor sale have unique aspects relative to other agricultural inputs. Specifically, tractors are indivisible technologies, which means they can't be broken down into sub-units for concurrent use by multiple farmers. This is distinct from divisible technologies, such as fertilizer or seed, for which the common units, e.g., bags can be divisible among individual farmers and be used concurrently (Lu et al, 2016).

Additionally, since tractors are bulky and expensive purchases, the smaller incurs transaction costs related to importation and trade as well as for the search for buyers. Damania et al (2017) found that Machinery use in agriculture in Nigeria is inversely relate to transportation cost. Hence, lower transaction is associated with greater machinery use. Since efforts has been made to replace local farm implement used by farmers with modern machinery, maintaining this Machinery to meet the end target must be at the heart of any organization.

In agriculture, various factors such as soil nutrient management, irrigation, variety, plant population per unit area, are involved for better growth, production of crops and their economics values cannot be over emphasized (Usman et al 2023). Over the years man is in need of food production for him as to derive the full maximum benefit. Efficient food supply in any country depends to a large extend on the level of agricultural mechanization of such nation (Odey et al., 2008). The reports of some researchers have highlighted that farm tractors are being underutilized in Nigeria. This was attributed to limited seasonal application of farm

tractors and lack of technical and managerial competence to handle, use and maintain farm machinery (Dauda et al., 2010; Usman and Umar, 2003). However, the cost of purchasing and maintenance of tractor makes it difficult for average Nigerian farmers to privately own a tractor (Dauda et al., 2010).

Even though it has been proven that maintenance plays an important role in production (Ylipää, 2017) it is a well-known challenge in the manufacturing industry to quantify the effects and value of maintenance. The effects are usually deferred, making it difficult to verify the upfront benefits and argue for maintenance investments. As an example, the benefits of a computerized maintenance system are obvious for maintenance personnel who can use the system to plan and evaluate maintenance actions. However, it is a challenge to prove those benefits for management and the financial department in advance.

Objectives of the Study

I. To know the possible causes of machineries breakdown and to suggest a possible solution.
II. To know the most frequent problems that are attached to the machineries.
III. To know the various maintenance culture.
IV. To compare and contrast the various method of maintenance among the various case study.

MATERIAL AND METHOD

Area of the study.

The study was specifically carried out in Four selected Locations of Borno state. These locations are: BOSAMA (Borno state Agricultural Mechanization Authority), Biu Local Government, Hawul Local Government, Kwaya-Kusar and Bayo Local Government areas of Borno State. Nigeria.

Source of Data

The sources of the data in this research work are the staffs of BOSAMA, and the Local Government ministry of Agriculture zonal units and other private owners.

Method of Data Collection

The study adopted the investigation survey research approach using questionnaires. The study was limited to Four places BOSAMA, Hawul, Biu and Kwaya-Kusar and Bayo under the Borno State Mechanization Authority. During the survey, quantitative and qualitative data were obtained from each of the establishments. The quantitative data was based on observations, existing records and authoritative publications which provided the age, purchase price, hours of use, repair and maintenance costs, fuel, lubrication etc. of the tractor makes and models selected. The qualitative data came from observations, expert opinions and questionnaires considering the fixed and variable costs of the tractor under investigation as well as their total hours of use per annum for a period of five years. Interviews will also be held with some relevant staff of the establishments.

The repair and maintenance costs of the tractors were determined by adapting repair and maintenance cost formula (Morris, 1965). The formula suggested that the repair and

maintenance costs for a tractor averaged 6% of the purchase price a year for a 10 years or 6000 hours life. A schedule of repair and maintenance costs as a percentage of purchase price were developed assuming that overhauls were done when needed and not delayed. The repair and maintenance schedule is as follows (Morris 1965) 1st year = 0%; 2nd year = 1%; 3rd year = 3.75%; 4th year = 8.5%; 5th year = 2.5%; 6th year = 10%; 7th year = 4.5%; 8th year = 5.75%; 9th year = 11.25%; 10th year = 6.5%

Method of Data Analysis.

The data collected were subjected to simple analysis. Some of the results were presented in a tabular form, and percentage values was obtained for various aspects of the questionnaire.

