ASSESSMENT OF FARM TRACTORS AND IMPLEMENTS MAINTENANCE CULTURE IN F.C.T. ABUJA.

BY

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DEPARTMENT OF AGRICULTURAL AND BIO RESOURCES ENGINEERING

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA,

NIGER STATE.

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TITLE PAGE

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A PROJECT SUBMITTED TO THE POST GRADUATE SCHOOL

FEDERAL UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF AGRICULTURAL AND BIO-RESOURCE ENGINEERING

FEDERAL UNIVERSITY OF TECHNOLOGY

MINNA NIGER STATE

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JULY, 2010

DECLARATION

I declare that the project titled "ASSESSMENT OF FARM TRACTORS AND IMPLEMENTS MAINTENANCE CULTURE IN F.C.T ABUJA" was written by me under the guidance and supervision of DR. A. A. ALABADAN.

To the best of my knowledge similar work was not written and presented for the same purpose.

BELLO, ABDUL SALEH. _____

_____

CERTIFICATION

The ASSESSMENT OF FARM TRACTORS AND IMPLEMENTS MAINTENANCE CULTURE IN F.C.T ABUJA was written by me under the guidance and supervision of DR. A.A. ALABADAN satisfy the requirement for the award of Post Graduate Diploma in Agricultural and Bio-resources Engineering in the Federal University of Technology, Minna.

_____

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_____

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Head of Department

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I appreciated the cooperation of the Head of Agricultural Engineering Department Dr. A.A Balami and also grateful to my lecturers and laboratory technicians who have imparted knowledge in me in no small measure, may Allah reward you all.

I cannot but thank my colleagues for their moral support and encouragement, which carried me along successfully.

I am grateful to my father Alh. Saleh Bello for his support, my wife Rukaiya for her patience and understanding and all those that contributed in one way or the others towards my education. I love you all.

DEDICATION.

The project work is dedicated to my late mother Hajiya Rakiya Adamu Badaru and my children Ruqayya Abdul Bello and Mohammed Abdul Bello.

ABSTRACT

The significance of tractor and implement in the advancement of agricultural production in Nigeria can never be over emphasized. Several efforts have been put forward and heavy investment made on agricultural equipments over the years aimed at boosting agricultural activities and making food available in the country. However, incessant breakdown of tractors and implements soon after purchase has become a problem and so, the drive towards tractorization of our farming activities unrealizable.

In view of these, the various factors that are responsible for the frequent breakdown of these tractors and implements in Abuja are determined by the assessment of the various maintenance procedures in the following establishments; the six Area Councils Agricultural Departments, Federal Establishments and some Private Farms that utilizes farm tractors and implements.

In conducting the survey three instruments were used; personal interview, on-the-spot assessment and administration of questionnaires to three categories of respondents. (Head of departments or Engineers, tractor mechanics and tractor operators)

The major findings from the study are; lack of workshop and workshop functionalities, lack of record keeping of repair events, unavailability of spare parts, lack of proper preventive maintenance program, illiteracy on the part of tractor operators and some tractors are better than others.

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CHAPTER ONE

1.0 INTRODUCTION

Machines for power farming appear at a critical time in the history of agriculture in the world. Farm Power and Machinery has never been more important than now. Today, more food for hungry people is the world's greatest problem, as population is increasing faster than food supply. Total world food needs are doubling by the day. Today, population out-races food supply and farm power and machines can help food win the race.

The tractor is the most useful farm machine, capable of using it's power in numerous farm task. They are designed to furnish the power to carry, propel, pull or drive implements, which subsequently has improved the effectiveness and efficiency of various farm operations. Hence, tractor is unavoidable in the race for food and how do you operate tractor and implement without adequate maintenance culture.

The government has over the years purchased several tractors of different makes and models aimed at boosting agricultural production. But, all these efforts has not yielded the desired result as these tractors breakdown after serving only for some few months. At most a year or two you see them abandoned.

The tractor is serviced by systems, each of which has a special function: They are the fuel system, the lubrication system, the ignition system, electrical system and the cooling system. Others are the hydraulic, transmission system, etc. The care and maintenance of these system is so important that no matter how good the engine is constructed, it's efficiency depends upon the ability and skill in operating and

maintaining it. Furthermore, a tractor today may contain 10,000 mechanical parts, all vulnerable to dirt, grease, salt, rust, corrosion, friction and shock. With good sense and forethought, the tractor can run reliably and last for years and years without spending a lot of money, hence saving the nation's economy.

The report, is in five chapters and it is entirely an investigative survey aimed at establishing the problems encountered in tractor and implement maintenance in Federal Capital Territory, Abuja.

1.1 AIM :

To identify the problems encountered in tractors and implement s maintenance.

1.2 OBJECTIVES:

a To design a questionnaire for the three categories of the target audience.

b To physically survey and investigate maintenance facilities on ground.

c To conduct personal interview with some staff.

1.3 STATEMENT OF PROBLEM.

Managers or operators pay little attention to the maintenance of tractors and machineries, they are normally carried out only when they break down. The number of tractors in the country are inadequate to meet the growing needs of millions of farmers who ordinarily cannot afford a tractor due to high capital investment involved. Yet, the few available tractors mostly owned by government are deliberately allowed to break down due to lack of strict adherence to maintenance procedures.

1.4 JUSTIFICATION.

Though, manufacturers supply these tractors and machinery along with the owner's and operational manuals for care, maintenance and operation of these machines. They often breakdown long before their service life and considering the capital investment involved and the shortage of these machines in term of number in the country. The need to jealously maintain the few available in the country gave rise to these study.

1.5 SCOPE OF THE STUDY.

This study aims to assess the farm tractor and tillage implement maintenance problems faced in Abuja. The research intends to cover the six area councils agricultural departments, federal establishments and some private farms as follows;

(a) Area Councils – Abaji, AMAC, Bwari, Kuje, Kwali and Gwagwalada.

(b) Federal establishments

-National Agricultural Seed Council (technical)	Shedda
- Abuja Environmental Protection Board	Maitama
- Abuja Agric Development Project	Gwagwalada
- F.C.T Agric Central Workshop	Gwagwalada
- State House Maintenance Department (villa)	Asokoro

(c) Some private farms in the farm lay-out of Kuje Area Council, Gwagwalada and Bwari.

1.6 LIMITATIONS OF THE STUDY.

1. This research work covers only two private farms each in Kuje, Gwagwalada and Bwari area councils .

2. Only private farms that owned and utilizes farm tractor and implements are considered in the pool of selection.
3. The research work only covers primary tillage implements (plough), as it is the most widely used implement in Abuja

CHAPTER TWO

2.0 REVIEW OF RELATED LITERATURE

The farm tractor is a power unit that is self-propelling and it is used either for pulling or pushing loads or for stationary belt work. It gets its driving force in combination with an engine and driving wheels or tracks. Engine power is transmitted to the driving wheels through a series of intermediaries called power trains. These power trains consists of clutch, transmission, differential, final drives and driving axles. Tractor power is used from its power take-off shaft, pulley, hydraulic system and draw bar.

2.1 HISTORY AND DEVELOPMENT OF FARM TRACTOR.

2.1.1 STEAM TRACTOR:

The invention and development of steam engine preceded those of internal combustion engine by 100 years or more (Archie. 1977). The earliest known tractors were of the steam type. They first came into general use for operating threshers in the wheat and grain growing farms during the last two or three decades of 19^{th} century (Lovegrove, 1968). Their self-propelling features were utilized primarily for moving about from one threshing job to another. With the opening up of large farms, steam tractor displaced animal power to a certain extent for preparing the land, sowing and harvesting the crop.

The steam tractor for field works had its limitations. It was very heavy and slow moving, the fuel was bulky and difficult to handle, and the matter of boiler-water supply and fueling meant constant attention on the part of one man; with a second man to handle and guide the machine.

2.1.2 EARLY GAS TRACTOR:

A greater future demand for suitable mechanical power for field work was foreseen by manufacturers in the wheat growing farms. The construction of gas tractor therefore started before the end of 19th century (Archie,1977).

Some tractors built in 1897 and 1912 were heavy, cumbersome in appearance and were the forerunners of the present day tractor industry, which started earlier this century and began to gain momentum. These early tractors consisted usually of a large one cylinder gas engine mounted on a heavy frame placed on four wheels. The two rear wheels were connected by a train of heavy exposed thus, making it possible to achieve belt propelling. Like steam tractors, they were heavy, cumbersome and powerful and in fact they seemed to be designed as a mere substitute for the former. They possessed certain advantages. The fuel was easier to handle, there was less water to haul, and less time and attention were required for starting and during operations.

2.1.3 THE LIGHT WEIGHT TRACTOR:

About 1910, the designers turned their attention towards the possibilities of a lighter weight gas tractor to meet the approaching demand of the smaller grain and livestock farmers for mechanical power. Consequently, some number of machines began to appear in the market, comparatively light in weight and differing greatly in construction and appearance. They are equipped with two and four cylinder engines. Some were driven from the front and others from the rear. Some had the ploughs attached under the frame, while others pulled them in usual manner. Some of these tractors proved more successful while others gave unsatisfactory results and tended to destroy the faith of their owners in the future value of tractor.

The period of these tractors was short and it appears in the market and the more foresighted designers observed that there were certain fundamentals of tractor design that had to be adhered to.

2.1.4 THE FIRST WORLD WAR AND THE TRACTOR:

The First World War has a profound effect upon farm tractor development and use. Maximum agricultural product was needed. There was a shortage of labour and prices became high abnormally. All these factors meant an increase demand for labour saving and time saving machinery, especially small farm tractors. As a result of these, a large number of manufacturers sprang up and placed upon market a number of machines of different makes and models. The average and the most popular size seemed to be a machine rated at about 10 to 15 draw bar horsepower and 20 to 30 belt horsepower. The tendency in design was toward a four-wheel rear drive tractor with a four cylinder engine.

Thus, the First World War proved to be a great stimulus to the adoption of mechanical power by the farmers.

2.1.5 EFFECT OF THE AGRICULTURAL DEPRESSION OF 1920.

The tractor industry, like many others that were dependent upon the prosperity of the farmers received a severe setback as a result of the unexpected agricultural depression in 1920. At this time more than 100 different companies were offering many different sizes, models and types of tractors. Many of these companies were small and lacked capital and the organization necessary to enable them to compete with older, larger and better established companies. Even some of the older and better established farm

equipment manufacturers who entered the tractor business found little sale for their machines.

Those companies that were able to remain in business realized that it was no longer a problem of convincing the small or average farmer that mechanical power in the form of a gas tractor was practical and economical. It was seen that the farmers were willing to pay the price for a well-built sensibly designed tractor that would actually do the work for which it was recommended. However, the small, low priced all-purpose tractor introduced at this time and as commodity prices improved an immediate wide spread demands developed for such tractor. As a result, tractor sales increased steadily.

2.1.6 DESIGN STANDARD.

It is true that very few of the tractors sold during this period were adapted to doing everything on the farm, that is , they were not of the all-purpose type. A really successful tractor of this type was yet to appear. Most of the tractors were light-weight, two or three plough tractors that were used largely for ploughing and land preparation. The farmers were satisfied to have something that would prepare the land more quickly and better and like-wise relieve the horse of this heavy work. Another outstanding fact was that, there was less variation in design and construction of farm tractors.

2.1.7 ALL-PURPOSE TRACTOR.

The next and the most logical step seemed to be the design of a light weight, low priced, all-purpose tractor that would do any kind of field or stationary work on the average farm, including ploughing. harrowing, planting, cultivating, harvesting, threshing or any thing requiring similar power. Several machines of this type were

designed during this period, but few of them proved really successful. It appeared to be a difficult problem to construct a tractor that will be heavy and rugged enough to plough and harrow the heaviest soil and still be used for light works as planting and cultivation of row crops. Efforts were continued by certain manufacturers to build a really successful and practical all-purpose farm tractor. After few years a machine was introduced which came nearer to meeting the requirement. Within a few years all the established manufacturers had designed and produced one or more model of all purpose tractors. Power take-off, diesel tractor, pneumatic tyre, power lifts and hydraulic controls-small tractor.

Numerous significant developments have taken place since, which have accelerated the adoption of tractors for agricultural power, extended their range of utility and improved their convenience and ease of operation. The first tractor supplying power directly to the mechanism of a field machine by means of power take-off attachment appeared and this device is now considered as standard for many farm applications.

Tractor equipped with diesel engine was introduced. These early engines were of heavy duty type and their use was confined largely to track-type tractors for earth moving and various types of construction operations. However, smaller diesel tractors were developed and introduced.

Low pressure pneumatic tyre first appear on farm track about 1932. It was discovered that rubber-tyre tractor offer a number of definite advantages compared with steel wheel tractors. The demand for this type of equipment was high and therefore, many improvements have been made in rubber tyres.

During the late 1930s a few manufacturers introduced small, one row, all purpose tractor. Others followed with similar or even smaller tractors during or immediately following the end of Second World War.

Other developments that have contributed to popularity and more effective utilization of tractors particularly the all-purpose types are:

1. Improved hydraulic and control devices.
2. Special direct-connected and quickly attached implement and tools.
3. Improved transmissions providing more travel speed and shifting.
4. Better power take-off operation and speed control.
5. Power steering.
6. Electric starting and lighting.
7. Better brakes.
8. Improved operator comfort and safety.

2.2 TYPES AND SIZES OF FARM TRACTORS:

There is almost endless variety of types and sizes of tractors to choose from. The smaller sizes may have engines of about 10 horsepower-power enough to operate one 100 inch (25cm) plough. The largest may have 200 or more horsepower –power enough to draw ten 16 inch (41cm) ploughs.

2.2.1 TYPES OF TRACTORS:

The tractor types that we shall consider here are only the major classes of wheel tractors and crawler tractors used in agriculture. Thus:

(a) ROW-CROP TYPE: It is specially designed for cultivating and planting row crops. When it first appeared, about 1924, it marked a milestone in tractor development. With a cultivator mounted on it - instead of being drawn behind it – the power (tractor) and implement became a single integrated unit.

The tractor can be adapted to various row widths; wheel will run midway between rows and causes a minimum of plant damage. The row crop tractor is used by more farmers than any other type because of the extensive acreage of major row-crops such as corn, cotton and soybeans.

(b) STANDARD WHEEL TYPES: This, the oldest type, is best suited for open-field-work-ploughing, harrowing, operating grain drills, harvesting machines and haying implements and similar operations. It is not designed for cultivating row crops, but is most useful for all kinds of draw-bar work and for furnishing power for trailed implements.

Standard tractors are built close to the ground, with less vertical clearance than the row crop type. For most field jobs the rear wheels are set to "track" with the front wheels. They operate large implements or multiples or combinations of implements especially the four-wheel drive models with engines of 200 horsepower or more.

(c) UTILITY TRACTOR: These models may be obtained with either fixed or adjustable tread, front and rear. With suitable tread they can be used for a wide variety of row crops.

They have slightly less vertical (cultivating) clearance than the true row-crop models and this lower profile gives them stability on hillsides. They are well suited for farmstead and barnyard work – manure loading, hauling and transport, and drawing feed wagons. And they are widely used for open-field work-ploughing, disking and haying operations.

(d) ORCHARD AND GROVE TRACTORS :Almost any tractor can be used in orchards and groves if the trees are widely spaced and the branches are high. But where orchards, groves or vineyards are the major enterprise, it is better to use a tractor specially designed for such work. Wheel tractors for orchards and groves are furnished with narrow tread and short wheel base. The steering wheel and the operator's seat are lowered and protected by a cowl. The overall height of the tractor is reduced, giving stability. Projecting parts are enclosed or covered. Exhaust and intake pipes do not project above the engine hood.

A positive quick action steering system, augmented by differential brakes, is desirable short turns of the ends and weaving in and out of tree rows are frequently necessary.

(e) LAWN AND GARDEN TRACTORS:

These small-wheel type "compact" have gained great popularity in recent years with a phenomenal increase in the number manufactured. At first they where used primarily by suburban residents and estate owners, but they soon found other markets and are now widely used in parks, industrial plants, golf course, cemeteries and recreation areas. Farmers are finding them useful also, not only for lawn-and-grounds care but for certain farm operations that require special accuracy and precision – thinning and weeding sugar beets for example.

