
# Assessing the Practices and Challenges on Light Vehicle Preventive Maintenance of Ethiopian National Defense Maintenance and Recovery Center

**By**

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**(ID Number: GSR/9758/09)**

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# Approved by Board of Examiner Committee

EXTERNAL EXAMINER

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INTERNAL EXAMINER

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ADVISOR

Name---------- Signature----------Date----------

## Declaration

I kebede Regassa Gerbi declared that the research thesis entitled “Assessing the Practices and Challenges on Light Vehicle Preventive Maintenance: Ethiopian National Defense Maintenance and Recovery Center” contains no material that has been submitted previously in whole or in part for the award of any other academic degree or diploma. I declare that this thesis and the work presented in it is my own and has been generated by me as the result of my own original research.

Researcher Name: Kebede Regassa Gerbi

Signature---------- Date----------

## Certification

This is to certify that Kebede Regassa has carried out this research work on the topic entitled 'Assessing the Practices and challenges of Light Vehicle Preventive Maintenance the Case of the Ministry of Defense Maintenance and Recovery Center' under my supervision that is his own original work and has not been presented to any other university for similar degree award and it can be submitted for partial fulfillment of the requirements for the award of Masters of Art Degree in Logistics and Supply Chain Management.

Shiferaw Mitiku (PhD)

Signature----------

Date----------

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## List of Abbreviations and Acronyms

**ANSI** : American National Standards Institute

**BPR:** Business-processing reengineering

**CBM:** Condition-based Maintenance

**FDRE:** Federal Democratic Republic of Ethiopia

**F-M**: Field Manual

**HIL**: Heeresinst and Ietzungs Logistik

**MoD:** Ministry of Defense

**PFI:** Private Finance Initiative

**PPP**: Public–Private Partnerships

**PMCS**: Preventive Maintenance Checks and Service

**POL**: Petroleum, Oil and Lubricant

**RCM**: Reliability Centered Maintenance

**TBM**: Time Based Maintenance

**TPM:** Total Productive Maintenance

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## Abstract

*This research entitled "The Practices and Challenges of Light Vehicle Preventive Maintenance: the Case of the Ministry of Defense Maintenance and Recovery Center" was conducted to assess the practice and challenges of preventive vehicle maintenace. The major objectives of the study were to assess the practice, competency and challenges of light vehicle maintenance. For the quantitative data, random sampling technique was employed and 245 samples responded to the questionnaire. In addition, purposive sampling was employed for gathering the qualitative data and 15 key informants were used. Both closed ended questionnaire and semi structured interview guideline were used to gather primary data from respondents. Descriptive data analysis; percent, frequency and mean were used to analyse quantitaive data while coding were applied for the qualitative. The findings of the study indicated that in most cases, preventive vehicle maintenance was carried out regularly and checked timely. It also indicates that professionals in the preventive maintenace department were knowledgeable, skillfull and had good attitude, despite with some limitations. Moreover, shortage of skilled man power, scarcity of tools and materials, limited access to trainings, employee turnover and less concern for reward and recognition for employees effort/ achievement was identified as major challenges that hindered the sucess of the light vehicle preventive maintenance department in the National Defense Force. Finally, the researcher recommends, more concern needs to be given for motivating employees, prepare and facilitate tarinings, and provision of tools and materials for vehicle maintenance activity.*



Key words: Vehicles, Practices, Challenges, Preventive, Maintenance

# CHAPTER ONE

## 1 INTRODUCTION

Here under the background, purpose, delimitations and research questions, with the intention to highlight the cause of this work. It is hoped that the reader is presented with the subject and in the end can connect with the conclusions of the work**.**

### 1.1 Background of the Study

According to Moubray (1997) The preventive maintenance tasks mean replacing components or overhauling items at fixed intervals that is, to premature equipment damage and prevent unscheduled downtime that would result in repair or corrective activities. This approach to maintenance management is predominantly recurring or time-driven tasks performed to maintain acceptable levels of availability and reliability. Preventive maintenance is maintenance that is regularly performed on a piece of equipment to lessen the likelihood of it failing. Preventive maintenance is planned so that any required resources are available (Mobley, 2002).

Maintenance in the world has been begun, as humans have always felt the need for the maintenance of their equipment, even the most rudimentary tools. First they would do maintenance only when it was no longer possible to run it. That was called Break down or Reactive maintenance, In1950 some groups of Japans engineers started a new concept in maintenance about the care that should take in the operation and maintenance of the machines and devices (Watkins, 1999).

Modern army divisions are highly equipment intensive, number of vehicles and vehicle types has grown rapidly in the last twenty years for general vehicle types, however, comprise bulk of the army tactical and combat vehicle fleet, tanks, armored personal carrier (Craig, 2000). Most modern army vehicles are far more complicated than their World War II counterparts because of the addition of sophisticated communication equipment fire control computers night vision devices laser range finders and other items the diversity of vehicles has also increased the group of vehicles referred to her simply as “tanks”(Ellinger, Watkins, & Barnas, 1996).

That new trend was called preventive maintenance as a result, plant managers were encouraged to have their supervisors, mechanics, electricians and other specialists, develop programs for lubricating and making key observations to preventive damages of the equipment. It helps to reduce downtime. Preventive maintenance is a schedule of planned maintenance actions aimed at the preventive of break downs and failures (Levitt, 2001). The primary goal of preventive maintenance is to prevent the failure of equipment before it actually occurs. It is designed to preserve and enhance equipment reliability. Preventive maintenance is becoming the most important task of maintenance. It plays a significant role to properly manage and keep the serviceability and technical condition of equipment or vehicle (Nyman, 2001).

The industrial revolution and the mechanization of the Army changed method of transportation and altered the special relation between the soldier and his method of transportation. Overtime the Army has changed, and its methods of transportation now reflect the latest technology. 1When the army first received their motor vehicles, the officers and NCOs tended to assure the vehicles care (Frazee, & Valerie, 1997).

The responsibility to care for the vehicle is performed through a system known as preventive maintenance checks and service (PMCS). This system prescribes a method and routine an individual soldier uses to take care of his vehicle and to assure that it is ready for the next mission. In modern times the military has given the most attention to preventive maintenance as a way to improve reliability. Successful commanders have always understood the importance of what, in today's Army, is called preventive maintenance. Commanders go on to describe the enormous level of effort required to get preventive maintenance to become a regular part of the routine (Levitt, 2009)

Light Vehicle Maintenance and Recovery Centre of the FDRE Ministry of Defense performs support of high mobility of troops, support of vehicle transport techniques, means of service in constant alertness, movement of units and sub-unit from one place to another, delivery of military equipment, foodstuff, ammunition, fuel and evacuation of wounded and sick personnel, and defective or damage materials from area of operation (Ministry of Defense Field Manual Report, 2016).

This study aimed to assess the practices and challenges of vehicle preventive maintenance at the readiness and the accomplishment of motor transport services during supporting the combat

tasks in the Light Vehicle Maintenance and Recovery Centre at Ethiopia Ministry of National Defense Force.