RESULT AND DISCUSSION

RESULT

The result of the study is presented in a tabular form and percentage value of the result was calculated and also interpretation was made where necessary.

Table 4.1 Farm Tractor Inventing at BOSAMA

Types/Model	Numbers of Tractor Available	No. of Functional	No. of Non-Functional	Percentage	
Farm tractor (60Hp)	600	600	0	Fn 100%	Non Fn 0%
Farm tractor (70Hp)	36	31	5	86.1%	13%
Farm tractor (80Hp)	4	2	2	50%	50%
Tractor YTO	672	653	19	62.5%	37.5%

Source: *Field Survey; 2021*

The number of farm tractor (60Hp) is 600, where all one functional; farm tractor (70Hp) are 36 where 31 are functional and 5 are non-functional; number of farm tractor (80Hp) are 4 where 2 are functional and 2 are non-functional.

Table 4.2 Farm Tractor Inventory at Farm Centre

Types/Model	Numbers of Tractor Available	No. of Functional	No. of Non-Functional	Percentage	
Farm tractor (80Hp)	66	44	12	Fn 66.6%	Non Fn 18.1%
Tractor YTO	27	8	19	29.6%	70.3%

Total	93	52	31

Source: *Field Survey; 2021*

The number of tractors is 66, where the number of functional are 44 and non-functional are 12; Number of tractors YTO 27 where 8 are functional; 19 are non-functional as shown in table 4.2 above.

Considering the total numbers of the tractors in farm center. There are total numbers of 93 tractors in the establishment taking the percentage of the functional and non-functional.

$$\text{Functional of farm tractor} = \frac{\text{Number of functional}}{\text{Total Number}} \times 100 \text{ or } \frac{\sum Fn}{\sum t} \times 100$$

$$= \frac{44}{66} \times 100 = 66.6\%$$

$$\text{Non-functional} = \frac{\text{Number of No-Functional}}{\text{Total Number}} \times 100 \text{ or } \frac{\sum NFn}{\sum t} \times 100$$

$$= \frac{12}{66} \times 100 = 18.1\%$$

Tractor YTO Percentage analysis of YTO tractor

$$\text{Functional YTO} = \frac{\text{Number of Functional}}{\text{Total Number}} \times 100 \text{ or } \frac{\sum Fn}{\sum t} \times 100$$

$$= \frac{8}{27} \times 100 = 29.6\%$$

$$\text{Non-functional} = \frac{\text{Number of No-Functional}}{\text{Total Number}} \times 100 \text{ or } \frac{\sum Fn}{\sum t} \times 100$$

$$= \frac{19}{27} \times 100 = 70.3\%$$

Table 4.3 Farm Tractor in Biu Establishment

Types/Model	Numbers of Tractor Available	No. of Functional	No. of Non-Functional	Percentage	
Farm tractor	4	4	-	Fn 100%	Non Fn 0%
Total	4				

Source: *Field Survey; 2021*

The number of tractors is 4 where all the tractors are functional considering the number of tractor available in the local government the tractors are not sufficient to support poor peasant farmers. This also affect maintenance and serviceability of the tractor. As shown in Table 4.3 above.

Table 4.4 Farm Tractor Inventory in Hawul Establishment

Types/Model	Numbers of Tractor Available	No. of Functional	No. of Non-Functional	Percentage	
Farm tractor	10	5	5	Fn 50%	Non Fn 50%
Total	10				

Source: *Field Survey; 2021*

The total number of tractors is ten (10), five (5) are functional five (5) are non-functional. As shown in table 4.4 above.

Table: 4.5 Farm Tractor Inventory in Bayo Establishment

Types/Model	Numbers of Tractor Available	No. of Functional	No. of Non-Functional	Percentage	
Farm tractor (80Hp)	5	2	3	Fn 40%	Non Fn 60%