(f) TRACKLAYER TRACTOR:

They are widely employed on large acreages of open-field work requiring long hours and heavy loads. Hence, diesel engines are popular in track-type tractors. They are good on soft, wet, swampy ground. Many farmers use them on hilly areas, on steep hillsides and on rough land. They can be used in orchards and groves. They facilitate land clearing and reclamation.

Soil conservation practices like terracing, contouring, leveling, furrowing, building farm pounds, preparing land for irrigation, making and maintaining irrigation ditches are purposes to which these tractors are suited. They operate deep – tillage and subsoil implements.

(g) TWO WHEEL WALKING TRACTORS:

For small operation. It is steered by a walking operator and one or two forward speeds and a reverse gear. The output of such a tractor is slightly more than that of a pair of bullocks. The smallest sizes are available in 1 to 2 kw range. They can pull either a 15cm plough or a 90cm wide spike tooth harrow.

2.2.2 SIZES OF TRACTOR: The sizes of tractors can be expressed by:

(1) Weight (2) horsepower (3) implement capacity. Capacity may also be expressed by the number of rows a tractor can cultivate, single row, two-row-six-row or eight-row.

Rating capacity by the number of plough a tractor can operate is a common and convenient method, but not very accurate. Power required for ploughing varies greatly

in some soils a tractor might pull three plough easily, but in a different soil is might pull only one.

CAPACITY OF TRACTORS

Engine Horsepower	Moldboard of Tractor
8 to 12	one 1211 or 30cm
15 to 20	one 1611 or two 1011 or 41cm/25cm
25 to 30	two 1411 or 36cm
35 to 45	three 1411 or 1611 or 36cm/41cm
50 to 60	four 1411 or 36cm
65 to 75	five 1611 or 41cm
80 to 130	six 1611 or 41cm

2.3 IMPORTANCE OF TRACTOR MAINTENANCE.

The importance of maintenance of tractor and machinery varies from farm to farm. However, the scope of each kind of maintenance is basically the same for the different models of tractors, though the duration of work may vary with the nature and complexity of the operation. A generalized view is submitted below.

1. Break down of tractor leads to loss of production:

(a) The breakdown at a single point means stoppage of work over the whole tractor engine/farming operations.

(b) It result in loss in production and productivity.

(c) An improperly maintained tractor requires excessive recurring charges whenever it breakdown, it requires high maintenance charges.

2. Breakdown of tractor causes the following problems:

(a) Loss in production time.

(b) Spoil material. The sudden stoppage of work may also damage the equipment.

(c) Higher overhead charges.

(d) Need for rescheduling production.

Need for extra work and overtime to meet production targets.

2.4 DUTIES OF A MAINTENANCE ORGANIZATION:

Proper maintenance of tractors and equipment involves sound organization, planning, operation and control. It requires proper maintenance of records, schedules and work orders.

The duties of a maintenance organization generally can be divided as follows;

1. To check, repair, adjust and lubricate the tractor as and when needed.

2. To anticipate the need for repairs and alteration.

In addition to the above duties, the other duties of maintenance department can be classified as;

(i) Inspection:- Inspection is concerned with routine schedules checks of the tractor and equipment to keep track of its conditions. Intensively used tractor requires inspection more frequently. After inspection, reports are prepared showing flaws and remedial suggestions. Weakness or future breakdowns likely to occur can also be shown in such reports.

(ii) Engineering:- The engineering section of a maintenance organization is concerned with developments, changes and improvements needed in tractor engine for increasing productivity. Recurring breakdown occurs in certain tractor and machinery.

The engineering department can suggest ways of improvement and changes in design to prevent such breakdowns.

(iii) Production:- The production section provides practical shape to ideas developed by the engineering phase. It also undertakes the work suggested by the inspection section.

(iv) Clerical:- The clerical section is responsible for keeping records of costs, times, progress of jobs, etc. it maintains all important records pertaining to major breakdowns, repairs of tractor and equipment.

(v) Housekeeping:- Is concern itself with maintaining building, equipment, tools sanitary ware, etc. in order. It also looks after employees facilities, such as cleaning floors, maintaining toilets, lockers, windows, doors, etc.

(vi) Construction:- In some organizations, the maintenance department is also entrusted with the responsibility of construction jobs. It undergoes construction of wood, brick, steel structural, cement and asphalt paving, electrical fittings, etc.

(vii) Salvage:- Salvage means disposal of scrap or surplus materials. The maintenance department is also involved in aggregation, reclamation and disposal of scrap. It also carries out the disposal work when the equipment is not repairable economically.

The maintenance department also looks after:

(i) Generation, transmission and distribution of power and other utilities.

(ii) Administration and supervision of labour force.

(iii) Provides protection to equipment by locating various hazardous point and suggesting precautionary measure.

(iv) Helps the department by suggesting insurance policies.

(v) Establishing and maintaining suitable stores for the maintenance department.

(vi) Routine white-washing

2.5 MAINTENANCE AND REPAIRS OF TRACTOR

Tractor maintenance comprises of both daily and periodic measures, inspection and adjustments. Due to constant use, the tractor and its engine parts wear out, involving major overhauls such as replacing cylinder liners, connecting rod bearings, main bearings replacing of piston rings, grinding or crankshaft, replacing of valves and valve seats, etc.

Many troubles encountered on engines and tractors can be avoided if a programme of preventive maintenance as laid down in the operating manual is set up and followed. Often, service that creates problems for the future. The best guide is the operating manual, which will specify the specific schedule recommended for the particular type and make of tractor.

As a broad guideline the following maintenance intervals as suggested in operational manuals should be complied with:

- every 10 hours (or daily)
- every 50 hours (or weekly)
- every 100 hours (or fortnightly)
- every 250 hours (or monthly)
- every 500 hours (or two months)
- every 1000 hours (or annually)

2.6 DEVELOPMENT OF PLOUGH :The plough is probably the oldest agriculcural tool. A forked-stick plough was used in Egypt about 6000B.C. That pre-historic plough was pulled by a man (Stone, 1977). One branch of the stick was a little longer; it serves as the tongue. The shorter branch scratched the earth.

Ploughs were first made of wood, next from cast iron and then from steel. Two wheel sulky ploughs were introduced in 1865 and were followed quite soon by three-wheel ploughs.

The plough pulverizes, aerates and loosens the soil. Usually some trash is buried and mixed with the earth. By completely or partially inverting the soil, ploughing provides new and unused plant nutrients near the surface for the new plant seedlings.

2.6.1 TYPES OF PLOUGH.

Ploughs are broadly classified according to the following types: moldboard ploughs, disc ploughs, subsoil ploughs, disc tiller ploughs and rotary tillers.

- Moldboard Plough: The regular moldboard ploughs can be divided into two main groups. One-way ploughs throw the soil only in one direction, usually to the right (when seen from behind) while Two-way ploughs, have the bottom so arranged that the right-turning buttons can be quickly and readily replaced with a set that turns the soil to the left.

Disc Ploughs : The two main types of disc ploughs are the standard and the vertical. The standard disc plough has one or more disc blades each with its own bearing and each slanted at an angle to the vertical and in some designs the disc plough can be adjusted to suit different soil conditions.

The vertical disc plough differ from the standard disc plough in that a series of disc are spread or fixed distance apart on a common circle. They rotate as a unit at an angle of 35-50 degrees from the line of travel (Arome, 1977).

2.6.1.1 TYPES OF DISC PLOUGH:

The three main types are;

1. Direct-mounted ploughs, are attached to the tractor by one, two or three point hitch linkages. They can be raised or lowered by the hydraulic system. Most can be attached in less than a minute.

They are usually rear-mounted and have a rear wheel to absorb the side thrust. But some are mounted ahead of the rear wheels. Because the blades in this case, are pushed downward as well as forward by the tractor, a depth wheel or a control chain is usually used to prevent too deep penetration in softer portions of the soil.

2. Semi-mounted Disc Ploughs, are pulled by the regular tractor draw bar or by a special draw bar. They are raised by moving a lever at the front of the plough. The rear wheel is steered by a long rod that extends to the tractor draw bar. This arrangement makes the plough follow the tractor correctly on curves and at end of the field.

3. Trailling Disc Ploughs, it has three wheels for support. They can be pulled by any make of tractor that has sufficient power. The land wheel may furnish the power to raise the plough, unless a hydraulic lift is used. The front furrow wheel helps lift the plough, turns sideways for steering the plough and absorbs some of the side thrusts. The rear furrow wheel is non steering, but it absorbs thrusts and lifts the rear part of the plough.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 BACKGROUND OF THE STUDY AREA:

Abuja is the seat of government of the Federal Republic of Nigeria. It was carved out of three states of Niger, Plateau and Kwara in 1975. Abuja has six area councils like the local governments in the states. It has an estimated population of 7,000,000 (census 2006), and covers a total land area of 8000sq. kilometers. Abuja is bounded by Niger State to the north, Kaduna and Nassarawa to the east and Kogi to the west.

The landscape of Abuja is "alluvial pier dissection" consists of rivers Gurara and Usuma and the range of hills with insert bergs and an extension of the Jos plateau popularly known as the Jama'a platform running through the center. The vegetation of the area is mainly guinea savannah as its temperature fluctuates between 30 and 37 degrees centigrade. (Dairy, 2003).

The indigenous population are mainly from Gbagis,Gwandaras,Bassas,Gades Hausas and the Fulanis ethnic groups. Over 80% of the indigenous population are rural farmers. The main food crops are guinea corn, rice, millet, beans, maize and yam. The cash crops includes ground nuts, sugar cane etc.

3.2 METHODOLOGY:

The methodology adopted in this study is the investigative survey approach. It involved data collection and analysis as a frame work.

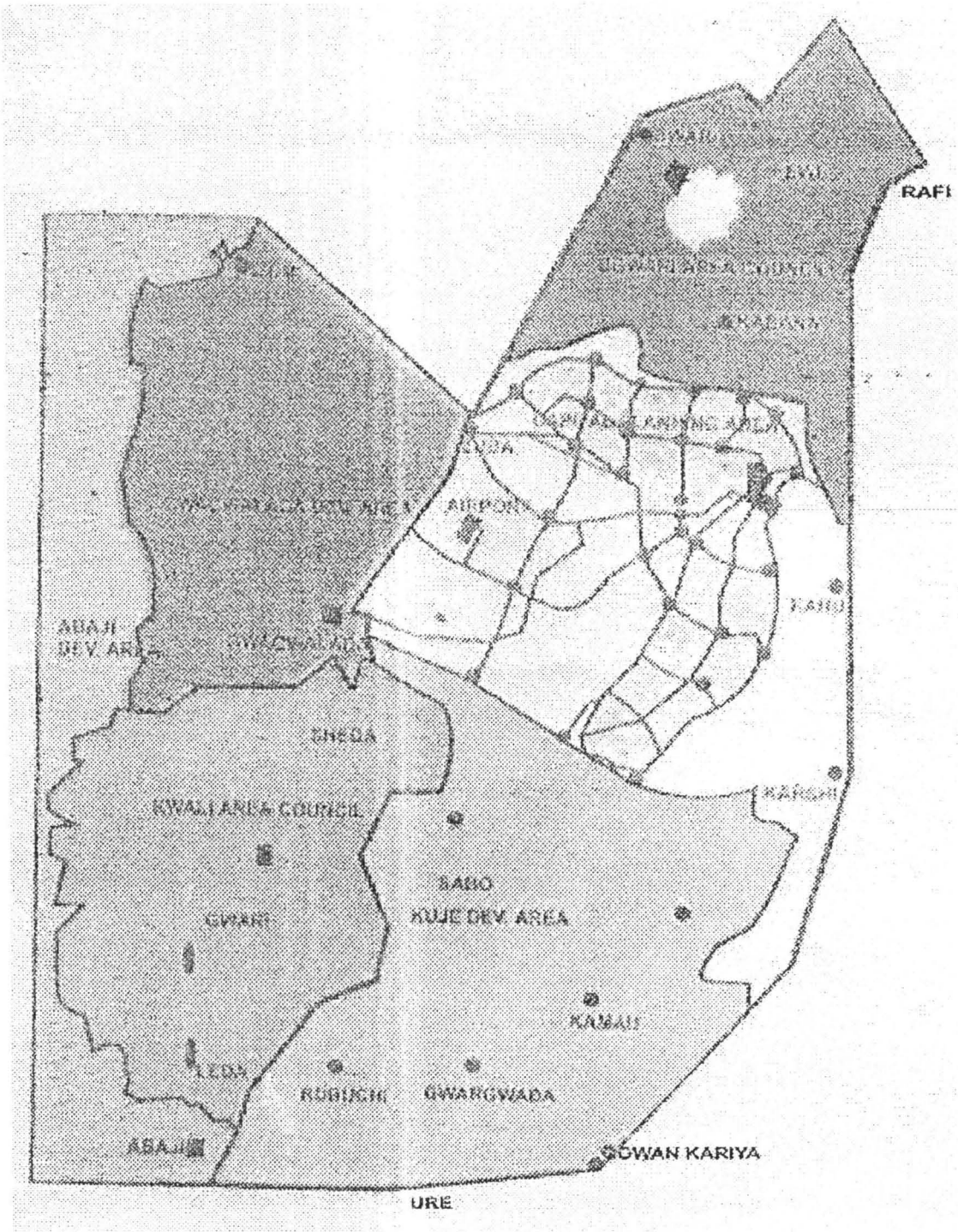

Figure 3.1 MAP OF ABUJA SHOWING THE SIX LOCAL COUNCILS

In this study, all the Area Councils Agricultural Departments, the Federal Establishments that utilizes Farm Tractors were taken into consideration.

The study involved administering questionnaires A,B, C to the three category of respondents. And also, on the spot assessment of facilities on ground was carried out besides the interviews of some staff in each establishment.

The total number of questionnaires distributed is sixty-eight (68) and from these sixty-four (64) retrieved. The retrieval from the six Area Councils and five Federal Establishments was 100% while the five private farms returned 20 out of the 24 distributed i.e (83% retrievals).

3.3 PROCEDURE FOR DATA COLLECTION.

The questionnaires A,B and C were administered to all the establishments surveyed. On the spot assessment of facilities and personal interviews were also conducted to get clarification and some vital information necessary for the study.

In each establishment, the Engineers, Head of Departments or Farm Managers (in the case of Private farms), were administered questionnaire A. They are in the best position to give the required information by virtue of their position and work experience.

While, the tractor mechanics and operators are administered questionnaires B and C respectively.

The various establishments visited for the purpose of this survey are:

1. The six Area Councils Agricultural Departments of: Abaji, Bwari, AMAC, Kwali, Kuje and Gwagwalada.

Workshop and workshop functionalities, records of repairs, cost of annual use of tractors and implements etc.

CATEGORY B: Category B questionnaire are meant for the tractor mechanics with questions that bother on maintenance principles and the procedures on how maintenance is carried out.

CATEGORY C: Category C questionnaire are meant for tractor operators. Here, due to its importance, two operators 1 and 2 were administered questionnaire simultaneously. In it, questions bother on the operational principles of the tractors, like how the tractor is started in the morning and whether or not the tractor is allowed to idle before engaging the gears.

3.4 RESEARCH INSTRUMENTS:

The research instruments are basically three used in recording and analysis of the data. These are:

3.4.1 PERSONAL INTERVIEW:

The use of English, pigeon English and Hausa languages were employed at various times in the study area where there is low level of literacy. Most of the target audience are mechanics and tractor operators.

3.4.2 ON-THE-SPOT-ASSESSMENT: In all the establishments visited, careful observations of facilities such as presence of workshops, workshops facilities, machine

sheds, or parking area and pit etc. were observed ,to ascertain the occasional claims by the respondents.

3.4.3 USE OF QUESTIONNAIRE:

The use of questionnaires has greatly helped in sourcing information required for the work. Samples of this questionnaire are as attached. (see Appendices 2A, 2B & 2C).

3.5 PROBLEMS ENCOUNTERED:

In both the government establishments and the private farms, most people are suspicious of the whole exercise as they thought it was a way of disclosing official information to which they needed the approval of their boss.

On several occasions, visit to some of the establishments was made more than three times before been able to retrieve the questionnaires. In some cases, a fresh questionnaire had to issued after the previous one might have been misplaced.

In some of the private farms, I was denied entry even after presenting my I.D cards. Also, I had to walk long distances from the farm gate to the main farm house. Unlike in the government establishments it is easy to locate and easily accessible.

I was unable to retrieve the sets of questionnaires issued to Kwande private farm, as several return visits was made and the gate remains under lock and keys.