## 1.2 Statement of the Problem

According to Patrick Hogan (2016) when it comes to car accidents causes, many people think of drunk drivers, texting and driving, and bad weather conditions though driver error is the number one cause of car accidents, poorly maintained vehicles also make larger contribution to the national road accident record every year. In other words, Vehicles may become unsafe due to lack of preventive maintains. Furthermore, many car owners do not realize that regular preventive maintenance is less costly than a major auto repair. Small problems get bigger when they are neglected. As a result, motorists face accidents, large repair bills, and poor performance from their vehicle.

To this end, motor vehicle accidents are the number killer of people aged 1-44. Over 2,600 deaths occur each year because of car neglect, and nearly 100,000 disabling injuries happen every year. This means that eleven people are injured every hour and one person dies every three hours (Brian 2010).

Some vehicles may be prone to excessive breakdown requiring expensive repairs, causing the vehicle to be out of service when list expected and possibly when needed the most. In terms of money, the coast is over 2 billion dollars each year due to neglect of preventive maintains. Over 650 million dollars are lost each year in wages. Medical expenses because of these coast another 200 million dollars. Insurance administration costs are almost 500 million a year. The coast of motor vehicle property damage amount nearly 750 million dollars every year. Of all motor vehicle accidents, 5.2% are caused by car neglect (Brian 2010).

Military systems are often operated in extreme and highly variable conditions. As a consequence great preventive maintains are required however hardly recognized (Tinga, 2010).When there is no proper vehicle preventive maintenance and management, the defense mission and day to day army activity cannot be going well, and it affects the country security directly (Baker, 1993). If vehicle maintenance management is weak vehicle operation will not be managed properly and the mission of the national defense will be interrupted. To this end the researcher experienced and observed that there is problem in the application of vehicle preventive maintenance (Oak Brook, 1992). In addition, lack of planned preventive

maintenance, absence of continues training to the members, lack of well-trained and skilled personnel in the area of vehicle preventive maintenance absence of integrated vehicle preventive maintenance and transport department management system were observed (Guet, 2007).

At this time in the Ethiopian National Defense Maintenance and Re-engineering Department report of 2014 to 2016 shows that, more than 271 light vehicle accidents caused by the lack of preventive maintenance which is due to shortage of human power, poor culture of vehicle status reporting, lack of training and absence of motivation are the main problems. Nowadays, within F.D.R.E military structure, the logistics main department is one of the key departments, it plays decisive role during war and peacetime military activities. This main logistics department also has six departments which are Maintenance and Reengineering Department, Transport Department, Finance and Administration Directorate, Human Resource Development Department, Ordnance Department, Ration and Equipment Department and some special units under this main department. This research study area was focus on light vehicle maintenance recovery center, which is under the maintenance, reengineering and recovery department.

Light vehicle maintenance studies were not conducted in the Ministry of National Defense of Ethiopia, which motivated the researcher to conduct the study. In addition, the researcher have examined some annual reports of the National Defense light vehicle; however, studying the problem scientifically would make the research result reliable and trustworthy, which finally, fill gaps in literature in areas of light vehicle maintenance. Therefore, the research had addressed the practices and challenges of light vehicle maintenance. Generally, the researcher believed the final results of the study would contribute to fill gaps in areas of the study.

## 1.3 Research Questions

- What are the practices of light vehicle preventive maintenance operation at the Ministry of National Defense Maintenance and recovery Center?
- How does the competency of employees (knowledge, skill and attitude) looks like at the Ministry of National Defense Maintenance and recovery Center?
- What challenges hindered the practice of light vehicle preventive maintenance activities at the Ministry of National Defense Maintenance and Recovery Center?

## 1.4 Objectives of the Study

### 1.4.1 General Objective

The general objective of this study was to assess the practice and challenges for light vehicle preventive maintenance operation at the Ministry of National Defense maintenance and re-engineering Department.

### 1.4.2 Specific Objectives

The specific objectives of the study are:

1. To assess the practices of light vehicle preventive maintenance operations at the Ministry of Ethiopian National Defiance Recovery Center.
2. To assess the competency of employees on light vehicle preventive maintenance operations at the Ministry of Ethiopian Defense recovery center.
3. To identify the challenges that hindered the practice of light vehicle preventive maintenance operations at the Ministry of Ethiopian Defiance Recovery Center.

## 1.5 Significance of the Study

This study would have importance as an input for the FDRE Ministry of Defense in proper and adequate vehicle preventive maintenance management of transport services. The research would also provide a feedback and with some recommendation on their current preventive maintenance implementation practice to maintenance and recovery Centre. The other significance of the study is for the transport department which used the finding for future adjust of their progress. Finally, this research would benefit for future due to security institutions are confidential and researcher reluctant due fear of lack of data and this research shall considered as bench mark.

## 1.6 Scope of the Study

The study is demarcated in time and geographically. The scope of the study area includes Light Vehicle Maintenance and recovery center at the FDRE ministry of defense at Addis Ababa. In addition to the scope of the study time were limited after business-processing reengineering (BPR) started in 2014, at this time vehicle preventive maintenance department well organized in this time. The study were focused on light vehicle preventive maintenance and transport departments activity, the vehicle preventive maintenance derived thereof is confined towards examining the practical framework of Addis Ababa vehicle preventive maintenance, and

challenges affecting light vehicle preventive maintenance and its implementation in maintenance and recovery department.

## 1.7 Definition and Operational Terms

**Challenges**:-Disturbances seen from the aspect of risks and consequences of preventive maintenance (Scott & Hiroshige, 2004).

**Light Vehicle:** is a small, jeep-like four-wheel drive vehicle designed for military uses which are usually short and relatively light compared to other trucks and cars, are unarmored and have short body overhangs for all-terrain mobility and at least 4 passenger capacities (https://en.wikipedia.org/wiki/Military_light_utility_vehicle.09-06-2018).

**Recovery Centre**: -in this context, it is the core place of maintenance in the Ethiopia National Defense Force Logistics Main Department.

**Preventive Maintenance**: - It implies the routine scheduled maintenance of motor vehicle and includes the inspection of motor vehicle tone-ups, tire wears and pressure checks ( Rachaniotis & Pappis, 2008).

## 1.8 Organization of the Study

The research study was organizing in to five chapters. The first part deals with introduction that includes, background of the study, statement of the problem, research questions, objective of the study, scope and limitations of the study, significance of the study, structure of the thesis and short description about the study area. The second chapter contained the review of related literature. The research method were employed in the study were dealt with in chapter three; whereas, data analysis and discussion were discussed in chapter four. The last chapter provided detailed description of the summary of the study, conclusion, and recommendation to be drawn.

# CHAPTER TWO

## 2 RELATED LITERATURE REVIEW

### INTRODUCTION

To gain knowledge about the role of a maintenance activities within an organization the various maintenance concepts presented by researchers, this study began with an extensive literature study areas such as vehicle maintenance operation, competency of light vehicle risk preventive maintenance management and challenges hindering light vehicle maintenance management, theoretical and conceptual frame work were studied in order to understand the light vehicle maintenance strategic level of maintenance role. The main goal of the literature study was to create a strong foundation of which the result is to be based upon general overview of Risk Preventive Maintenance.