Source: *Field Survey; 2021*

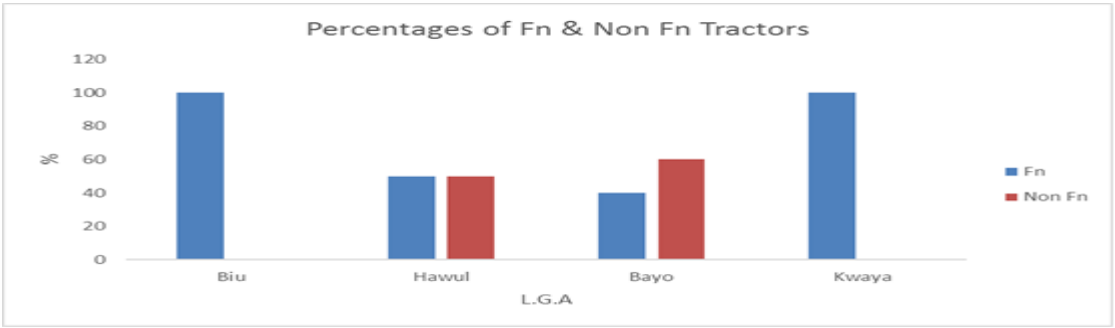
The total number of tractors in the establishment is 5, out of the total five, 2 are functional and 3 are non-functional. After taking the percentage analysis, it shows that the percentage of non-functional tractors supersede the functional ones.

Table 4.6 Farm Tractor Inventory in Kwaya-Kusar Establishment

Types/Model	Numbers of Tractor Available	No. of Functional	No. of Non-Functional	Percentage	
Farm tractor	5	5	-	Fn 100%	Non Fn 0%

Source: *Field Survey; 2012*

From the above table, it shows that there are total numbers of five (5) tractors, and all the five (5) are functional.



4.2 WORKSHOP MACHINES/TOOLS AVAILABLE AND THE WORKSHOP STAFF

During the course of this study, the workshop machines, tools and workshop staff were equipped through the administration of a questionnaire and the results are presented in the tabular form but during the interpretation of the result, it was found that all the case studies with farm center as an exception has no established workshop for repair and maintenance of farm tractors. Servicing and repair of tractors are done by private technicians.

The table below represent only the data of farm center.

Table 4.7 Showing the Workshop Machines/Tools Available in Farm Center

S/N	TYPE	QUANTITY
1	Lathe Machine	1
2	Arc Welding Machine	1
3	Oxy-acetylene Welding Machine	1
4	Battery Charger	1
5	Cutting Machine	2
6	Filing Machine	2
7	Tool Kit	1
8	Bench Vice	2