3.6 METHOD OF ANALYSIS.

The type and nature of the data collected for the achievement of the objectives of the study has influenced the choice, the use and the type of analysis and method of presentation. The research data collected, exhibited certain characteristics such as associations, relationships, trend, variations, frequencies and pattern, etc when considering both government and private farms visited.

The data obtained in this research is to be analyze using simple percentage. The formulae below was used to establish the relationship:

$$\% \text{ Response} = x / y$$

Where; x = number of response on a question

y = total respondents on that question

The method of analysis provides a level of response on percentage basis of each individual respondent.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 ANALYSIS OF THE QUESTIONNAIRE

Among the major findings that contribute to the frequent breakdown of tractors and implements in Abuja are;

QUESTIONNAIRE A

-Lack of workshop and workshop functionality.

-Lack of record keeping.

QUESTIONNAIRE B

-Lack of preventive maintenance.

-Unavailability of spare parts.

-Some tractors are better than others.

QUESTIONNAIRE C

-Low literacy level of the operators

-Sources of both engine oil and diesel fuel.

4.2 FINDINGS OF THE STUDY:

The major findings of the investigative survey carried out from the analysis of data and the summary of the questionnaires (appendices 3A,3B and 3C) are:

4.2.1 LACK OF RECORD KEEPING:

It is always advantageous to keep an accurate record for each tractor and farm engine of such parameters as fuel consumption, lubrication oil consumption, specific breakdown and other operational problems.

By carefully observing fuel and lubricating oil consumption, it is possible to detect any serious variations on the month to month basis and identify those who needs attentions. It may only mean tightening a few nuts or changing a gasket (for example, where leakage is detected as the cause of the variation) as the cost of repairs on the long run can be tremendous.

However, on all the establishments surveyed, (see table 4.1), only seven (7) i.e 31.25% keeps records while Nine (9) i.e 56.5% have no records of all their repairs, as represented on figure 4.1.

4.2.2 LACK OF WORKSHOP AND WORKSHOP FUNCTIONALITIES.

In most of the agricultural establishment visited, there is total lack of workshop and when this workshop exists, there are no facilities necessary for repairs.

A workshop is desirable on a large farm for maintenance and repairs of farm equipment and buildings. A substantial amount of time and money can be saved and extra work and inconvenience avoided on the farm by having a fully planned and well equipped workshop.

However, in this farms surveyed, only six (6) out of the sixteen (16) farms could boast of a store of spare parts and out of these six (6) mentioned only one (1) is well equipped and fully stocked with spare parts.

The total number of establishment that has no workshop are 62.5% and 37.5% has workshop even though ill-equipped. See (table 4.2) and (figure 4. 2).

4.2.3. LACK OF PREVENTIVE MAINTENANCE

Many troubles encountered on engine and tractors can be avoided if a programmed of preventive maintenance as laid down in the operating manual is set up and followed. Often, it is the carelessness in delaying a particular recommended service that creates problems for the future. The best guide is the operating manual, which will specify the specific schedule recommended for the particular type and make of tractor.

The survey carried out indicates that there is total lack of adherence to the principles of preventive maintenance as most of the repairs carried out are only done when the tractor spoils.

In the establishment surveyed, 25% said yes, they do carry out preventive maintenance. 75% said they only carry out maintenance only when the tractor spoilt (i.e. breakdown repairs). Table 4.4 and Figure 4.4.

4.2.4 UNAVAILABILITY OF SPARE PARTS:

Tractor and implements are being accepted by the farmers in large numbers as a major source of power but often meet accident or undergo breakdowns, during operation.

Adequate measures are not taken to avoid accidents and prevent breakdown so as not to have down times for machines, especially those in remote areas.

The government has not made it mandatory on the part of the dealers to stock sufficient spare parts for immediate repairs if farmers so desire. Of course, government subsidy on the importation of agricultural machinery is a failure and duty free policy has not yielded the desired result.

However, in most of the establishment visited, apart from the inability of the mechanics to make major repairs, there is also the problem of non-availability of the facilities to make these repairs.

Among the farmers visited only three (3) i.e. 18.75% have access to spare parts but the remaining thirteen (13) i.e. 81.25% have serious difficulties in getting spare parts. In fact, according to table 4.13 and figure 4.13, they only obtain their spare parts from scrap tractor 50%, Brand new 12.5% and Belgium parts 37.5%.

In all the government establishment, if a tractor breakdown and needs a spare part, it takes about 2-4 weeks for the repairs to be effected, depending on the ease of getting the spare part.

4.2.5 SOME TRACTORS ARE BETTER THAN OTHERS.

Different makes/models of tractors responds differently when subjected to the same harsh conditions. They adapt and give ways to failure differently as some are more robust and rugged than others. According to the mechanics and the tractor operators, Fiat tractor make/model are more resistant to damage as they do not breakdown easily

when compared to Massey Ferguson tractor make. This is despite the fact that MF is statistically more in number and in common use in Abuja.

Table 4.6 and figure 4.6 gives the percentage responses from all the respondents on frequency of tractors brought for repairs. However, when considering the part of the tractor that gives trouble the most, this fact is further buttress. (table 4.3 and figure 4.3).

4.2.6 SOURCE OF BOTH ENGINE OIL AND DIESEL FUEL

The selections of the correct types and grades of lubricants is not considered as a step towards ensuring efficient lubrication of the tractor in Abuja. The very best oils and grease will not perform satisfactorily if they are not carefully handled and properly applied. Packages and containers containing lubricants are not stored under cover, hence, they are exposed to the weather conditions.

These was brought to the open, by table 4.9 and figure 9, where the sources of engine oil that are branded (gallon with label) are only (6), 18.75%, (2) ie 6.25% are uncertain where their engine oil comes from i.e they normally receive oil from their senior officers. The majority, about (24) ie 75% buy their engine oil from the road side inside drum, the purity of which cannot be guaranteed.

Contamination of oil is caused by un-burnt fuel, dirt, water and/or pieces of metal detached from the engine. Of course, in the area of exhaust cover against rainfall, we have seen from the data (see table 4.8 and figure 4. 8) that 43.75% goes for tin cover, 40.63% goes for no cover at all, and 15.63% prefer to cover their exhaust with rag.

Recall that, water causes rust formation. Thick contaminated oil sticks to engine parts or passages. In the same vein, diesel fuel are obtained mostly from black market which accounts for about 78.13%, fuel from workshop drum has 15.63% while diesel fuel from pump station accounted for only 6.25%. (table 4.11 and figure 4.11). From these, it can be said that the security and safety of the fuel obtained from black market is not guaranteed owing to the probabilities of contamination in either transit or in storage or other dubious acts.

4.2.7 LOW LITERACY LEVEL OF THE TRACTOR OPERATORS:

It is the responsibility of the operators to read and understand the safety manuals before operating tractors. The safety instruction must be followed step by step through working day. The operator must be qualified and authorized to operate. To be qualified the operator must understand the written instruction supplied in the instruction book, have training and know the safety rules and regulations for the job.

Considering all the above mention qualities expected of an operator and the data obtained under study, it is mandatory on the part of the tractor operators to be able to read and obey the manuals and this will go a long way in smoothening even the operational principles of the tractor and implements in the field.

It is visible from the data (table 4.15 and figure 15), that the literacy level of the tractor operators are inappropriate as (17) ,about 53.13% of them attended primary, while (12) ie 37.5% did not go to school, only(3) ie 9.38% went to secondary school. At least at secondary school level, the operators should be able to read and interpret instructions on the manual.

Table 4.1: Record Keeping Status of Repairs Made to Tractors and Implements

Responses	Number of Establishment that keeps records	Percentage
Yes	9	56
No	7	31

Table 4.2: Presence of Workshop and Workshop Functionality

Responses	Total Number of Establishment that Have Workshop	Percentage
Yes	6	3
No	10	62.5

Table 4.3: Tractor System that Gives Trouble the Most

Tractor Systems	Total Number of Responses	Percentage
Cooling System	0	0
Hydraulic System	7	43.75
Fuel/Injector System	6	37.5
Steering System	6	37.5

Table 4.4: Status of Preventive Maintenance on Tractors

Responses	Number of Establishment that Carry out Preventive Maintenance	Percentage
Yes	4	25
No	0	0
Until the Tractor Spoils	12	75

Table 4.5: State of Availability of Spare Parts

Responses	Number of Establishment that Have Access to Spare Parts	Percentage
Yes	3	18.75
No	13	81.25

Table 4.6: Repair Status of Tractors

Tractor Make / Models	Total Number of Tractors Brought for Repairs	Percentage
MF	15	93.75
Steyr	8	50
Ford	1	6.25
John Deere	0	0
Fiat	7	43.75

Table 4.7: Mode of Starting the Tractor in the Morning

How Tractor is Started	Total Number of Establishment	Percentage
Key/Ignition	12	37.5
Pushing	20	62.5

Table 4.8: Mode of Covering the Exhaust Against Rain

Exhaust Cover	Total Number of Establishment	Percentage
Tine cover	14	43.75
No cover	13	40.63
Rag cover	5	56.23

Table 4.9: Sources of Engine Oil

How Engine Oil is Obtained	Total Number of Establishment	Percentage
Road side	24	75
Branded oil	6	18.75
Uncertain	2	6.25

Table 4.10: The Rate at Which Tractors Goes Off While Working on the Field

Responses	Total Number of Establishment	Percentage
No quench	7	21.08
Quench 2-3 times	1	3.13
Quench to rest	24	75

Table 4.11: Re-fueling Tractor with Diesel Fuel

Where Fuel is Obtained	Total Number of Establishment	Percentage
Pump station	2	6.25
W/shop drum	5	15.63
Black market	25	78.13

Table 4.12: Tractor and Implement Storage Facility

Mode of Storage	Number of Establishment	Percentage
At shed	9	28.13
Outside (sun)	18	56.25
Cover with tarpaulin	5	15.63

Table 4.13: Source of Spare Parts

Where Spare Parts are Obtained	Number of Establishment	Percentage
Branded new	4	12
Scrap tractor	16	50
Belgium	12	37.5

Table 4.14: Educational Qualification of Tractor Operators

Qualification of Operators	Total Number of Establishment	Percentage
Primary School	17	53.125
Secondary School	3	9.37
No School	12	37.5

Table 4.15: Frequency of Sharpening Implements (Plough)

Rate of Sharpening	Total Number of Establishment	Percentage
Once Daily	5	15.63
2-4 Time Weekly	0	0
Never Sharpens	27	84.37