The industry did not have a high mechanical level before the Second World War, that is, most of the equipment was over-designed and simple. The consequences of failure did not have a strong influence and the effect was neglected (Alsyouf, 2007). Due to this, the industrial equipment was running until failure occurred, and when it did it was either replaced or repaired. Thus the Mentality was: “fix it when it breaks”. In the first approach of vehicle preventive maintenance no actions were taken to detect the onset of failure neither to prevent failures, this approach can be described as reactive maintenance (Alsyouf, 2007).

The Second World War turned things around and everything changed dramatically during the war. This is due to shortage of manufacturing manpower and an increasing demand on production (Kister and Hawkins). As a result, the mechanization increased and the manufacturing facilities changed to be more complex (Alsyouf, 2007). To meet the growing demand for war materials.

customer goods and to compensate to the manpower shortages, the technology within manufacturing was forced to develop more mechanization (Kister and Hawkins, 2006). Cost, longevity and availability were now regarded as important factors to achieve the business objectives and therefore, vehicle preventive maintenance was considered as a technical manner and became a task of the maintenance department (Alsyouf, 2007). The equipment reliability was now important and production downtime became everybody’s concern. The new found stature of vehicle preventive maintenance allowed the maintenance

organization to develop and implement periodic, planned and preventive programs (Hawkins, 2006).

The manufacturing facilities became even more automated and complex during the 1970s (Alsyouf, 2007). Reliability, availability and maintainability, as well as quality, safety, environment and multi-skilling were now considered very important. Condition monitoring, condition based vehicle preventive maintenance and maintenance management information systems began to be used in the industry. Condition based monitoring became easier to use in industry due to automation and development in information technology, and maintenance became more integrated and was no longer an isolated function (Alsyouf, 2007).

In the beginning of the 1980s had many systematic concepts been proposed, such as Total Productive Maintenance (TPM) and Reliability Centered Maintenance (RCM) (Alsyouf, 2007). The middle and corporate level management have until recently, ignored the impact of the maintenance operation on production costs, bottom-line profit and product quality. The general opinion has been that "nothing can be done to impact maintenance costs" or "maintenance is a necessary evil". The developments of computer-based instrumentation or microprocessors have provided the means to manage the vehicle preventive maintenance operation due to that it can be used to monitor the operating condition of plant equipment and systems. Unnecessary repairs can with this technique be reduced or even eliminated, catastrophic machine failures can be prevented and the negative impact of the vehicle preventive maintenance operation on the profitability can be reduced (Mobley, 2004).

The goals of the vehicle maintenance program of national defense are to support safe, reliable, and high quality transit services while making maximum use of financial resources. The purpose of the maintenance plan is to provide consistent, systematic and integrated program guidance that will enable national defense to properly maintain and service its vehicles in support of revenue operations. An effective maintenance plan ensures safe, clean and comfortable transit vehicles on the road and maximizes transit vehicle life (ARND, 2009).

## 2.1 Theoretical Frameworks of the Study

According to (Legát V, Mošna F, Aleš Z, Jurča V. 2017) Traditionally 5 types of maintenance have been distinguished, which are differentiated by the nature of the tasks that they include:

**Corrective maintenance**: The set of tasks is destined to correct the defects to be found in the different equipment and users of the same equipment communicate that to the maintenance department.

**Preventive Maintenance:** Its mission is to maintain a level of certain service on equipment, programming the interventions of their vulnerabilities in the most opportune time. It is used to be a systematic character, that is, the equipment is inspected even if it has not given any symptoms of having a problem.

**Predictive Maintenance:** It pursues constantly know and report the status and operational capacity of the installations by knowing the values of certain variables, which represent such state and operational ability. To apply this maintenance, it is necessary to identify physical variables (temperature, vibration, power consumption. The maintenance it is the most technical, since it requires advanced technical resources, and at times of strong mathematical, physical and / or technical knowledge.

**Zero Hours Maintenance (Overhaul):** The set of tasks whose goal is to review the equipment at scheduled intervals before appearing any failure, either when the reliability of the equipment has decreased considerably so it is risky to make forecasts of production capacity . This review is based on leaving the equipment to zero hours of operation, that is, as if the equipment were new. These reviews will replace or repair all items subject to wear. The aim is to ensure, with high probability, a good working time fixed in advance.

**Periodic maintenance (Time Based Maintenance TBM):** the basic maintenance of equipment made by the users of it. It consists of a series of elementary tasks (data collections, visual inspections, cleaning, and lubrication, retightening screws).For which no extensive training is necessary, but perhaps only a brief training, this type of maintenance is the based on TPM (Total Productive Maintenance).

**Corrective Maintenance (CM)/ Breakdown Maintenance (BDM)** is the kind of maintenance carried out after a failure has occurred, and it is intended to restore an item to a state in which it can perform its required function. According to Chiang (2001), corrective maintenance may consist of maintenance activity which includes repair, restoration or replacement of component that has undergone failure or that has totally broken down. The challenge as explained by Mobley (2002) is to detect problems that are beginning to develop, before they lead to total failure and to correct the faults at the lowest possible cost. One of the advantages of adopting corrective maintenance is that the machines are not over maintained and machine condition is not monitored. However, its disadvantages lies in the increase of production down time, overtime labor, high cost of spare parts as well as risk of secondary failures.

**Condition-based Maintenance (CBM)** is the kind of maintenance that is carried out according to the need which is been indicated by the condition monitoring. CBM strategy is one which is based on deterministic and probabilistic models. It takes predictive maintenance one step further by performing the inspection in a "real-time" mode. Data about the failure behavior of the system are obtainable through suitable condition monitoring (CM) parameters which provides information concerning the real state of the systems. Vibration monitoring, shock pulse measurement, oil and debris monitoring and electrical current are few of several existing condition monitoring techniques that may well be used in a user-friendly way to select the most cost-effective maintenance policy (Alsyouf, 2004).

### 2.1.1 Vehicle Maintenance and Recovery

Maintenance is defined as: "Combination of all technical, administrative and managerial actions during the life cycle of an item intended to retain it in, or restore it to, a state in which it can perform a required function." (pren, 1998).

Well-managed vehicle maintenance programs are extremely important in any business that operates motor vehicles. Reduced operational costs, reduced accidents from vehicle defects, and improved public opinion are direct benefits of a well-implemented maintenance policy (Hanover Risk Solutions).

The Recovery and Maintenance Vehicle (FRMV) is the recovery and maintenance system for employment within both the Unit of Action (UA) and Unit of Employment

(UE) and contributes to sustaining and generating combat power to the Future Force structure

All successful maintenance programs depend on the support of top management and effective communication. Drivers, maintenance personnel, and supervisors must be held accountable for the condition of vehicles, and clear lines of communication need to be established between them. Periodic review of a company's existing maintenance program, and the degree to which it is being carried out on a daily basis, will help management determine if any program modifications are necessary *(*Hanover Risk Solutions*).*

### 2.1.2 Maintenance Resources

Maintenance resources includes personnel (manpower), spare parts, technical data/ information, test equipment/ tools, funding etc. that are available or provided for the purpose of maintenance operations.

**Manpower** – according to Kelly (2006), this can possibly classified according to the technical area in which it is employed (mechanical, electrical, instrumentation, etc.), it can however be further divided according to craft (welder, electrician, etc.). Since maintenance work mostly tends to require more than one craft, the above categorization is done on the basis of the main craft content to each job.