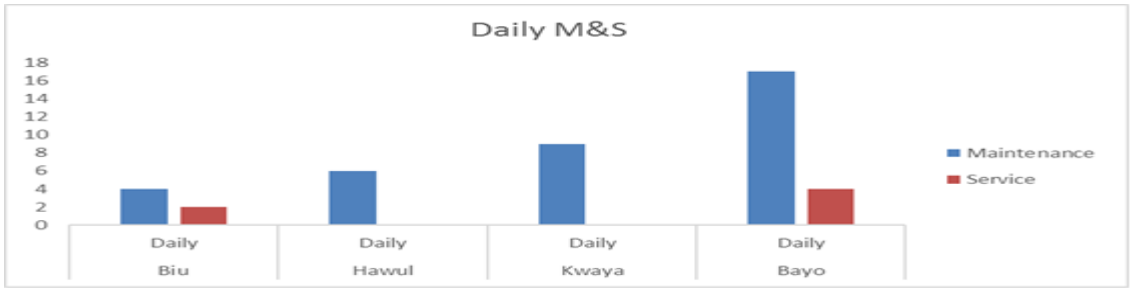
Source: *Field Survey; 2021*

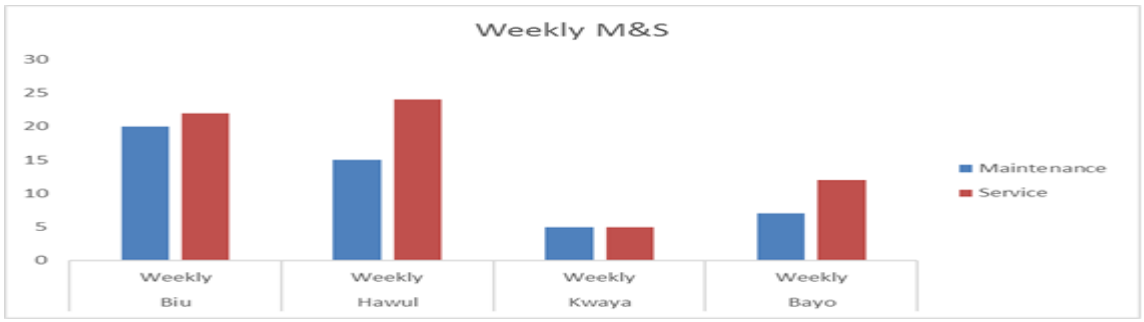
Table above shows the workshop machines/tools available in the workshop looking the data above, it shows that the workshop machines available are not sufficient, this is because some machine-like shaping, boring machines etc. are not available and the quantity of available ones are not enough for proper maintenance, repair and serving & considering the numbers of tractor in the BOSAMA.

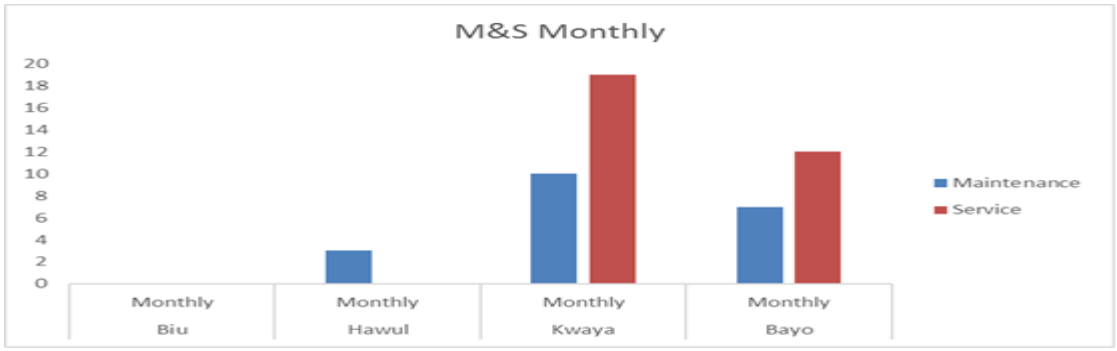
Table 4.8 Showing the numbers of Workshop Staffs

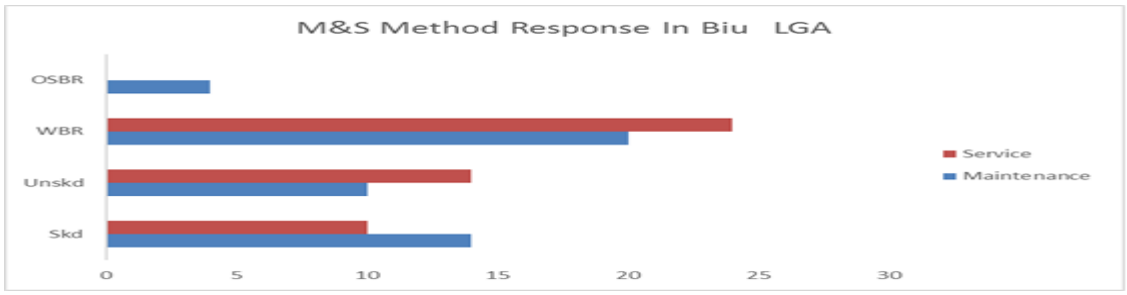
NUMBER OF WORKSHOP STAFF	WORK EMPLOYED FOR
Workshop Manager (1)	As the section head to oversee
Assistant Manager (1)	To assist the Workshop Manager
Foreman (5)	Mechanics Operating
Tractor Operators in Farm Center (10)	Tractor operators
Tractor Operators in Biu (2)	
Tractor Operators in Kwaya Kusar (5)	
Tractor Operators in Bayo (6)	
Tractor Operators in Hawul (2)	