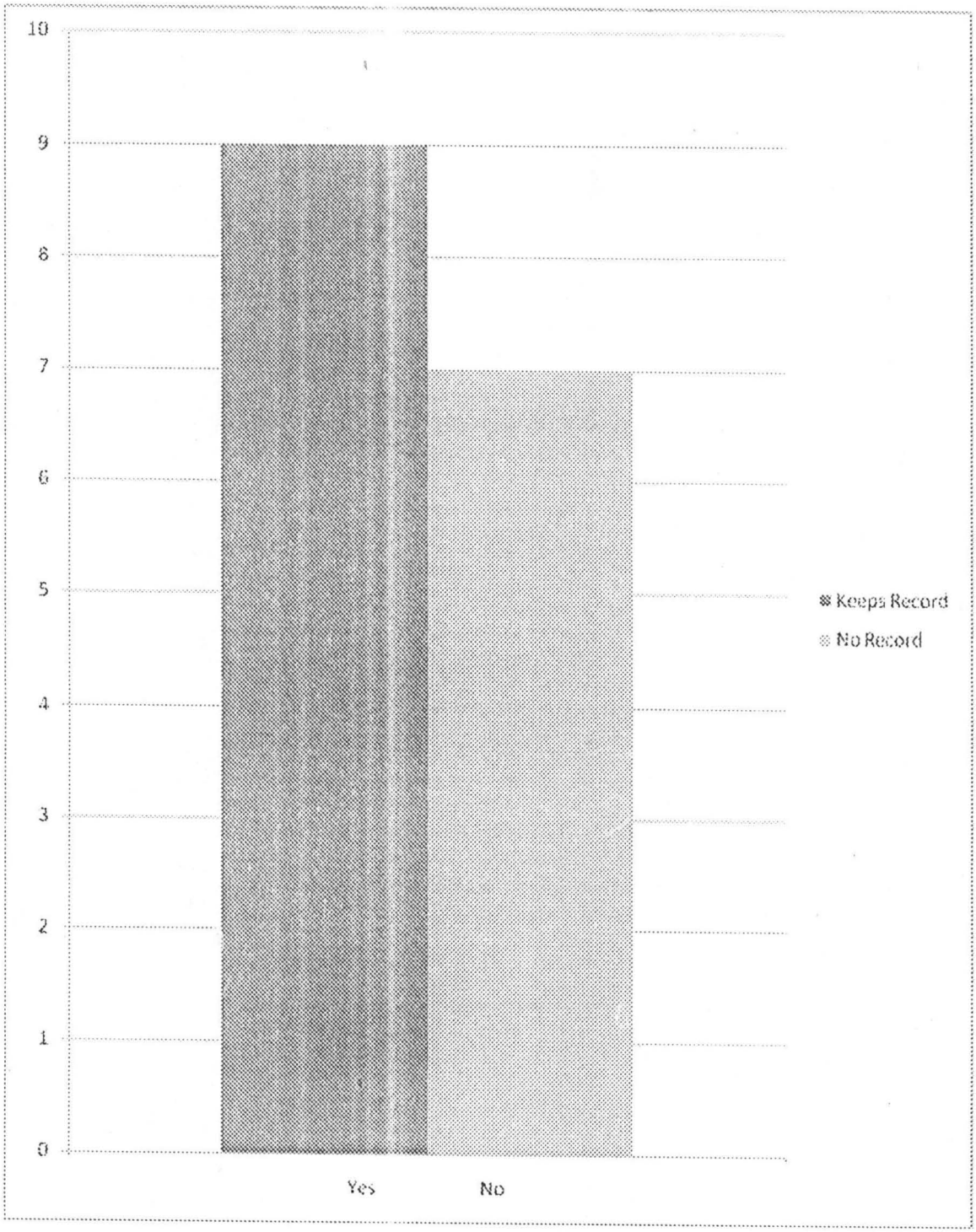

Figure 4.1 Record Keeping Status of Repairs Made to Tractors and Implements

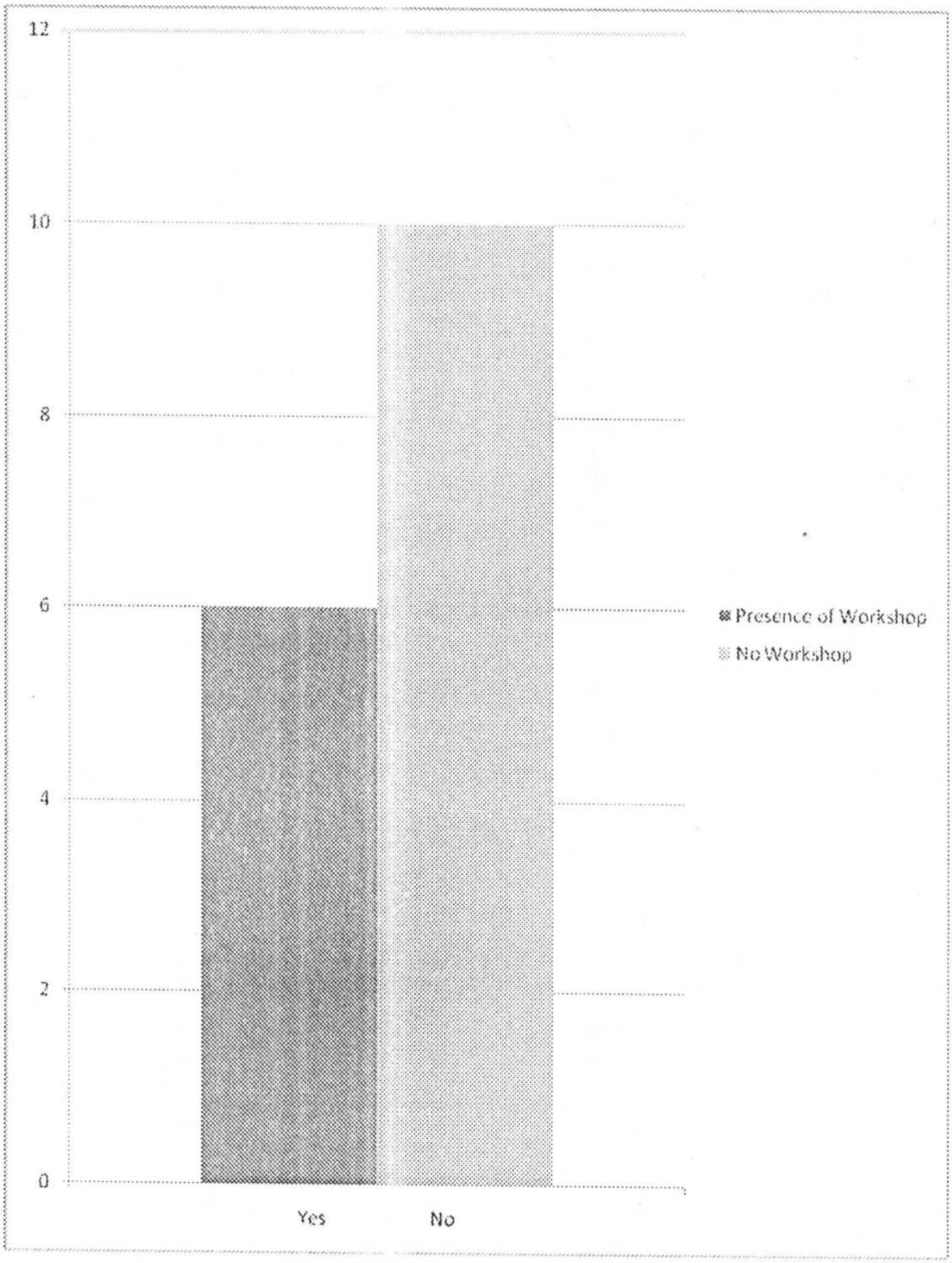

Figure 4.2 Presence of Workshop and Workshop Functionality

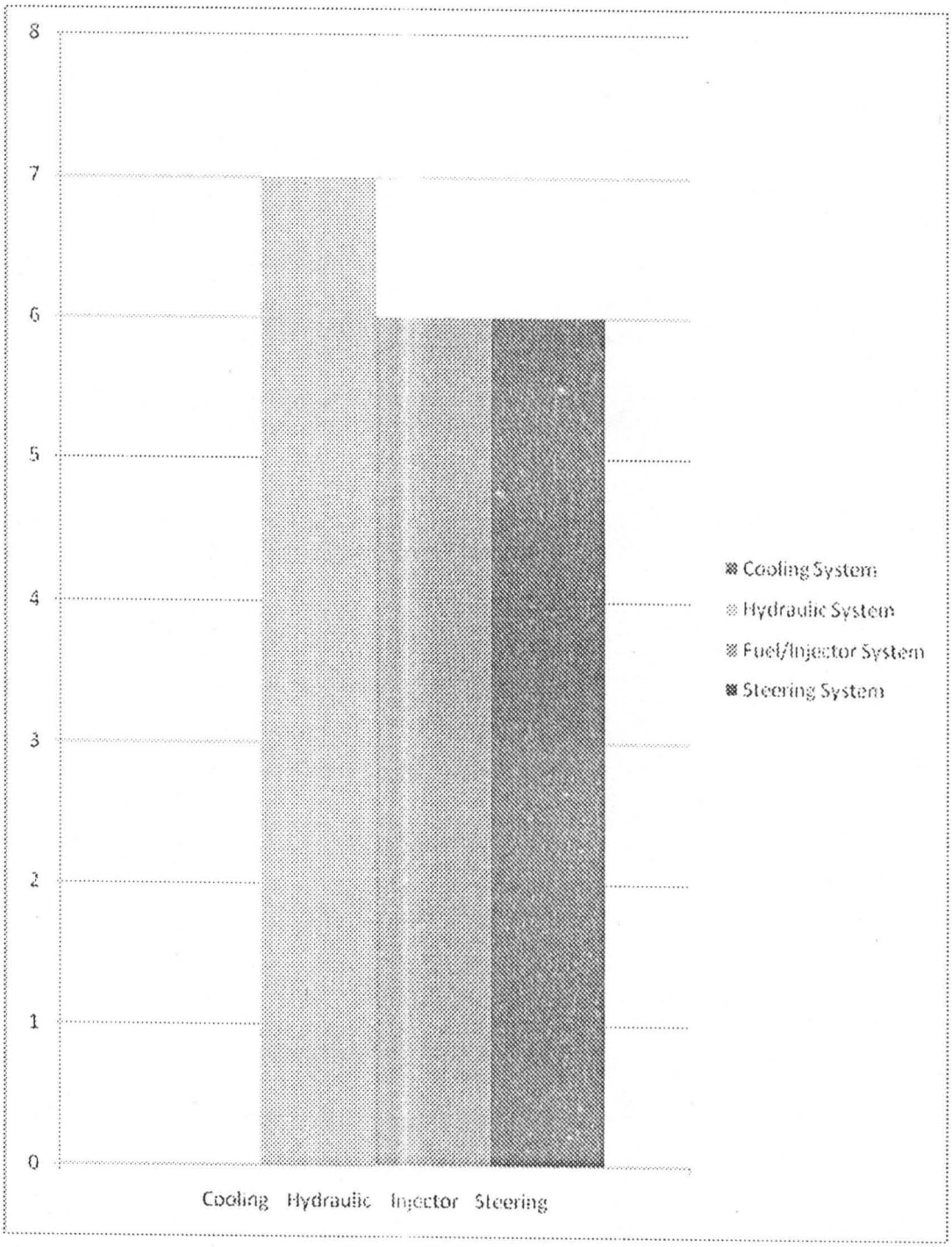

Figure 4.3: Tractor System that Gives Trouble the Most

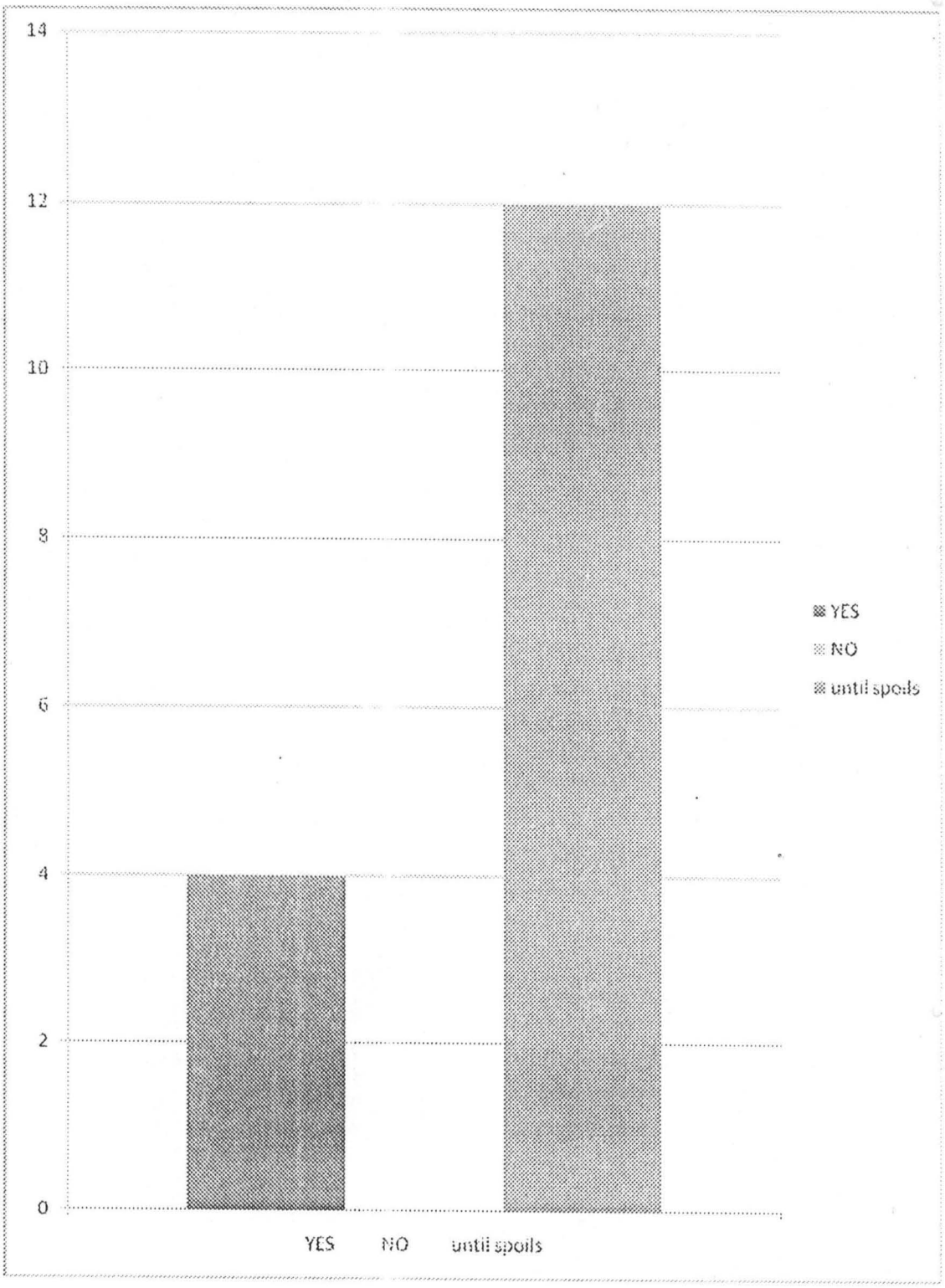

Figure 4.4: Status of Preventive Maintenance on Tractors

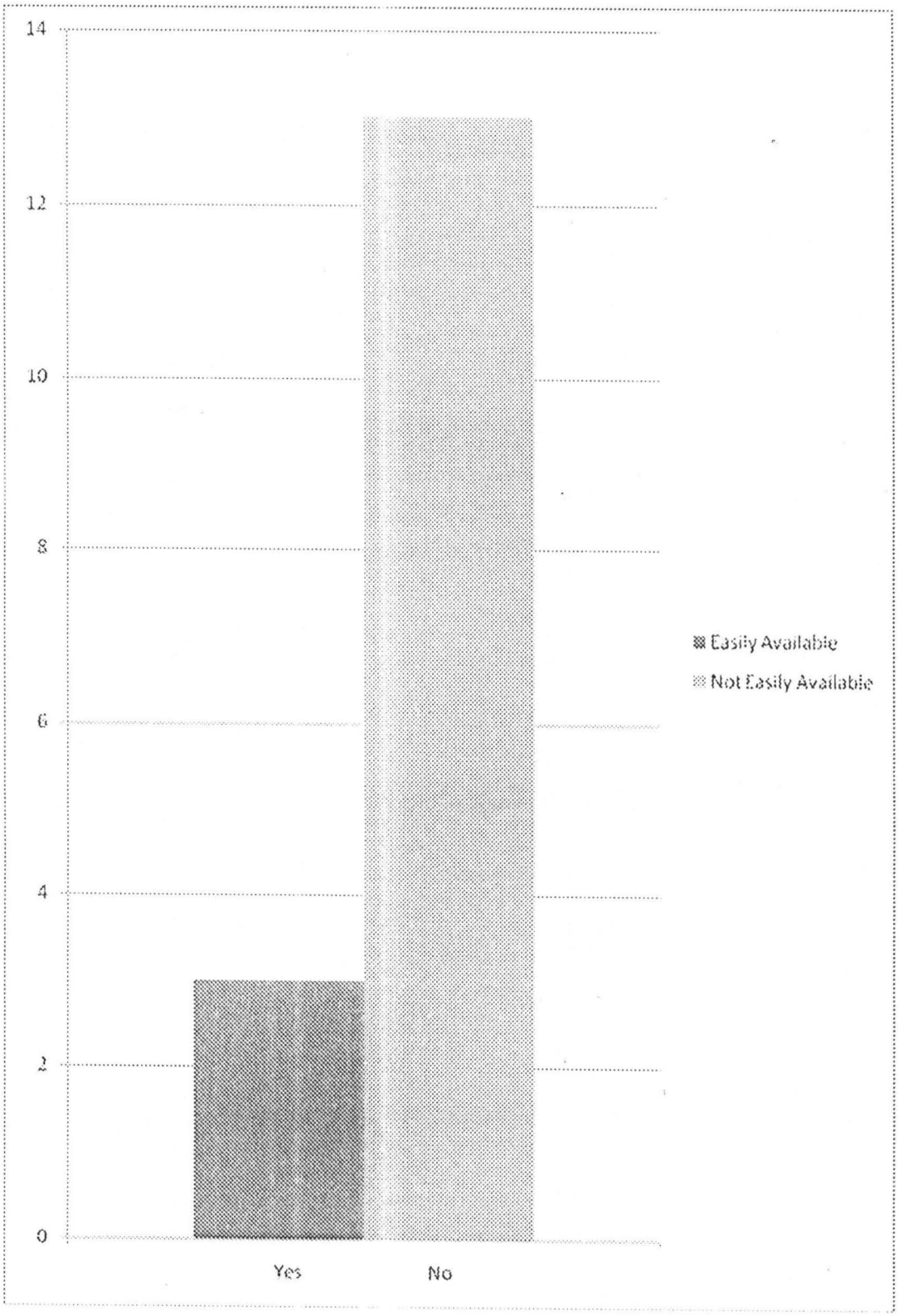

Figure 4.5: State of Availability of Spare Parts

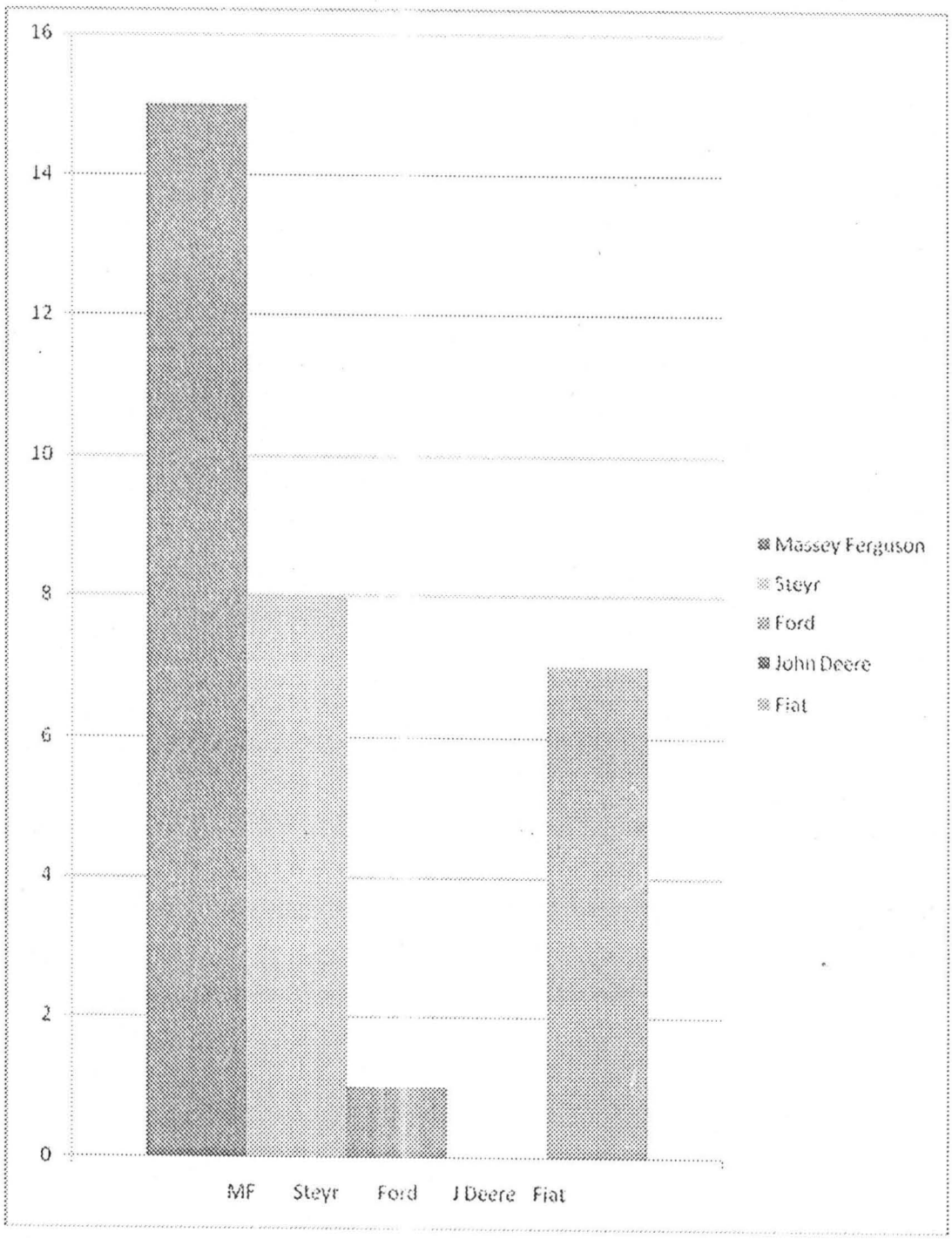

Figure 4.6: Repair Status of Tractors

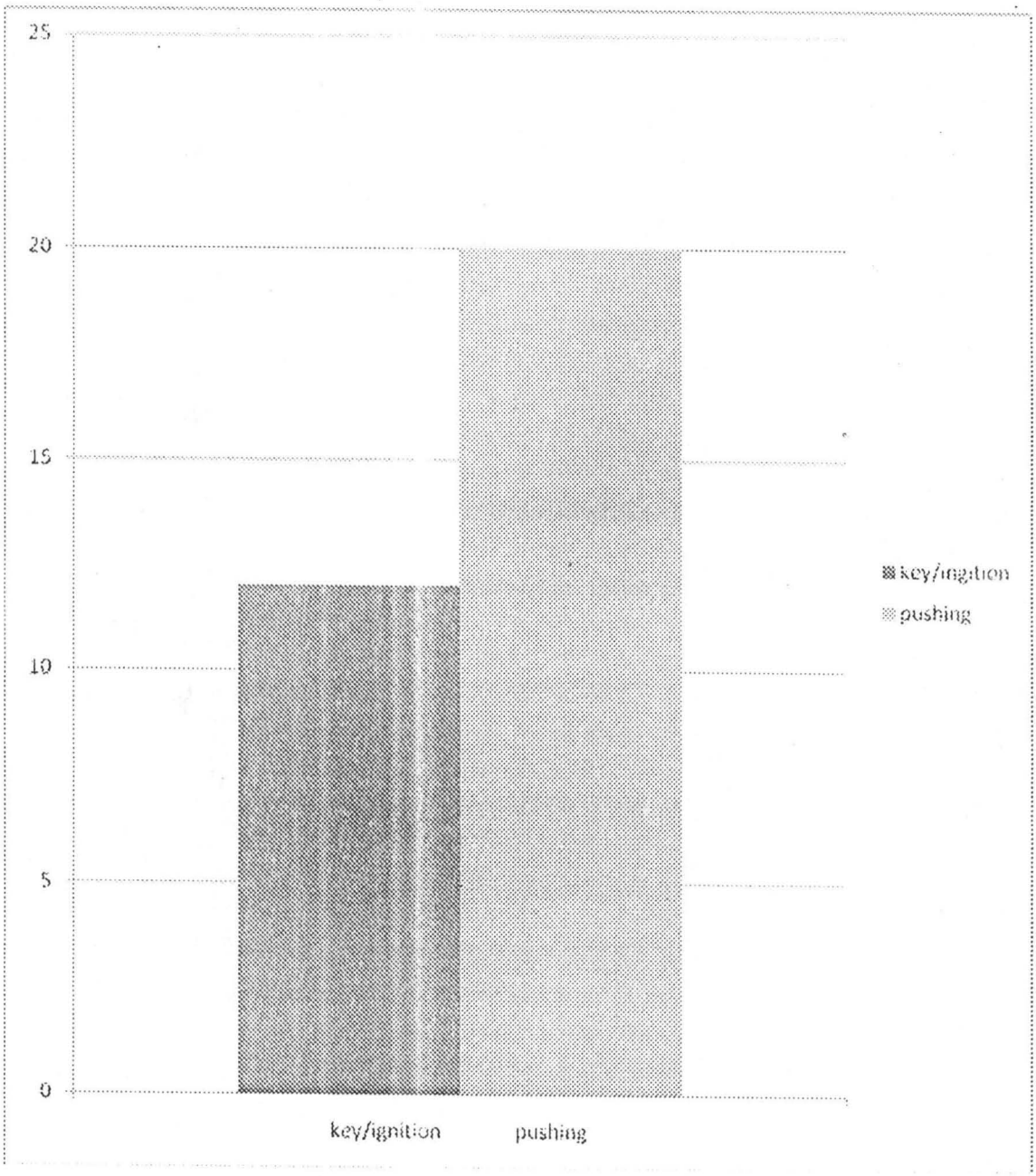

Figure 4.7: Mode of Starting the Tractor in the Morning

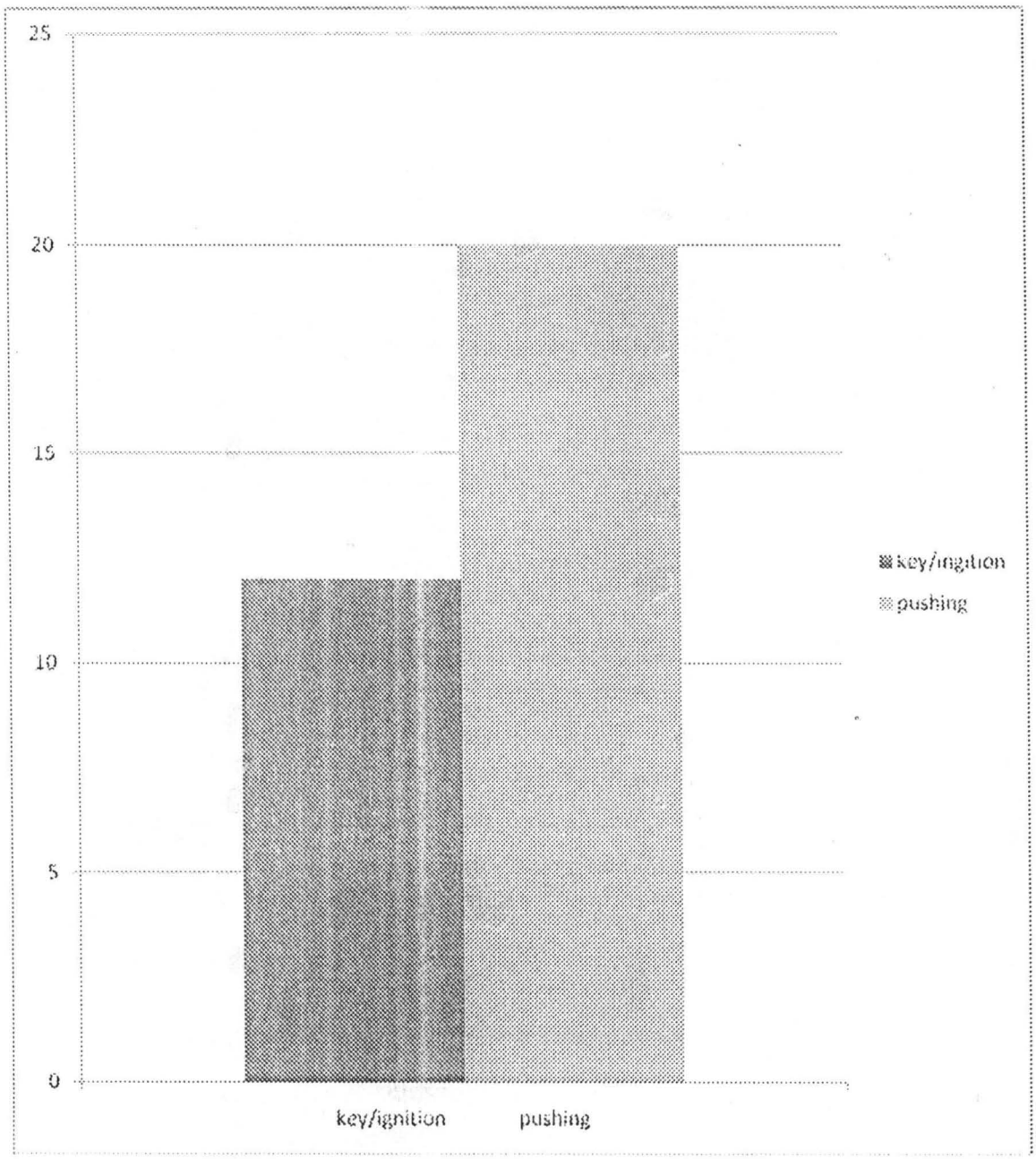

Figure 4.7: Mode of Starting the Tractor in the Morning

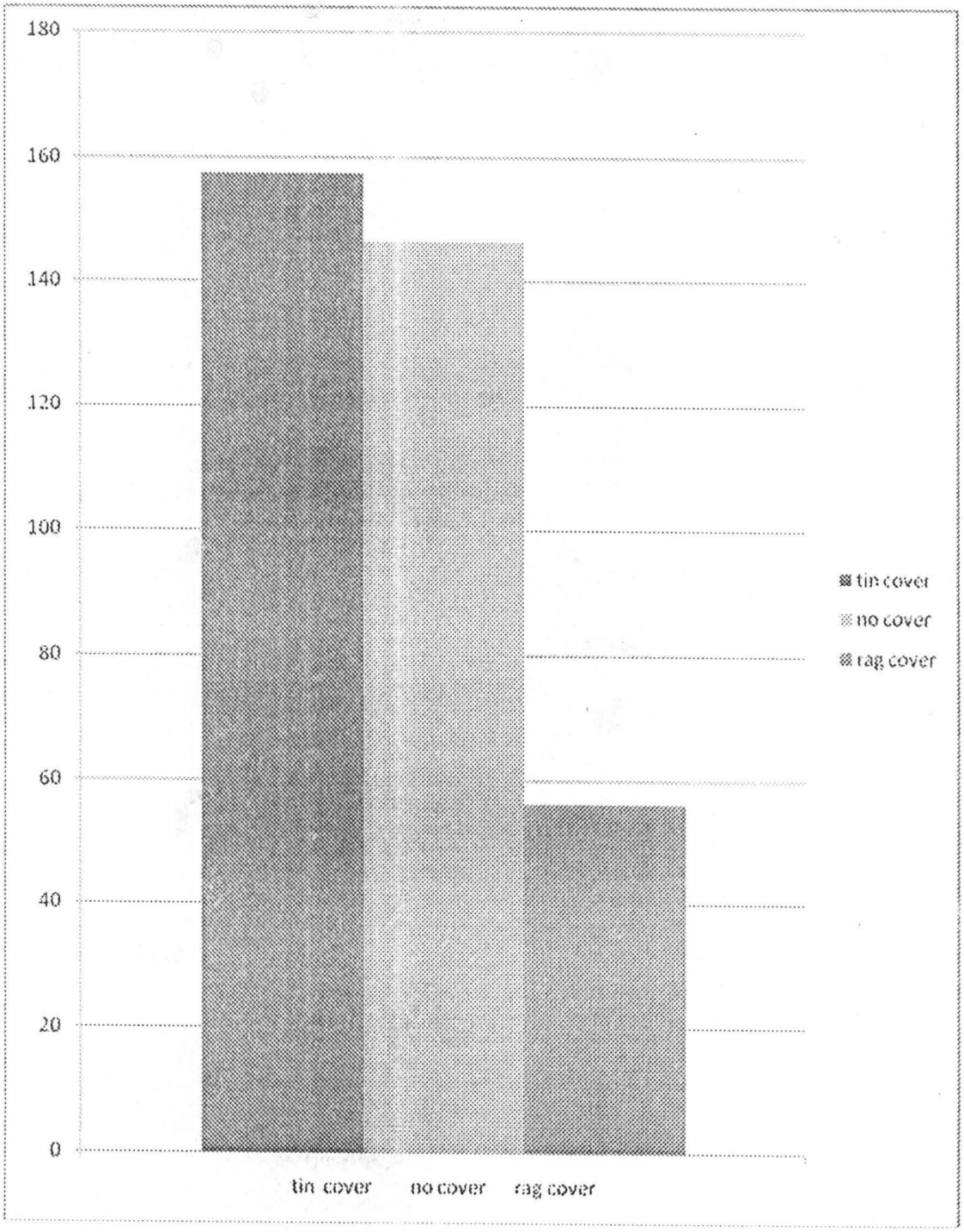

Figure 4.8: Mode of Covering the Exhaust Against Rain

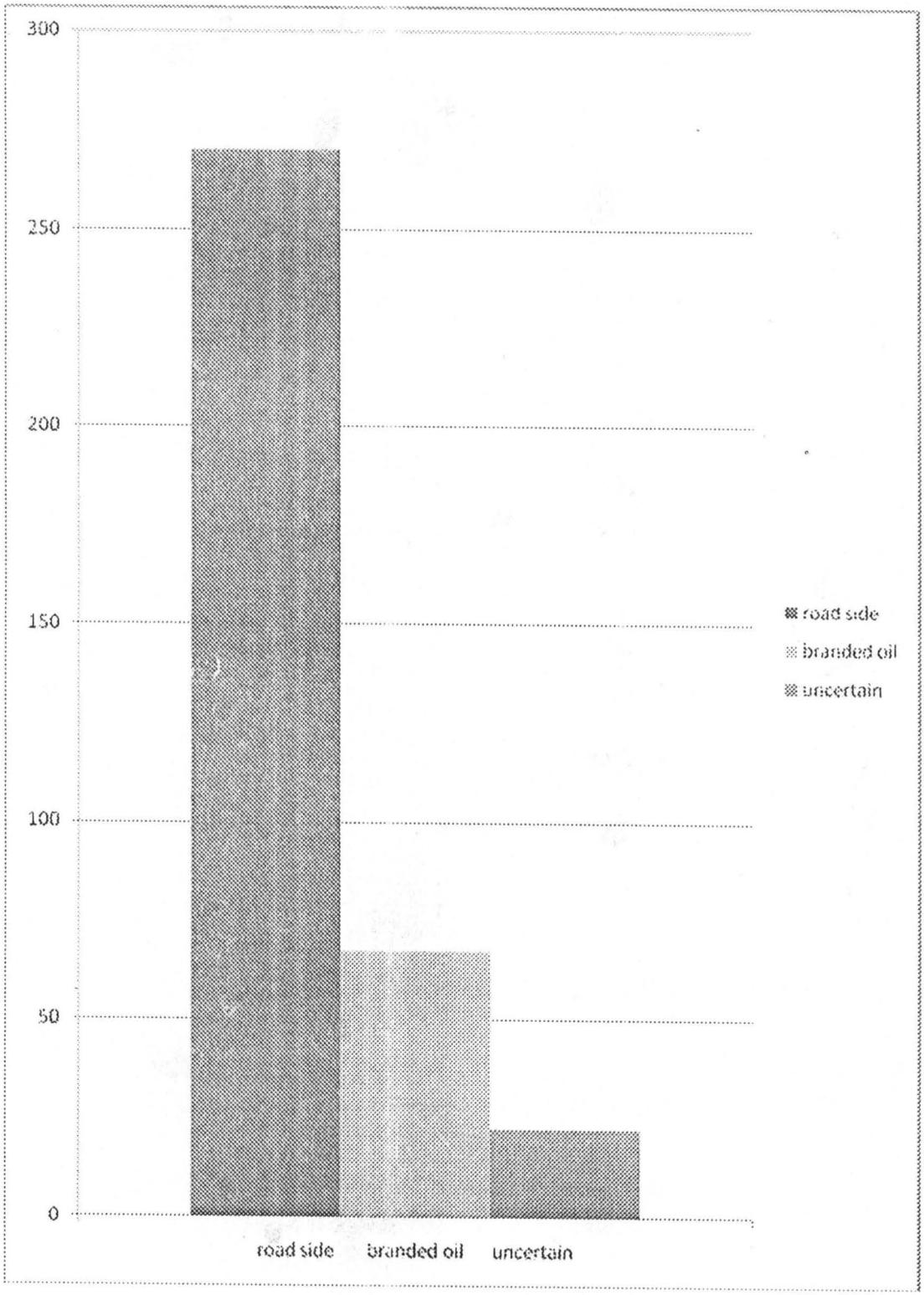

Figure 4.9: Sources of Engine Oil

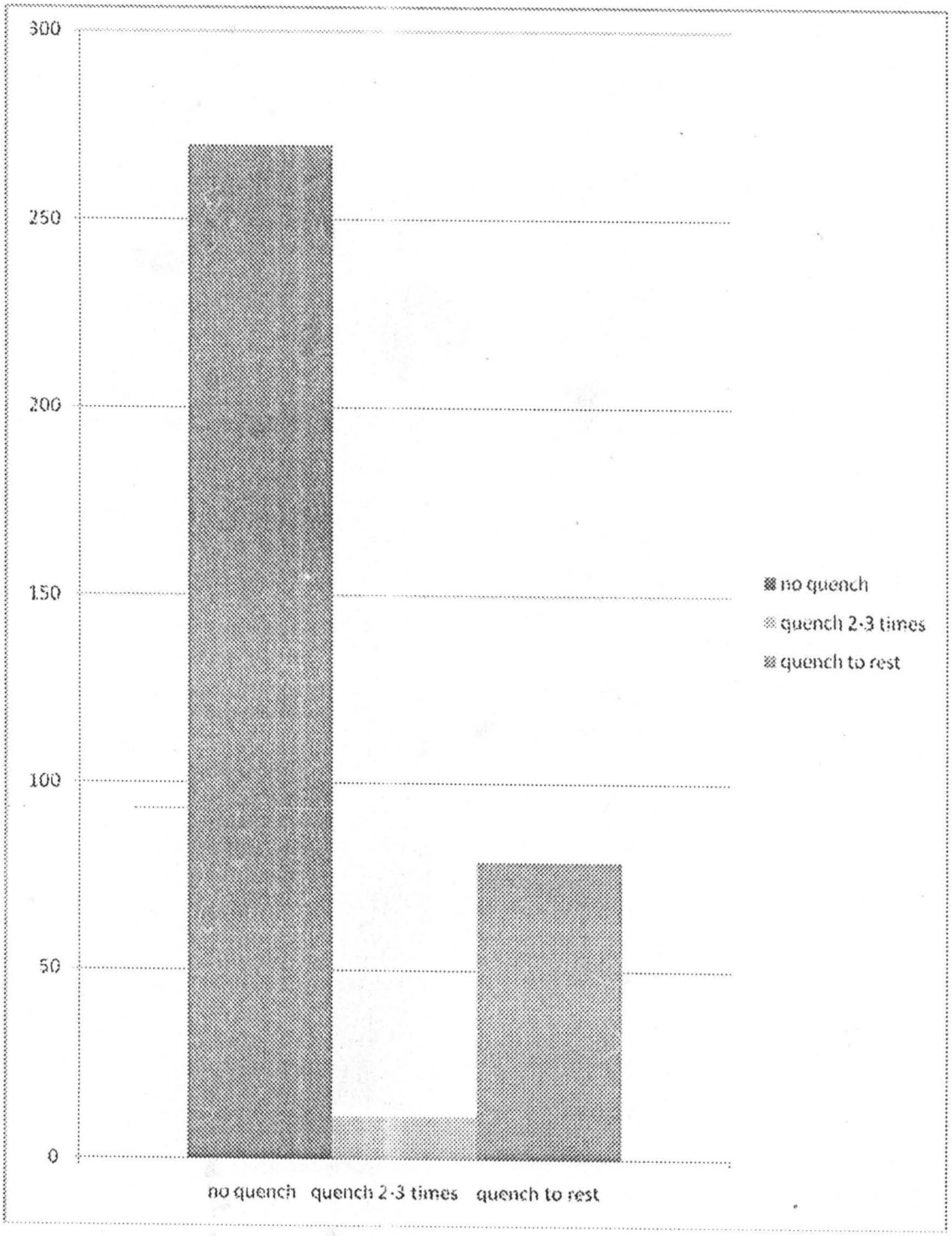

Figure 4.10: The Rate at Which Tractors Goes Off While Working on the Field

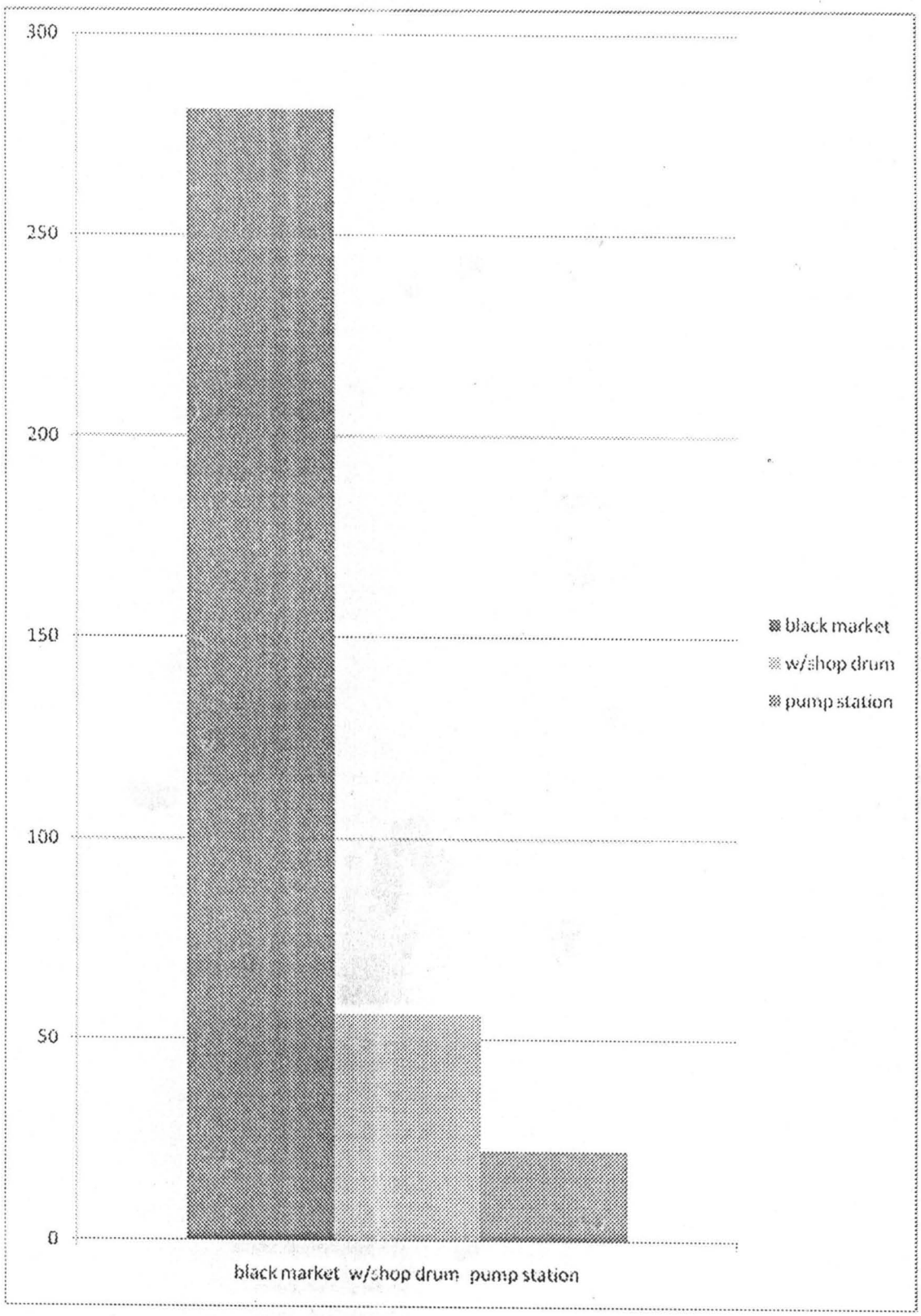

Figure 4.11: Re-fueling Tractor with Diesel Fuel

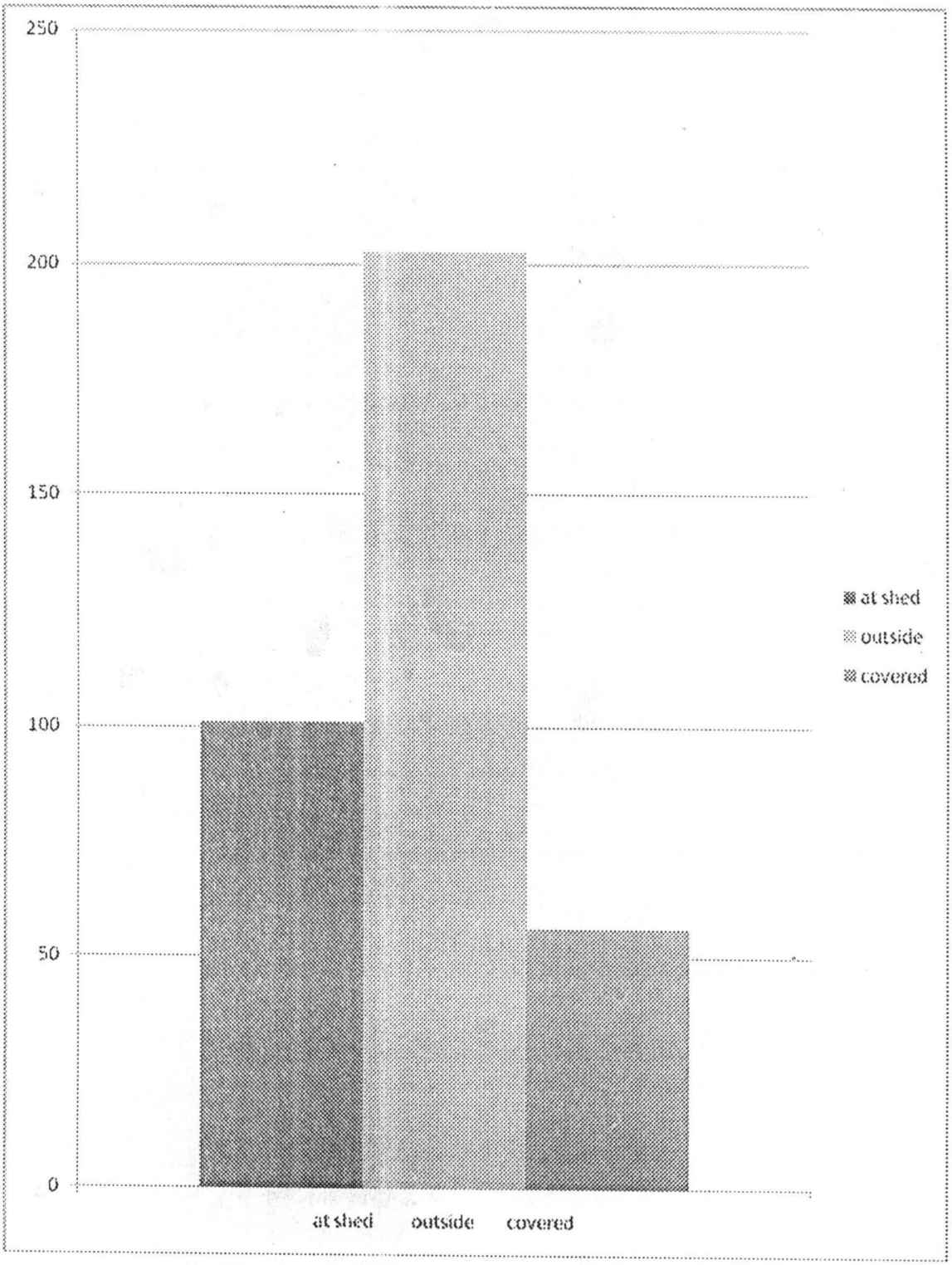

Figure 4.12: Tractor and Implement Storage Facility

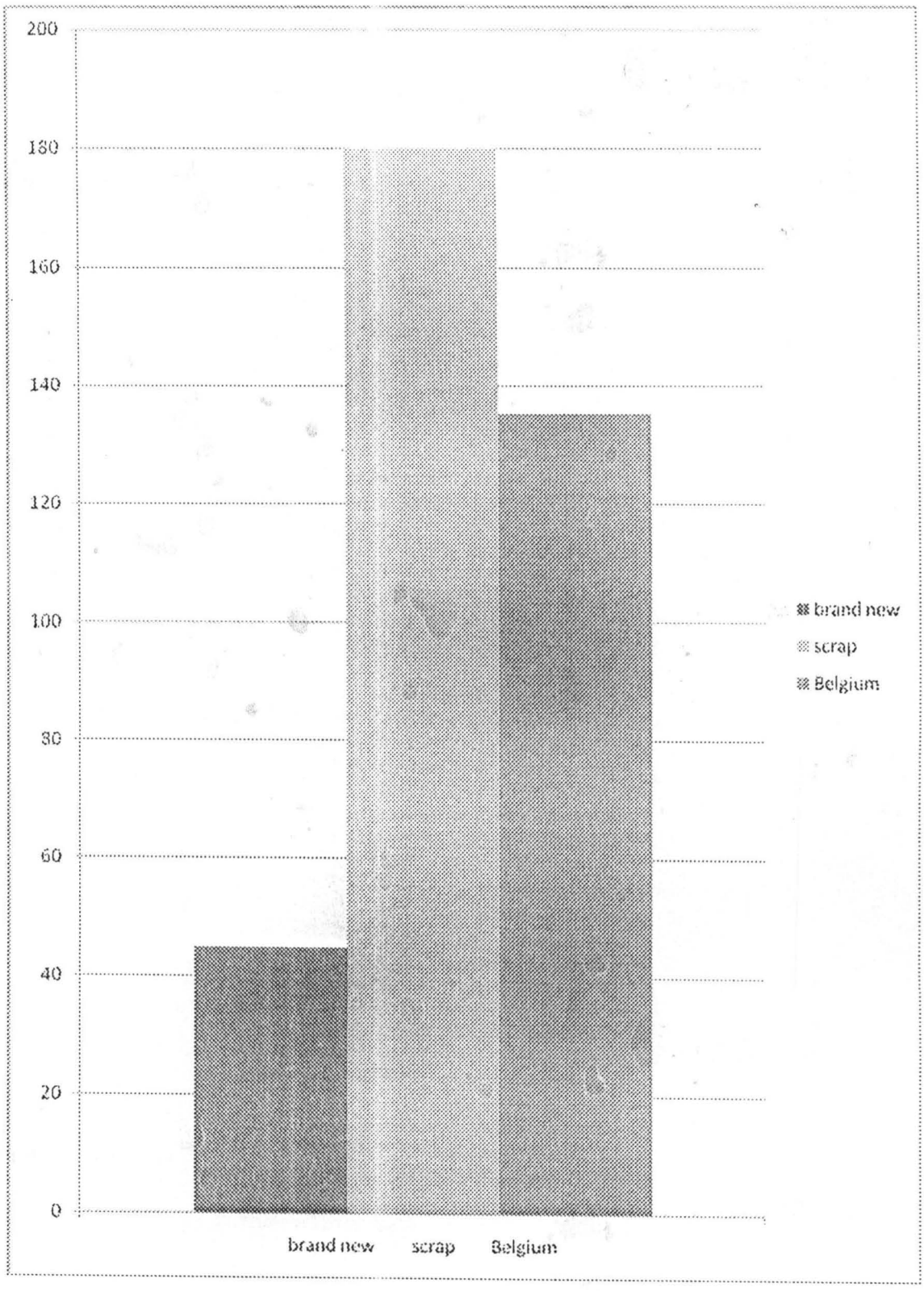

Figure 4.13: Source of Spare Parts

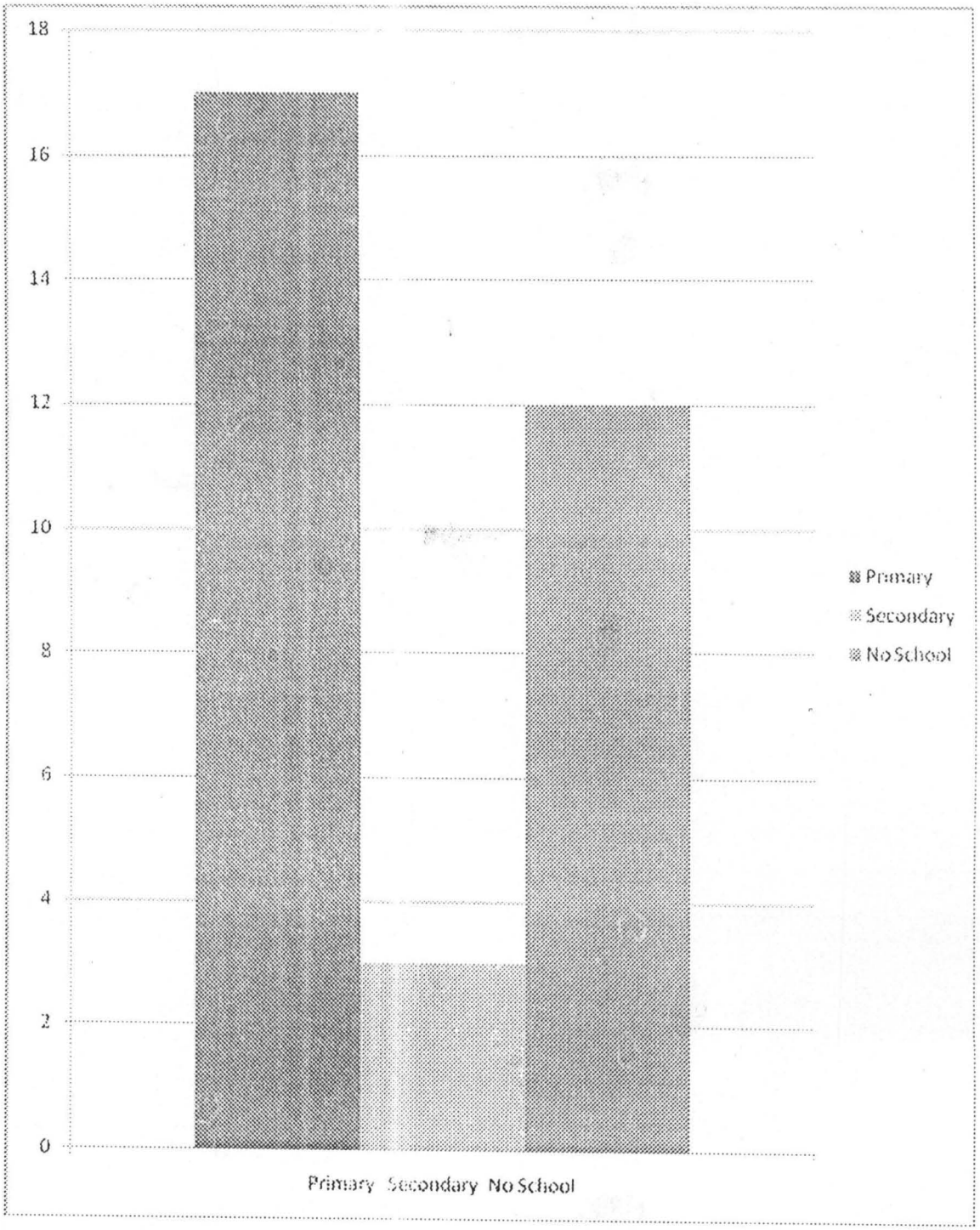

Figure 4.14: Educational Qualification of Tractor Operators

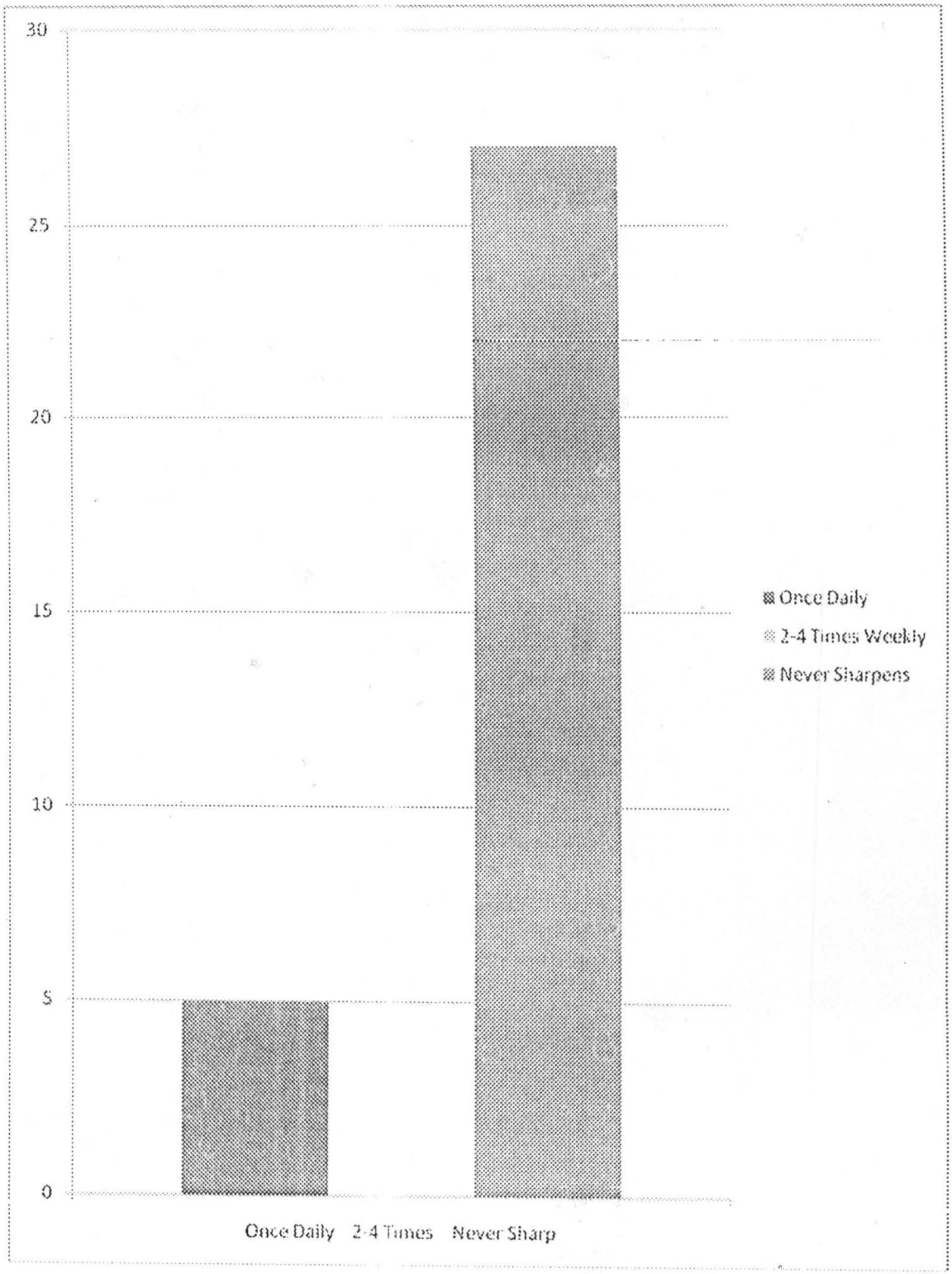

Figure 4.15: Frequency of Sharpening Implements (Plough)

CHAPTER FIVE

5.0 CONLUSION AND RECOMMENDATION.

5.1 CONCLUSION.

The problem militating against effective tractor and implement maintenance in all the agricultural set-ups that utilizes tractors in Abuja have been exposed. Basically, the issues bother around lack of planned and preventive maintenance, lack of workshop and workshop facilities, which is made worst by unavailability of spare parts. Lack of repair history of tractors, the sources of both engine oil and diesel fuel and low literacy level of the operators.

It must be emphasized that tractor and implement cannot last long, so long as maintenance is not taken seriously even if made of good materials and with best of designs.

5.2 RECOMMENDATIONS.

5.2.1 RECORDS.

All manufacturers provide a handbook giving detailed instructions on such matters as adjustment, greasing, changing lubrication oil, correct grade of oil for various parts of the tractors and so on. The handbook is probably the most important part of the tractor's tool- kit and the instructions contained in it should be carried out as thoroughly as possible.

In the same vein, records of all breakdown, repairs and adjustment should be recorded in a book or alternatively a record of maintenance chart must be kept for each tractor.

5.2.2 WORKSHOP AND WORKSHOP FUNATIONALITIES.

During the course of the survey (study), it was understood that the F.C.T. Agric. Central workshop was meant to serve as a central service centre for all the agricultural tractors and machineries of all the area councils in Abuja. This is encouraging.

It is important to expand and provide all the necessary tools and equipment for servicing tractors and agricultural machineries.