**Spare parts** – achieving optimum balance between the cost of ordering and holding (depreciation, interest charges, rental etc.) and cost of stock out (loss of sales due to unavailability, temporary hire charges etc.) is the objectives spare parts organization should address. The main difficulty according to Kelly (2006) arises from the variety and complexity of thousands of different items (of widely varying cost, lead times and usage rate) required sustaining a typical operation.

**Testing equipment/ tools** – though it is similar to the objective of spare parts organization, but the problem of control differs because tools are not in the same sense consumable. The main task however with returnable tools is the development of a system for monitoring their loan and maintaining or replacing them if necessary when returned.

Technical data/ information – this include all document, catalogs, manuals or drawing that might facilitate maintenance work or operation. This can be categorized into training, reference, instruction, scheduling and control.

### 2.1.3 Competency of Risk vehicle Preventive Maintenance

Preventive maintenance involves the systematic inspection of equipment where potential problems are detected and corrected in order to prevent equipment failure before it happens (Moubray,1997). In practice, a preventive maintenance schedule may include things such as cleaning, lubrication, oil changes, adjustments, repairs, inspecting and replacing parts, and partial or complete overhauls that are regularly scheduled.

The exact preventive maintenance required will vary based on operation and type of equipment. Recommended standards of the American National Standards Institute (ANSI) are used to help determine the type of inspections and maintenance needed and how often they should be performed. ANSI helps ensure the health and safety of consumers by creating and overseeing the use of thousands of guidelines and norms for nearly every industry, and ANSI standards can be used like a preventive maintenance checklist to define requirements and instructions for maintaining equipment (Moubray,1997)).

Preventive maintenance includes much more than simply performing routine maintenance on equipment. It also involves maintaining accurate records of every inspection and servicing, as well as knowing the lifespan of each part to understand the replacement frequency. These records can help maintenance technicians anticipate the appropriate time to change parts and can also help diagnose problems when they occur. Preventive maintenance software helps collect and organize this information so it is readily available to maintenance technicians ((Moubray, 1997).

### 2.1.4 Advantages and Disadvantages of Preventive Maintenance

Many maintenance professionals have recognized the benefits of preventive maintenance. However this activity has its own advantages and disadvantages. Here are some of the advantages and the disadvantages of preventive maintains.

**Advantages:**

**Less risk factor-** Because the equipment are being regularly checked, they are at less risk to breaking down without notice. Therefore creating a safer working environment for employees.

**Follows a schedule-** By following a schedule, you are able to keep to a budget while maintaining your building. Also you will be able to keep track of all your equipment and pin point times when you will need to replace your equipment.

**Longer equipment/building life-** When equipment is being checked and maintained, it will be kept in its best shape, therefore extending its lifetime. With routine check-ups on building parts such as pipes, boilers, and roofing you'll extend the life of your building as well.

**Money saving-**Over time, you will see that less money is being spend because you will not have to replace equipment as much, as well as dealing with last minute break downs. While there still may be some unplanned maintenance needed, the likely hood will go down when the building and equipment are regularly checked. Property wise, you'll be able to catch roof leaks before they escalate and quickly repair them before mould and debris occur.

**Less energy wasting-** In general when equipment is not kept in the best conditions possible, it will drain more energy, increase up your bill. With properly maintained equipment, it will be saving you energy and money

**Disadvantages:**

More money upfront- When initially starting a preventative maintenance plan, it will cost you more to regularly maintain equipment and the building, than it would be if you waited for things to simply break down.

**Over maintenance-** Because there is a regular plan, sometimes items may not need to be checked as often as planned. If this is the case, you can change your maintenance plan to checking the specific equipment or areas less often, while still maintaining a schedule.

**More workers-** Preventative maintenance require more workers because regular checks are a must. When compared to reactive maintenance, you simply need to call someone in for a onetime fix. Instead this method requires workers to always be on site and perform daily works.

(http://www.protechpropertysolutions.co.uk/advantages-and-disadvantages-of-preventative-maintenance/)

### 2.1.5 Challenges of Preventive Maintenance

It was not until recently that vehicle preventive maintenance has gained recognition as potential profit generator. This is, despite the fact that in many vehicle preventive maintenance amounts for a substantial sum and the vehicle preventive maintenance personnel sometimes comprises a significant number of the total work force (Waeyenbergh and Pintelon, 2002).

The focus today is, due to globalization, to create internal and external partnership between vehicle preventive maintenance and other elements in the supply chain, for example are maintenance involved when designing and improving the production process, and helping the purchasing department to select the original equipment manufacturer. Monitoring the deviations in both the quality of the product and the machine condition are now more emphasized (Alsyouf, 2007).

vehicle preventive Maintenance becomes more and more part of the integrated business concept and there is a growing trend towards outsourcing, also a shift from failure-based to use-based maintenance and increasingly towards condition-based maintenance. Availability, reliability and safety in the production plants are now more emphasized (Waeyenbergh & Pintelon, 2002).

## 2.2 Empirical Literature Review

According to a survey report by (Harz 1981) on U.S army land vehicle maintains problems. The response to this survey indicated that deep and serious problems existed in the army maintains system. These hamper efficient operations and degrading combat readiness. The following problems appeared to be the most serious.

**Qualified man power shortage**: this problem exists in Army units, because:

- many of the authorized openings are unfilled

- A significant portion of the manpower that exists is unqualified to do the necessary work because the personnel are not properly trained.
- There is relatively low utilization of maintenance personnel because of poor time management and the common practices of using such personnel in unrelated duties. The high turnover of personnel also results in productivity loses during a rival and departure periods of rotating personnel.

**Training and motivation:** training in school and especially during on-the-job training periods is another major problem. The average mechanic is poorly trained, especially in technical tasks such as troubleshooting. The level of school technical training has not kept up with the increasing vehicle complexity. The burden of the training has thus shifted to the units, which is not equipped for the task. On-the-job training is generally not properly programmed.

Lack of motivation an undercurrent of all the major problems. Poor motivation may be caused by the rapid turnover, the poor training, the perceived lack of respect and rewards for the working mechanics, and the abuse of proper supervisory or management control. The low level of motivation is evidenced by flour to follow prescribed preventive maintenance procedures, the careless handling of vehicles, the completion of maintenance forms with invalid data, and so on.

**Periodic / Preventive maintains:** army regulation calls for thorough inspection by the crew of a vehicle before, during and after operation. Such inspection is generally not done. In addition, unit maintains personnel do not properly perform those vehicle services required on parodic bases (by time or mileage). Thus potential problems remain undetected and lead to major vehicle problem, and the vehicle condition is degraded.

**Diagnosis and Diagnostic equipment:** the critical problem with diagnostic equipment is that it is normally not used. The major reason appears to be poor diagnostic training and lack of enforcement of approved troubleshooting procedures. In general, there is an accepted mode pf operation of “Diagnosis by replacement”.

**Vehicle status reporting:** match of the basic data on the maintenance practices is irregular and unreliable. Since the basic maintenance and equipment status report tends to be unreliable.

**Management and Supervision:** most commanders don't have interest in maintenance operation nor do they put enough emphasis on maintenance operations nor do they put enough emphasis on maintenance.