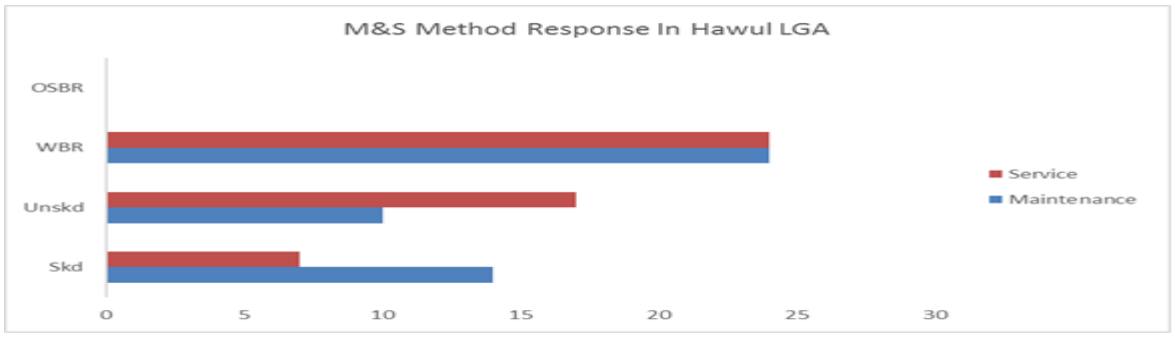
4.3 SHOWING THE RESPONSE TO THE METHOD OF MAINTENANCE AND SERVICING

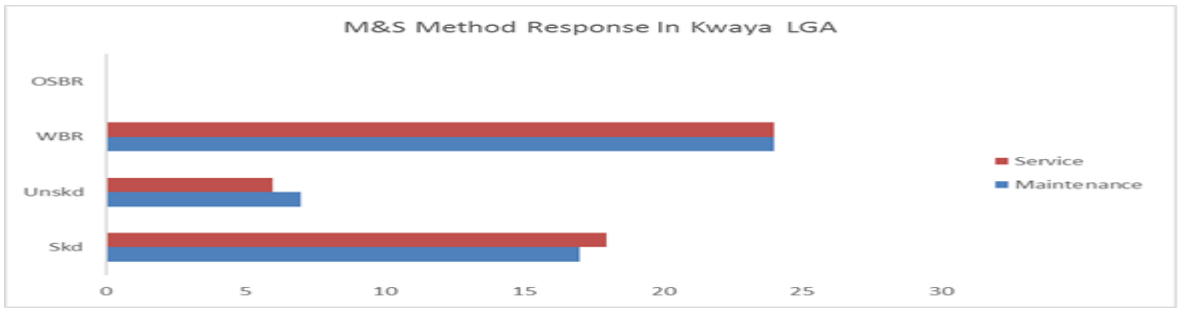


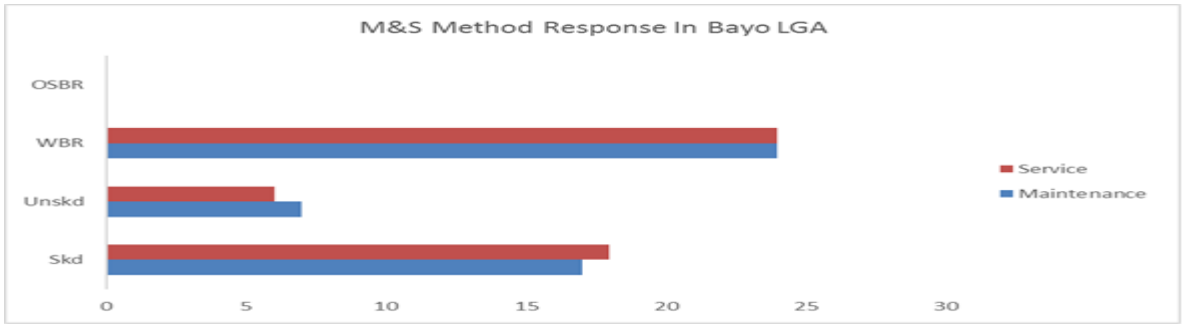


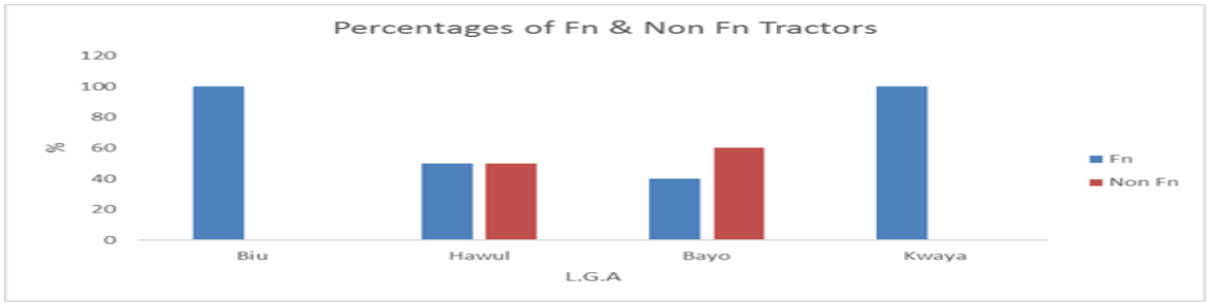












Source: *Field Survey; 2021*

Skd= skilled, Unskd= unskilled, WBR= within Borno, OSBR= outside Borno, Fn= functional, Nfn= non-functional.

Table 4.9. Respondent Age, gender and Education level

The table below shows the respondents age, gender and their education level and their percentage

Age	Respondent	Percentage %
15–25	21	21
26–35	41	41
36–55	38	38
Gender		
Male	100	100
Female	0	0
Level of Education		
Primary	20	20
Secondary	59	57
Post–primary	31	31
Non	0	2

Source: field survey 2021

Majority of the respondent that were considered in this study are between 25–55 years age range. One Hundred (100%) of the respondent were male. Ninety-eight (98%) percent of the respondents were literate and two (2%) were illiterate.

Table 4.10. Method of farming practice

Table below shows the types of farming practice in the case study and their percentage.

Types	Respondents	Percentage
Irrigation	7	7
Rain-fall	59	59
Both	34	34

Source: field survey 2021

Seven (7%) percent of the farmers depends on irrigation farming, fifty-nine (59%) percent of the farmers depends on rain-fall farming while thirty-eight (38%) percent depends on both method

Discussion, Conclusion and Recommendation

Discussion

The results found that there are total number of ninety six (96) tractor in farm center fifty two (52) are functional and thirty one (31) are non-functional while the percentage analysis shows that 54.16% are functional and 32.29% are non-functional; there are total number of four (4) and all are functional with a percentage analysis of 100%; Hawul with a total number of ten (10) tractors, five (5) are functional and five (5) are non-functional and with a percentage analysis of 50% functional and 50% non-functional; Bayo with a total number of five (5), two (2) are functional and (3) are non-functional with a percentage analysis of 40% functional and

60% non-functional; Kwaya-kusar with a total number of five (5) tractors and all are functional the percentage analysis is 100%.