The tractor manufacturers and their dealers should be contacted to supply spare parts at affordable prices to the centre.

The personnel and engineers capacity should be developed. More technical training to apprentices and mechanics, etc.

The centre should be opened to outside private farmers to bring their tractors for on-ward repairs when the need arise. This will go a long way in ameliorating the tractor problem in Abuja and also expand the activities of the staff as more revenue will accrue to the centre.

5.2.3 PREVENTIVE MAINTENANCE.

The best guide to preventive maintenance is strict adherence to operational manuals, which will specify the specific schedule recommended for the particular type and make of tractor.

As a broad guideline the following maintenance intervals already in operational manuals should be complied with strictly.

Every Ten (10) Working Hours: Oil level in sump (crankcase) and air cleaner, water level in the radiator and batteries and tractor tyre pressure should be checked before the tractor is put to work. Under dusty conditions, air cleaner oil should be changed frequently.

Every 50 Working Hours: It is necessary to check fan belt tension, oil level in the transmission system and tightness of the battery and motor terminals. Water trapped in the fuel filter should also be drained. Faulty plugs should be cleaned.

Every 120 Working Hours: Engine oil should be changed and replaceable type filters should also be changes. As far as possible all grease points should be lubricated.

Every 750 Working Hours: Transmission oil should be changed. Oil level in other places like fuel injection pump housing and steering worm and sector housing should also be changed.

Once a Year: Front and rear wheel axle bearings may be washed and repacked. Radiator and complete air cleaner unit should be drained, cleaned, flushed and refill, valve spring and tapper clearance should be examined and checked. Clearance on other parts must be checked and corrected at least once a year.

5.2.4 SPARE PARTS.

Tractors and implements often meet accidents or undergo breakdowns, during operations. Adequate measures must be taken to avoid accidents and prevent breakdown not to have down times for the machines. In order to help this farmers

particularly those living and using these machineries in remote areas, the government must make mandatory on the part of the dealers to stock sufficient spare part for immediate repairs if the need arises.

Breakdowns during the working season should be avoided by making repairs during the idle period. Repairs on the tractor should not be delayed until many parts are badly worn, thereby necessitating a costly repairs operation.

As far as possible, the spare parts should be stored in advance to avoid delay in repairing of breakdowns during the operating season. Bottle necks and corruption on the part of those in-charge of government policies , subsidy on importation of agricultural equipments, spare parts of farm machinery etc must be reviewed by government in other to encourage farmers.