The **United Kingdom** has been one of the flagship countries in using public–private partnerships (PPP). It has launched many large-scale projects since 1992, when the government introduced a program, which later became known as the Private Finance Initiative (PFI). The program follows a cross-ministry approach, covering practically all categories of service procurement, including accommodation, equipment and training. Without involving the state, the private sector often establishes a separate undertaking (special purpose vehicle – SPV) for every project. (MOD Private Finance Unit Guidance Note, 2009).

As part of the budget cuts which have been implemented since the end of 2010, it has been decided to privatise the Defence Support Group, which provides maintenance and repair services for the UK Armed Forces' land vehicles, aircraft, equipment and electronic systems, performs calibration procedures and fulfils other logistics support functions. In addition, the UK Ministry of Defence (MoD) is making preparations for the privatization of specialized logistics support providers, including the Defence Storage and Distribution Agency, tasked with the transportation, storage, maintenance and distribution of the equipment and supplies of the UK Armed Forces (Jane's Defence Weekly, 2010).

The **Estonian** Defense Forces rely mostly on in-house solutions to repair and maintain defense equipment. However, the existing infrastructure and machinery cannot provide for their long-term needs, the more so as it will be difficult to recruit and retain qualified personnel in adequate numbers in the longer perspective (Martin Hurt, 2011).

These problems are in no way unique to Estonia. Other states have faced similar challenges. Several European countries have decided to solve the problems through closer cooperation with the private sector, which is always fighting for survival through efficiency enhancements.

In **Germany**, maintenance and repair of the Army's equipment are carried out by Heeresinst and setzungs logistik GmbH (HIL). HIL's owners are the Federal Republic of Germany (49%) and a holding company (51%) with three major German defence enterprises as its shareholders: Krauss-Maffei Wegmann , Rheinmetall Landsystemevi and Diehl Defence (each of them controls directly or indirectly one third of the holding company). The adoption of a PPP-based model started in 2001, when a domestic tender was organised to find providers of maintenance

and repair services for the Bundeswehr. This involved limited negotiations only with successful tenderers. Dealers and the umbrella organisation for the German defence industry were not invited to take part in the process. HIL was officially established in 2005, when it took over the first workshops from the Bundeswehr. Full operational capability was achieved in December 2006. Today, HIL repairs and maintains almost all of the Army's equipment, including vehicles, weapons and electronic components. HIL guarantees 70% availabilityix for the equipment it services. The company has about 2,200 employees16 and its annual turnover is about 250 million euros. It provides repair services for the Bundeswehr only. The reason behind this is partly related to the fact that HIL bears no personnel or infrastructure-related costs, which is why the provision of services to third parties would distort the market. (http://www.diehl.de/index.php?id=11&L=1.)

In Germany**,** the staffs of the workshops have not become HIL's employees, but continue to be employed by the Bundeswehr, which pays their wages. Similarly, state assets have not been transferred to HIL. The Bundeswehr covers the upkeep costs of infrastructure. In its repair activities, HIL uses the Bundeswehr's spare parts. The spare parts that are purchased by HIL are automatically transferred to the Bundeswehr's ownership. Upon the expiration of HIL's contract, all the personnel and assets will be re-assigned to the Bundeswehr, although the contract fails to outline the exact details of this arrangement. Consequently, it could be claimed that HIL is a company that provides management services. The state has placed its resources – state assets and personnel – at the disposal of HIL's leaders who manage them more effectively than the Bundeswehr (as is typical of and expected from the private sector) (Martin Hurt, 2011).

In the Finnish Defence Forces, third and fourth level maintenance and repair works on equipment (including weapons and electronic components) are carried out by Millog. Its majority shareholder is Patriaxi (55%) which, in its turn, is owned by the Finnish state (73%) and EADS (27%). Millog's other shareholders include Insta (34%), Raskone (8%) and Oricopa (3%). The Finnish MoD owns a so-called golden share in Millog and has its own representative on its Board of Directors. In addition to equipment maintenance and repair, Millog provides the spare parts necessary for these activities (mobilisation stockpiles are still owned by the Finnish Defence Forces). The preparations for Millog's establishment were launched in 2001, when the Finnish MoD began consultations with the Finnish defence industry and trade unions. The umbrella organization for the defense industry (AFDA) played a minor role in the consultations. Millog became operational on January 1, 2009. In 2010, its turnover was 76 million euros and it

employed 665 people, most of whom were civilians. Millog may offer services to other customers too. So far, it has carried out repair works for the state-owned company Finavia, but it is also interested in providing services for the armed forces of other nations (Martin Hurt, 2011).

In Finland, the staffs are employed by Millog and their employment contracts with the Defence Forces were terminated. Millog uses the real estate assets owned by the state via a company similar to Riigi Kinnisvara As in Estonia called Senaatti and the Finnish Defense Forces used to lease real estate from it. In connection with restructuring, the rental contracts were reviewed and now Millog is the lessee. Other fixed assets whose value exceeded 50,000 euros, were purchased by Millog from the Finnish Defense Forces(Martin Hurt, 2011).

Following a Cold War tradition, the Swedish Armed Forces mostly prefer in-house solutions for equipment maintenance and repair. As a result of large-scale restructuring and downscaling, their workshops have substantial excess capacity, which renders the current logistics organization ineffective. As most of the equipment acquired is imported and the technological complexity of equipment continues to increase, the objectives of the Swedish defense industry policy have been downgraded in order to allow Sweden not to produce and repair all of its equipment by itself and to be able to depend on foreign governments and firms (http://www.deagel.com/equipment/Main-Battle-Tanks2009.aspx).

As a rule, the Swedish Armed Forces do not transfer state assets to private ownership, but prefer to rent them out or to grant the right to use them free of charge. In essence, they carry out a tendering process and the winner must operate the asset (for example, a shipyard, a simulator or a centrifuge) and provide services related to this asset to the Swedish Armed Forces. This solution has one major advantage: the state denies a private company the attainment of a monopoly position, the more so if a relatively short term contract is concluded. So, the state preserves the opportunity to reclaim the assets from its partners, to find more profitable alternatives or even to opt once again for in-house solutions. Unlike tangible assets, the workforce of the Swedish Armed Forces is handed over to its private sector partner in full, which allows the latter to raise the efficiency of its operations after some time by optimizing its staff numbers. At the same time, minimum key competences are retained to enable the state to define its needs and to act as an ‘intelligent customer’ in the future (Martin Hurt, 2011).

In the Netherlands, the involvement of private companies in the day-to-day operations of the Dutch Armed Forces is largely contingent on the availability of resources – their key objective

is to cut costs. At the moment, the Dutch do not plan to establish joint ventures similar to those in Germany and Finland. In-house solutions are usually adopted for the Army's equipment repair activities. Maintenance and repair of the light vehicles, Air Force's aircraft and the Navy's vessels are carried out in close cooperation with the private sector, although the roles of the state as a commissioner and the private sector as a service provider are kept separate. In Den Helder, there is a state-owned workshop – leased to a private company –which is used for painting naval components and equipment. The workshop used to cater for the Dutch Armed Forces only, but due to spare capacity it was decided to rent it out. Its current operator may employ its spare resources to provide services for other customers (Martin Hurt, 2011).