The major causes of tractor brake down are improper use of tractor; rocks; over working with tractor due to inadequate numbers of tractors with no implement shed in the case study. The study also found that the most frequently problems attached to tractor are: either injector fault or hydraulic failure (lifting pump, Ram).

Conclusion

Regular maintenance is the single most important thing you can do to minimize breakdowns and repairs. Maintenance simply means cleaning, inspecting, lubricating, changing fluids and filters, and adjusting equipment on a regular time schedule for proper performance, long life, and minimal breakdowns of farm tractors. Whether you are using, maintaining, or repairing tractor, safety must be your leading priority. Tractor can maim or kill you if you're in the wrong place at the wrong time: Working on tractor puts you in a position to be hurt by some parts. Turn off the engine and PTO, block and chock, and use your common sense.

The most important tool to have for each piece of tractor is the owner's manual. This explains maintenance procedures and schedules, where they are located, how to make adjustments, and how to clean or change filters; a "troubleshooting" section, usually in the back, lists the causes of common problems with that particular tractor. The list of capacities and specifications for fluids and tires is essential for proper maintenance. If you buy used tractor and it doesn't come with a manual, you can in most cases find one on the Internet. Note also that many small engines now come with separate manuals for the engine and the machinery, and old tractors may have both an operator's manual and a maintenance and repair manual. In those cases, you'll want both manuals.

Recommendation

The recommendations were made: Due to the less numbers of tractor, tractors should be added to avoid overworking of the existing ones; there should be established workshop with trained mechanics; strong and durable tractors are to be purchased to resist the nature of the working soil; there should be machinery shed to avoid solar radiation

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