The tractor driver is assisted and encouraged to attend regularly to maintenance ,if he is provided with a log-book in which changes of lubricating oil and dates of the various other types of servicing are regularly recorded. Such a log-book, if properly kept permit a check on fuel and oil consumption and makes it easy to see at any time whether the tractor is due to be serviced or not.

The electronic information sensing, display and storage equipment provided on some modern tractors can yield substantial assistance to drivers and managers in carrying out needed routine maintenance procedure.

If the above mentioned are to be observed by a low literate driver, he will definitely need some special training in the art of maintenance for him to cope with all these challenges. So, training and more training for the tractor operators.

5.2.5 SOURCE OF BOTH ENGINE OIL AND FUEL (DIESEL).

The removal of heat generated due to rubbing of components moving in contact with each other is essential to protect them from over-heating and other serious damages. That is the function of lubricating oil or engine oil.

I strongly recommend the branded type of oil obtainable in filling stations.

The engine oil should be of high quality to give longer engine life. And it is difficult to judge the quality of an engine oil from its appearance, it is always better to select oil according to the manufacturers recommendation. Lubricating oil are classified according to their viscosity which gives a measure of their flow at various temperatures. The classification is based on a numbering system adopted by the US Society of Automotive Engineers (SAE). The numbering system for oils is such that SAE 10, SAE 20,SAE 30 and SAE 40 generally denote engine oils. Higher numbers like SAE 50,70,90,140 denote gear and transmission oils.

In view of all these standards, it is advisable that the operational manuals should be strictly followed on the specifications.

Similarly, fuel are also obtain mostly from black marketers, the purity of which is doubtful and adulteration is the commonest occurrence with such fuels.

So only fuel obtained from pump stations should be used. Where the fuel from filling station is not accessible due to the remote nature of most farms visited in Abuja, clean filter (clean cloth) should be employed when pouring fuel into the tractor fuel tank. This will go a long way in removing the solid particles that may likely block the fuel lines leading to injector nozzles.

APPENDIX 1: LETTER OF INTRODUCTION

Department of Agricultural and
Bio-resources Engineering,

Federal University of Technology,

Minna,

Niger state.

Dear Sir,----------

ASSESSING FARM TRACTOR & IMPLEMENT MAINTENANCE CULTURE IN F.C.T. ABUJA.

Please, here-attached are questionnaires designed to aid BELLO ABDUL SALEH, a student of the above address school in carrying out a survey on the above project topic. The questionnaires are in three categories namely; Tractor Operator, Tractor Mechanic and H.O.D/Engineers/Farm Managers.

The responses received from the questionnaire will help in the analyses of the thesis which is a pre-requisite to awarding PGD certificate.

This is purely for academic purposes as all information will be treated in confidence.