The Dutch keep their assets in state ownership. Operators lease state-owned infrastructure and equipment. In terms of personnel, the Dutch Armed Forces follow the principle that they must be able to independently perform a part of maintenance and repair activities in the future because in the case of foreign missions, 100% reliance on private companies cannot be tolerated. The reason for this is that unless a state of war has been declared, private companies may breach their contracts to save the lives and to protect the health of their employees, paying a penalty for doing so, which would not be acceptable for a unit on a mission. In addition, it is considered to be vital that the Dutch Armed Forces retain sufficient competences that would allow them to define their future technical needs for their equipment's entire life-cycle (Martin Hurt, 2011).

## 2.3 Identified Literature Gap

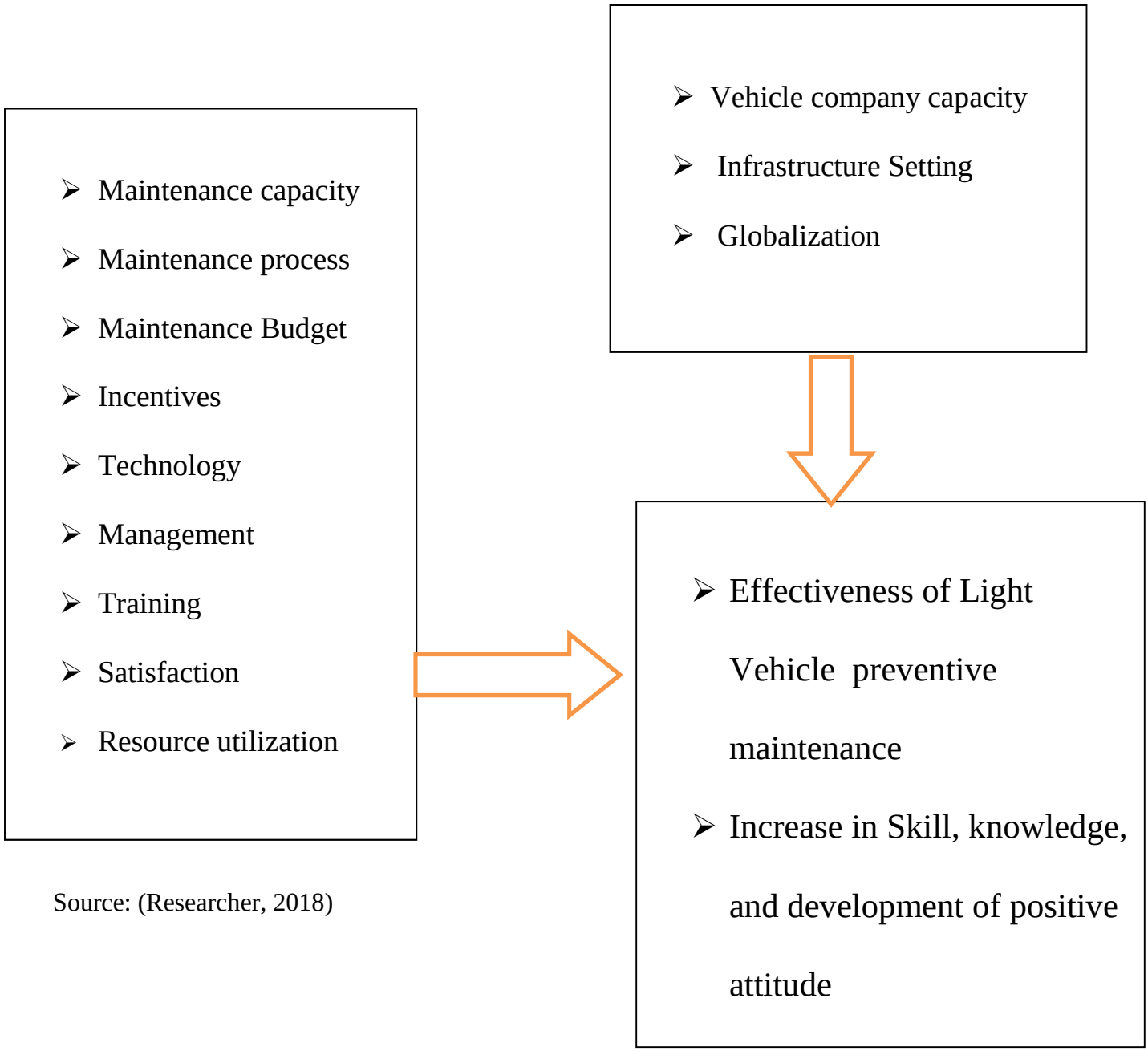
The above literature states about the theoretical, empirical and conceptual framework related to the study problem. This part also discussed the descriptive study framework for the study. The empirical part indicated that vehicle maintenance has been carried in different countries of the national defense like Germany, Estonia, and Finland. These countries have outsourced vehicle maintenance fully or partially.it is argued that due to most of military activity is confidential, rare researchers have conducted research in the military areas. That's why, the researcher of the study initiated to conduct the study. The researcher has tried much effort to find out researches conducted in the issue of light vehicle maintenance in the National Defense of Ethiopia. However, it was not discovered that and the researcher decided to study the problem so as to fill

gaps in literature to the problem under study. Accordingly, the researcher has believed that, this research would add knowledge in the practices, competency of employees and challenges faced in the light vehicle maintenance of National Defense Force of Ethiopia

## 2.4 Conceptual Framework of the Study

When a company performs its own maintenance, adequate facilities and equipment must be provided, as well as ongoing training of mechanics to keep them abreast of changes in equipment and repair procedures. Companies using vendors for vehicle maintenance want to assure that they are qualified to perform the work and are reputable. When vehicles are leased, it must be clearly stated who is responsible for providing maintenance. The schedule for performing vehicle maintenance must be detailed and performed accordingly (Brian, 2010).

Many maintenance organizations are pride of how fast they can react to production disturbances or catastrophic failure instead of their ability to prevent such events. Most plants continue to operate in this breakdown mode while few admit their continued adherence to this mentality. The role of the maintenance organization is in contrary to the popular belief; it is to maintain the equipment of the plant i.e. to be proactive and not to repair it after failure i.e. reactive. However, all catastrophic failures cannot be avoided and maintenance must therefore continue to react quickly to unexpected failures (Mobley, 2004). Optimum reliability is one part, which determines the production capacity of the plant. Maintenance organization primary function is to ensure that all equipment and systems always are in good operating condition and on line, in other words to reduce disturbances (Mobley, 2004).




Source: (Researcher, 2018)

**Figure 2.1: Conceptual Framework of the Study**

# CHAPTER THREE

## 3 RESEARCH DESIGN AND METHODS
## INTRODUCTION

This part of the paper sets out research design and methodology. A specific, related research design is identified to ensure the accomplishment of the set objectives of this study. It may also be stated that the research design and related methods are developed with the aim of obtaining reliable and valid quantitative and qualitative data to answer those research questions, as well as to address the objectives of the study. In addition, the study areas are described; research design and approach discussed; target population, sampling method, and procedures are outlined; data collection procedures, including data sources are described; and statistical techniques or tests were employed in the analyses of quantitative and qualitative data explanation. Finally, it discussed on research ethics that are considered when collecting, analyzing and reporting of the issues under investigation.

## 3.1 Description of the Study Area

The Light Vehicle Maintenance and Recovery Center is located in Addis Ababa around Mexico Square, which is under the Ethiopian National Defense Force Logistics Main Department. The Maintenance and Re-engineering Department was responsible for directing and leading above the maintenance and recovery center. The maintenance and recovery center is responsible for preventing, maintaining, recovering, re-engineering, renewing of light vehicles that are under the Ethiopia National Defense Force. Under the Logistics main department, there were more than 80 different types of light vehicles' like 105 Toyota Land cursers, v8 Toyota Land cursers, 80 Toyota Land cursers and Prado were to name the few. According to the data, obtain from Maintenance and Engineering Division (2017) there were 4500 preventive maintenance workers at the center. This preventive maintenance department is composed from 2500 Auto mechanical, 500 Auto electricians, 200 Auto engine and 50 Tapestry, 100 wielding, and the rest 1150 were supportive staffs. The National Defense Force maintenance team performs two major activities. These major activities are follow-up of vehicles driven for certain kilometer by the preventive maintenance team and drivers activities, which they follow, tier, oil, and water of their vehicles.

## 3.2 Research Design

The research issue was not described well in literatures and therefore, the researcher used descriptive research. Kothari (2004) states that descriptive research is basically about describe issues, phenomena and feelings. Therefore, the researcher described the practices, competency and challenges of light vehicle maintenance department. In addition, the research was conducted at one time which makes it cross-sectional study.

## 3.3 Research Approach

To achieve the stated objectives of the study both quantitative and qualitative research approach were employed. Recently employing the combination of both quantitative and qualitative approaches has gained popularity (Creswell, 2009). This popularity is because research methodology continues to evolve and develop, and mixed method is another step forward, utilizing the strengths of both qualitative and quantitative research. According to Neumann (2006), the logic of triangulation is based on the idea that looking at something from multiple points of view improves accuracy. There is more insight to be gained from the combination of both quantitative and qualitative research than from either of them. Their combined use provides an expanded understanding of research problems. Thus, the method of triangulation was preferred to undertake this study and the justification for the choice of triangulation method is presented as follows. Quantitative research was used to understand the level of competency of employees. Qualitative research was integrated in the study to investigate the view of customers of the vehicle maintenance department. Indeed, the nature of this study comprised both quantitative and qualitative research methods in a mixed fashion for the sake of maintaining high level of reliability and validity of the study.

## 3.4 Population and Sampling Procedures

The subjects of the study were composed from employees of the light vehicle maintenance and recovery department. The population of the study was 4500 preventive vehicle maintenance workers. Random sampling was chosen since there is list of elements of the survey population. In addition to this, using rule bounded and rigorous sampling techniques are very relevant to the accomplishments of the specific objectives of the present study. If the total population of the study comprises from 101 up to 5000, taking 5% of the total population as sample size of the study is advisable (Rule of Thumb). Thus, according to rule of thumb, the sample of the study was 4500*0.05=225. However, to compensate the non-response rate, researchers recommend adding 10%-30% of oversampling (Israel, 2003). Therefore, the researcher was believed that

non response rate would be 20%. Hence, 225*0.2=45. Therefore, the total sample of the study was 225+45=270. However, due different reasons, the response rate was 90% which means 245 samples were willing to participate in the study. Accordingly, 10% of non-response rate was registered. By taking the sample frame, the researcher selected the sample randomly by using excel.

On the other hand, for the qualitative data key informants were selected from customers. These customers were selected by using purposive sampling, which sets criteria to select the sample. The researcher selected these samples, who came to the maintenance department more than 3 times, and drivers of light vehicles for at least 2 years. Accordingly, 15 key informants were interviewed and after this, the researcher stopped due to saturation of data.

## 3.5 Data Source and Type

### 3.5.1 Primary Data

Primary data would be focused on collect data's directly through interviews and closed questionnaires .Basic source for data collection for the purpose of this research study were primary data.

**Key Informant Interview**

The researcher conducted key informant interview with representatives of service users which were 15. The researcher was undertook a serious of semi structured key informant interviews with a reasonable number of selected representative sectors to know the issues under study until the data become saturated. These key informants were selected purposely based on their relative possession of knowledge and practices about the issue under study. Key informant interview guides prepared to accomplish the interview. Note taking were used to capture the information obtained from key informants. The interviews were carried out with service users when they came to maintenance department and on average 20-30 minutes were taken for the interview.

### Survey Questionnaire

Survey research is the best way to collect a large amount of data from a large number of people in a short amount of time and it is peculiar to ask for people's self-reported behavior or attitudes (Neuman 2006; Vanderstoep and Johnstone 2009). Thus, Surveys can be used in investigating many life domains including workers competency levels. In developing countries, where

information recording and keeping is very fragile and unreliable, survey is a standard tool to measure issues (Ansah and Jackson 2013).

The necessary data for the survey were collected by employing both self and interviewer-administered questionnaire. According to Vanderstoep and Johnstone (2009), this technique of face-to-face interview helps to come up with very thorough data, and allows for probes and follow-up questions to tailor interviews based on respondents' unique knowledge or experience. The data collection was conducted during the period from January to March 2018. The questionnaire was administered in both Amharic and English to ease the interview processes. Finally, the necessary orientations were given to interviewers about how to interview the selected samples. The basic reason the researcher decided to use survey questionnaire is to know the level of knowledge and competency of vehicle maintainers.

### 3.5.2 Secondary Data

Relevant secondary data regarding light preventive vehicle maintenance have assessed and utilized in the study. To this end, different published and unpublished sources from preventive vehicle maintenance are incorporated. In addition to this, various written documents like journals, personal diaries, books, articles, conference papers, brochures, bulletins and other archival documents, which focus on preventive maintenance, were used extensively, retrieve systematically and review critically.

## 3.6 Data Collection Procedure

The data collection procedure covered Defense Minister Logistics Division. All stakeholders of defense preventive vehicle have been included in the procedure. After obtaining the complete list of employees' preventive vehicle maintenance from logistics division, random sampling technique was used to select. The exact locations of the selected employees were communicated through provided training to data collectors and by the researcher. Based on this the deployed data collectors were directly went to employees of the selected participants and made them fill the questionnaire. Besides, their leaders and supervisors were also making to fill questionnaires. The data collectors were also interviewed service users of the departments in which they have deployed.

## 3.7 Method of Data Analysis

Descriptive statistical tests were used to answer those research questions and to address the objectives of the study. To analyze, summarize, describe and interpret the quantitative data in

this research, the researcher were employed descriptive statistical techniques which were frequency, mean and percent. The researcher used IBM SPSS Version 23 to analyze the data obtained from participants. On the other hand qualitative data were analyzed through coding, and merging concepts and sub concepts that had similar meanings.

## 3.8 Ethical Considerations

First, the ethical approval and clearance were obtained from Addis Ababa University School of Commerce. The objective and purpose of the research were clearly communicated to participants and let them know to withdraw if they get discomfort in the process of their participation in undertaking. More over all ethical issues were considered in the whole process of the research.