Thanks for your co-operations.

BELLO ABDUL SALEH.

APPENDIX 2A:
QUESTIONNAIRE A
(ENGINEERS, FARM MANAGERS AND H.O.D)

RESEARCH TITTLE: ASSESSING FARM TRACTOR & IMPLEMENT MAINTENANCE CULTURE IN F.C.T ABUJA.

Dear Respondents,

It has been observed that every technological development usually has it's effect. The operation and maintenance of farm tractor and implements has been registering some kind of concerns and has been a subject of discussions within academic and professional cycles because of it's tremendous effect on the nation's economy.

The investing capacity of farmers is too poor to buy a tractor and tractor-drawn implements. The tractors in the country are inadequate in number to meet the need of millions of farmers. The few available tractors in the country are mostly owned by government and the managers or operators pay little attention to the maintenance of these tractors and implements. They are carried out only when they breakdown. This is the case today with many organizations.

As a result, tractor and implements inevitably breakdown long before their service life and these constitutes technical regression in the face of food shortage and the clamour for tractorization of our farming operations.

In view of these, research studies have been deemed necessary to establish the efficiency of maintenance culture, the causes of tractor and implements breakdown and invariably the cost to the Nigerian economy.

Therefore, we would like you to help in sharing your experience with us by answering the following questions. Your anonymous responses will help in the analysis of this study aimed at achieving safe maintenance management of farm tractor and implements.

Please, give sincere response for it shall be treated in confidence as every minutes spared in answering the questions is appreciated. Thanks for your cooperation.

SECTION A

BACKGROUND INFORMATION

Please tick the box that corresponds with your own response.

1. Location: Name of establishment/farm.....
   Area council:.....

2. Sex of the respondent? (a) Male ☐ (b) Female ☐

3. Age of respondent ? (a) under 20 years ☐ (b) B/w 21 & 30 years ☐ (c) B/w 31 and above ☐

4. Status/Post of the respondent? (a) Manager/ H.O.D ☐ (b) Engineer/Technician ☐ (c) Supervisor/Foreman ☐

5. *Educational qualification of the respondent?*

   (a) GCE/SSCE holder ☐ (b) Nat. Diploma/NCE ☐ (c) Degree/HND ☐

6. Years of working experience of respondent ?

   (a) 1 year ☐ (b) 1 to 5 years ☐ (c) 6 to 10 years ☐ (d) over 10 years ☐

7. Years of working experience of the tractor operator?

   (a) less than 1 year ☐ (b) Between 1 to 5 years ☐ (c) Between 6 to 10 years ☐ (d) Over 10 years ☐

RESEARCHER; Bello Abdul Saleh (Pgd)
Department of Agricultural and Bio-Resource Engineering.
Federal University of Technology, Minna, Niger state.

APPENDIX 2B
QUESTIONNAIRE B
SECTION A: (TRACTOR MECHANIC)

ESEARCH TITTLE: ASSESSING FARM TRACTOR & IMPLEMENT MAINTENANCE CULTURE IN F.C.T ABUJA.

ear Respondents,
he way people dey take care and maintain tractor and implements don dey give concern so te e don become something ey worry government and acada people for school.

Ve know say our farmers dey poor amd no dey fit buy tractor with their money. The tractors wey dey for we country na overnment dey buy am and the people wey dey handle this tractor no dey put mind to maintain am, sometimes sef until is tractor spoil before they carry am go mechanic.

Ja because of this habit, tractors no dey last as e dey spoil quick quick. And all this things dey happen when food no dey or we country and our government dey try make all the farmers dey use tractors instead of hand for farm work.

o ,we go like make you help us share the thing weh you know and give us answer for all these questions wey go help us now where the problem been dey.

ou must know say all the answers wey you give na for school work only.

BACKGROUND INFORMATION.

lease pick and tick for the box wey you choose

. Location : Name of establishment/farm:.....

Area council: .....

. Wetin be your age? (a) under 20 years ☐ (b) Between 21 and 30 years ☐ (c) Between 31 years ☐ zabove

. Wetin you be for workplace?

(a) Tractor operator ☐ (b) Mechanic ☐ (c) Tractor operator/mechanic ☐

. Wetin be the school wey you go? (a) Primary school ☐ (b) Secondary school ☐ (c) I no go ☐ chool

5. How many years wey you don dey work?

(a) Less than 1 year ☐ (b) 1 to 5 years ☐ (c) 6 to 10 years ☐ (d) over 10 years ☐

SECTION B: (MAINTENANCE PRINCIPLES)

6. Which kind of tractor(s) you dey repair for your workplace?

(a) Massey ferguson MF ☐ (b) Steyr ☐ (c) Ford ☐ (d) John Deere ☐

(e) Fiat ☐ (f) other types of tractor ☐

7. The spare parts of the tractor wey you dey repair,whether e dey easy to get for town weh you dey

(a) Yes ☐ (b) No ☐

8. E get any time wey you no fit repair any tractor wey spoil because you no get the parts? Name the part.

(a) Yes ☐ (b) No ☐

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Federal University of Technology, Minna, Niger state.

(f) Other product

APPENDIX $2C_1$

QUESTIONNAIRE C_1

SECTION A: (TRACTOR OPERATORS)

RESEARCH TITTLE: ASSESSING FARM TRACTOR & IMPLEMENT MAINTENANCE CULTURE IN F.C.T ABUJA.

Dear Respondents,

The way people dey take care and maintain tractor and implements don dey give concern so te e don become something wey worry government and acada people for school.

We know say our farmers dey poor amd no dey fit buy tractor with their money. The tractors wey dey for we country na government dey buy am and the people wey dey handle this tractor no dey put mind to maintain am, sometimes sef until this tractor spoil before they carry am go mechanic.

Na because of this habit, tractors no dey last as e dey spoil quick quick. And all this things dey happen when food no dey for we country and our government dey try make all the farmers dey use tractors instead of hand for farm work.
So ,we go like make you help us share the thing weh you know and give us answer for all these questions wey go help us know where the problem been dey.

You must know say all the answers wey you give na for school work only.

BACKGROUND INFORMATION.

Please pick and tick for the box wey you choose

1. Location: Name of establishment/farm:.....
   Area council:.....
2. Wetin be your age? (a) Under 20 years ☐ (b) Between 21 and 30 years ☐ (c) Between 31 and above ☐
3. Wetin you be for work ? (a) Tractor operator ☐ (b) Mechanic ☐ (c) operator/mechanic ☐
4. Which certificate you get for the school wey you go?
   (a) Primary school ☐ (b) Secondary school ☐ (c) I no go school ☐
5. How many years wey you don they work?
   (a) Lessthan 1 year ☐ (b) 1 to 5 years ☐ (c) 6 to 10 years ☐ (d) Over 10 years ☐

SECTION B: (MAINTENANCE PRINCIPLES)

6. Select the type of tractor wey you dey drive for your workplace?
   (a) Massey ferguson MF ☐ (B) Steyr ☐ (c) Ford ☐ (d) John Deere ☐
   (e) Fiat ☐ (f) Other products ☐
7. Na how you dey start the tractor for morning (a) We dey push the tractor ☐ (b) I dey use key for ignition ☐
9. When rain don start to dey fall,how you dey do with the exhaust,. Whether You dey for field dey work or you park (a) I dey cover the exhaust with tin ☐ (b) I no dey cover the exhaust ☐ (c) I dey use rag to tie am ☐
10. For morning, I wan know whether the tractor dey hard to start ? (a) Yes ☐ (b) No ☐

RESEARCHER; Bello Abdul Saleh (Pgd)
Department of Agricultural and Bio-Resource Engineering.
Federal University of Technology, Minna, Niger state.

(f) Other product

APPENDIX $2C_2$

QUESTIONNAIRE C_2

SECTION A: (TRACTOR OPERATORS)

RESEARCH TITTLE: ASSESSING FARM TRACTOR & IMPLEMENT MAINTENANCE CULTURE IN F.C.T ABUJA.

Dear Respondents,

The way people dey take care and maintain tractor and implements don dey give concern so te e don become something wey worry government and acada people for school.

We know say our farmers dey poor amd no dey fit buy tractor with their money. The tractors wey dey for we country na government dey buy am and the people wey dey handle this tractor no dey put mind to maintain am, sometimes sef until this tractor spoil before they carry am go mechanic.

Na because of this habit, tractors no dey last as e dey spoil quick quick. And all this things dey happen when food no dey for we country and our government dey try make all the farmers dey use tractors instead of hand for farm work.

So ,we go like make you help us share the thing weh you know and give us answer for all these questions wey go help us know where the problem been dey.

You must know say all the answers wey you give na for school work only.

BACKGROUND INFORMATION.

Please pick and tick for the box wey you choose

1. Location: Name of establishment/farm:.....

   Area council:.....

2. Wetin be your age? (a) Under 20 years ☐ (b) Between 21 and 30 years ☐ (c) Between 31 and above ☐
3. Wetin you be for work ? (a) Tractor operator ☐ (b) Mechanic ☐ (c) operator/mechanic ☐
4. Which certificate you get for the school wey you go?

   (a) Primary school ☐ (b) Secondary school ☐ (c) I no go school ☐
5. How many years wey you don they work?

   (a) Lessthan 1 year ☐ (b) 1 to 5 years ☐ (c) 6 to 10 years ☐ (d) Over 10 years ☐

SECTION B: (MAINTENANCE PRINCIPLES)

6. Select the type of tractor wey you dey drive for your workplace?

   (a) Massey ferguson MF ☐ (B) Steyr ☐ (c) Ford ☐ (d) John Deere ☐

   (e) Fiat ☐ (f) Other products ☐
7. Na how you dey start the tractor for morning (a) We dey push the tractor ☐ (b) I dey use key for ignition ☐
9. When rain don start to dey fall,how you dey do with the exhaust,. Whether You dey for field dey work or you park (a) I dey cover the exhaust with tin ☐ (b) I no dey cover the exhaust ☐ (c) I dey use rag to tie am ☐
10. For morning, I wan know whether the tractor dey hard to start ? (a) Yes ☐ (b) No ☐

RESEARCHER; Bello Abdul Saleh (Pgd)
Department of Agricultural and Bio-Resource Engineering.
Federal University of Technology, Minna, Niger state.

APPENDIX 3A
SUMMARY OF QUESTIONNAIRE A
HEAD OF DEPARTMENT /ENGINEER/FARM MANAGER

			Abaji	AMAC	Bwari	G/Lada	Kwali	Kuje	ADP	AEPB	NASC	W/SHOP	S/ H	Efugo	Eden	Kuku	Maishanu	Kwande	Badarawa	Total	Percent %
1	qualification	GCE/SSCE																	✓	1	6.25
		ND/NCE	✓	✓		✓								✓		✓	✓	✓		7	43.75
		HND/B.Sc			✓		✓	✓	✓	✓	✓	✓								8	50
2	work Experience	1 Year																		0	
		1-5 Years			✓															1	6.25
		6-10 Years		✓		✓					✓			✓				✓		5	31.25
		over 10 Years	✓				✓	✓	✓	✓		✓	✓			✓	✓		✓	10	62.5
3	operator work experience	< 1 year																		0	
		1-5 years			✓		✓							✓				✓		4	25
		6-10 years		✓		✓		✓											✓	4	25
		over 10 yrs	✓						✓	✓	✓	✓	✓			✓	✓			8	50
4	tractor ownership	govt.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓							11	68.75
		private												✓	✗	✓	✓	✓	✓	5	31.25
		joint																		0	
5	No.of tractors in estab.	1 only																	✓	1	6.25
		2-4 only	✓			✓	✓	✓			✓			✓		✓	✓	✓		9	56.25
		5-7 only			✓								✓							2	12.5
		over 7		✓					✓	✓		✓								4	25
6	tractor status	no. working	1	5	5	2	3	2	4	4	1	3	5	2		2	3	3	1	55	
		no. not working	2	2	2	1	1	2	4	4	1	2	1	—		2	3	—	—	27	
7	Implements	no. working	2	4	4	1	3	2	3	—	4	3		1		5	2	2	2	38	
		no. not working	2	3	2	1	1	0	1	—	—	3		1		5	2	—	—	21	
8	age of tractor	within shelf life			✓	✓			✓	✓			✓	✓				✓	✓	8	50
		exceed shelf life	✓	✓			✓	✓			✓					✓	✓			7	43.75
9	annual use of tractor & impl.	breakeven																			
		not breakeven																			
10	presence of workshop	yes							✓	✓		✓	✓			✓	✓			6	37.5
		no	✓	✓	✓	✓	✓	✓			✓			✓				✓	✓	10	62.5
11	Grease gun	yes							✓	✓		✓	✓							4	25
		no	✓			✓	✓				✓			✓		✓	✓	✓	✓	9	56.25
12	Tyre gauging equip.	yes							✓	✓		✓	✓							4	25
		no	✓			✓	✓				✓			✓		✓	✓	✓	✓	9	56.5
13	Records keeeping	yes	✓	✓	✓			✓	✓			✓	✓			✓	✓			9	56.5
		no				✓	✓			✓	✓			✓				✓	✓	7	31.25
14	Tractor sys./most trouble	cooling sys.																		0	
		hydraulic sys.	✓				✓		✓	✓	✓	✓							✓	7	43.75
		fuel/injector sys.						✓			✓	✓				✓	✓	✓		6	37.5
		steering sys.		✓	✓	✓							✓	✓					✓	6	37.5
15	Tractor make/model	massey ferguson	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓		14	87.5
		steyr	✓		✓						✓	✓								4	25
		ford																		0	
		john deere																		0	
		flat					✓		✓	✓		✓	✓						✓	6	37.5
		other products																			

APPENDIX 3B
SUMMARY OF QUESTIONNAIRE B
TRACTOR MECHANICS

CCV			Abaji	AMAC	Bwari	G/Lada	Kwali	Kuje	ADP	AEPB	NASC	W/SHOP	S/H	Efugo	Eden	Kuku	Maishanu	Kwande	Badarawa	Total .	percent %
1	qualification	primary sch.		✓	✓		✓			✓	✓						✓	✓		7	43.75
		secondary sch.	✓						✓			✓	✓			✓			✓	6	37.5
		no school				✓		✓						✓						3	18.75
2	work experience	1 Year																		0	
		1-5 Years																	✓	1	6.25
		6-10 Years		✓	✓	✓	✓		✓			✓	✓					✓		8	50
		over 10 Years	✓					✓		✓	✓			✓		✓	✓			7	43.75
3	tractor make you repair	massey ferguson	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	15	93.75
		steyr				✓	✓		✓	✓	✓	✓		✓					✓	8	50
		ford																		1	6.25
		john deere																		0	
		fiat	✓					✓	✓		✓	✓	✓						✓	7	43.75
		other products																		0	
		joint																		0	
4	spare part availability	yes												✓		✓	✓			3	18.75
		no	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					✓	✓	13	81.25
5	difficulty in getting parts	yes	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓				✓	✓	13	81.25
		no									✓					✓	✓			3	18.75
6	frequency of air bath cleaning in a season	once only	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓						✓	11	68.75
		2-4 times only									✓			✓				✓		3	18.75
		5-10 times only														✓	✓			2	12.5
7	tractor sys. That gives trouble the most.	cooling sys.																		0	
		hydraulic sys.	✓			✓	✓		✓	✓	✓	✓								7	43.75
		fuel/injector sys.			✓						✓		✓			✓	✓	✓		6	37.5
		steering sys.		✓		✓		✓	✓			✓		✓					✓	7	43.75
8	preventive maintenance	yes	✓										✓			✓	✓			4	25
		no																		0	
		until it spoils		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				✓	✓	12	75
9	200 hrs servicing	2 weeks									✓									1	6.25
		4 weeks	✓	✓	✓			✓	✓	✓			✓	✓		✓	✓	✓	✓	12	75
		6 months				✓	✓					✓								3	18.75
10	Overhaul	yes		✓	✓			✓			✓	✓		✓		✓	✓			8	50
		no	✓			✓	✓		✓	✓			✓					✓	✓	8	50
		yes								✓	✓	✓				✓	✓			5	31.25
		no	✓	✓	✓	✓	✓	✓	✓				✓	✓				✓	✓	11	68.75
		yes									✓					✓	✓			3	18.75
		no	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓				✓	✓	13	81.25
		yes	✓		✓				✓	✓	✓	✓	✓			✓	✓			9	56.25
		no		✓		✓	✓	✓						✓				✓	✓	7	43.75
11		yes	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓				✓	✓	13	81.25
		no									✓					✓	✓			3	18.75

APPENDIX 3C
SUMMARY OF QUESTIONNAIRE C
TRACTOR OPERATORS

CV			Abeji	AMAC	Bwari	G/Lada	Kwali	Kuje	ADP	AEPB	NASC	W/SHOP	S/H	Efugo	Eden	Kuku	Maisharu	Kwande	Badarawa	Total	percentage %
1	qualification	primary sch.																		17	53.125
		secondary sch.																		3	9.375
		no school																		12	37.5
2	work experience	1 Year																		1	3.125
		1-5 Years																		5	15.625
		6-10 Years																		14	43.75
		over 10 Years																		12	37.5
3	tractor make you repair	massey ferguson																		28	87.5
		steyr																		10	31.12
		ford																		2	6.25
		john deere																		0	
		fiat																		5	15.625
		other products																			
		joint																			
4	How tractor is started i:: the morning.	By pushing																		20	62.5
		Key/ignition																		12	37.5
5	Exhaust cover	Tin cover																		14	43.75
		No cover																		13	40.625
		Rag cover																		5	15.625
6	Hard to start in the morning	Yes																		17	53.125
		No																		15	46.875
		engine overheat																		10	31.12
7	what happens during field work?	engine smokes																		8	9.375
		engine chop fuel																		19	59.375
		flood side(drum)																		24	75
8	Source of engine oil	Branded oil(gallon)																		6	18.75
		Uncertain																		2	6.25
9	Time allow for idling	No waiting																		7	21.875
		wait 5 minutes																		25	78.125
	Frequency of quenching while working.	No quench at all.																		7	21.875
		quenches 2 or 3 times																		1	3.125
		quench for rest																		24	75
11	Fuel finishes	Yes																		19	59.375
		No																		12	37.5
12	Bleeding	Bleed myself																		26	81.25
		mechanic bleeds																		6	18.75
13	method of re-filling fuel	pump at station																		2	6.25
		workshop drum																		5	15.625
		Black market																		25	78.125
14	frequency of bleeding	once everyday																			
		2 times daily																			
		once everyweek.																			
15	Tractor system that gives trouble the most.	cooling system																			
		Hydraulic system																			
		Fuel/injector sys.																			
		Steering system.																			
16	Frequency of sharpening implements.(plough and harrow).	once daily																		6	18.75
		2 to 4 times																		15	46.875
		Never sharpens.																		15	46.875
17	Frequency of greasing implements bearing.	All the time.																		3	15.625
		All everyweek																			
		Daily.																			
18	When is implement bearing replaced.	when necessary																		27	84.375
		when it spoils.																		7	21.875
19	implement storage	At shed																		18	56.25
		Outside for sun																		6	18.75
		cover with tarpolin																		2	6.25
20	Sources of spare parts.	Brand new																		28	87.5
		From scrap tractor																		9	28.125
		Belgium part																		18	56.25
21	How do you determine when tractor needs servicing.	every month																		5	15.625
		when due																		4	12.5
		when necessary																		16	50
																				12	37.5
																				9	28.125
																				23	71.875