## 3.9 Validity and Reliability Test

### Validity of the Data

As to measurement validities in the study, Neuman (2011) describes measurement validity "as how well an empirical indicator and the conceptual definition of the construct that the indicator is supposed to measure fit together". In other words, validity refers to the soundness of the interpretation of scores from a test, the most important consideration in measurement.

Although there are many types of validity, the authors are generally agreed that there are a few common techniques used. In the light of the objectives of this research, content, face, criterion and construct validities will consider. Construct validity, for example, demonstrates the high level of construct validity of question items in the questionnaires being homogenous in relation to each other. With factor analysis, the construct validity of a questionnaire can be generally tested (Ratray& Jones, 2007). If the questionnaire is constructed valid, all items together represent the underlying construct.

In order to ensure the reliability and trustworthiness of the qualitative data that were generated in this research, the researcher were applied criteria of credibility, dependability, authenticity and confirmation. These criteria are accepted to ensure the reliability and validity of qualitative data by qualitative researchers (Noble & Smith, 2017). The researcher prior to developed the questionnaire, have referred literature related to the topic and then developed both closed and open key informant guidelines. After that, to assure the validity the instruments the researcher advised experts of vehicle maintenance and also when interview carried out confirmation was

requested to decrease misinterpretation of respondents' ideas. Through these methods, the researcher has tried to assure the trustworthiness of the qualitative data.

**Reliability of Data**

Several procedures exist for establishing the reliability of an instrument, such as the test-retest and alternate-form methods and the split-half technique (Gratton & Jones, 2010; Delport & Roestenburg, 2011). In this research, two statistical tests were discussed extensively with which the reliability and validity of the questionnaires measuring knowledge, skills, and related aspects can be tested using Cronbach's alpha of reliability analysis.

Internal consistency also refers to the degree of correlation between the various items of a measuring construct. The Cronbach's alpha coefficient is widely used as a reliable procedure to indicate how well various items are positively correlated to one another (Sekaran & Bougie, 2010). The Cronbach's alpha is based on the inter-item correlations. If the items are strongly correlated with each other, their internal consistency is high and the alpha coefficient will be close to one. On the other hand, if the items are poorly formulated and do not correlate strongly, the alpha coefficient will be close to zero. To interpret the Cronbach's alpha coefficient(α), statisticians and researchers have widely and generally accepted following ranges of value 0.7-0.95 as accepted value of reliability (Filed, 2009) and the reliability tests of the research were 0.75 for knowledge competency, 0.85 for skill competency and 0.82 for attitude competency. Therefore, these items measured these variables were reliable and was above to the accepted value (please refer the on page below for details)

Accordingly, the Cronbach's alpha coefficient was used to calculate for each group of items in order to illustrate the internal consistency of each subsection in the questionnaires. It also serves another purpose in indicating the level of measuring the same construct validity. The Cronbach's alpha coefficient for the different subsections of the questionnaire follows. The Cronbach's alpha for knowledge competence, skills competence and attitude competence items were computed using reliability analysis of SPSS version 23 software.

**Reliability Statistics for Knowledge Competency**

| Cronbach's Alpha | N of Items |
|---|---|
| .723 | 6 |

| Item-Total Statistics for knowledge competency | | | | |
|---|---|---|---|---|
| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
| preventive maintenance knowledge | 18.42 | 12.868 | .413 | .700 |
| accident control | 18.83 | 12.675 | .198 | .767 |
| training effectiveness to maintenance | 18.41 | 12.013 | .368 | .710 |
| the improvement of maintenance | 18.37 | 10.217 | .590 | .640 |
| maintenance profession exemplary | 18.25 | 11.319 | .609 | .647 |
| organizational change | 18.62 | 9.399 | .654 | .614 |

**Reliability Statistics for skill competency**

| Cronbach's Alpha | N of Items |
|---|---|
| .848 | 5 |

| Item-Total Statistics for skill | | | | |
|---|---|---|---|---|
| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
| technical maintenance | 16.12 | 14.100 | .292 | .894 |
| maintenance tools | 16.16 | 9.777 | .854 | .760 |
| planning and report | 16.10 | 9.228 | .828 | .765 |
| maintenance implementation time | 16.06 | 10.254 | .730 | .796 |
| group work | 15.75 | 11.958 | .603 | .831 |

**Reliability Statistics for Attitude**

| Cronbach's Alpha | N of Items |
|---|---|
| .825 | 11 |

| Item-Total Statistics | | | | |
|---|---|---|---|---|
| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
| members effectiveness | 37.28 | 23.324 | .698 | .789 |
| prevention commitment | 37.18 | 22.875 | .806 | .778 |
| day to day follow rules and ethics | 37.08 | 23.313 | .855 | .777 |
| accountability and responsibility | 36.92 | 23.321 | .728 | .786 |
| organizational interest | 37.28 | 23.734 | .532 | .809 |
| tolerance majority | 36.55 | 27.199 | .710 | .805 |
| survive of difficulty | 37.02 | 27.352 | .420 | .817 |
| any situation responsible exemplary and effective | 36.82 | 27.959 | .274 | .829 |
| respecting leaders | 36.84 | 25.025 | .497 | .811 |
| knowledge and skill | 39.85 | 29.749 | .024 | .852 |
| maintenance effectiveness | 39.87 | 30.483 | .003 | .840 |

Source :( Research Survey, 2018)

# CHAPTER FOUR

# 4 RESULTS, DISCUSSION AND INTERPRETATION

## INTRODUCTION

This chapter dealt with the results, discussion and interpretation of data gained from participants of the study. The major issues discussed in the chapter were background of participants, competency of the military department in competency of knowledge, attitude and skill. The chapter also explained the challenges faced the vehicle maintenance department that hinder against successfully accomplishing works. Therefore, based on the results, discussion were made whether other researchers findings were consistent or in contrary to this research.

## 4.1 Demographic Characteristics

This part of the study presents data analysis and discussion. It first presents socio-demographic characteristics of respondents, light vehicle preventive maintenance and transport departments. The main target of this study is to gather data regarding the practice of Vehicle preventive maintenance to find problems in Ethiopian national defense.

**Table 1: Gender and Age of Participants**

| Gender of participants | | | Age of participants | | |
|---|---|---|---|---|---|
| Gender | Frequency | Percent | Age group | Frequency | Percent |
| Male | 202 | 82.4 | 21-30 | 178 | 72.7 |
| Female | 43 | 17.6 | 31-40 | 37 | 15.1 |
| Total | 245 | 100.0 | above 40 | 30 | 12.2 |
| Total | | | | 245 | 100.0 |

Source (Research Survey, 2018)

Table 1 showed that most participants were male while female participants are low which are 82.4% and 17.6% respectively. This indicates that the female participation in the study area is low.

On the other hand, most participants were in the age group of 21-30, which account 72.7% followed by age group 31-40 (15.1%) and age of above 40 (12.2%). Hence workers of vehicle maintenance department were dominantly in the age category of age group 21-30.

**Table 2: Educational Level and Experience of Participants**

| Educational status | | | Experience | | |
|---|---|---|---|---|---|
| Education level | Frequency | Percent | Experience | Frequency | Percent |
| Diploma | 198 | 80.8 | 1-5 | 112 | 45.7 |
| Degree | 41 | 16.7 | 6-10 | 97 | 39.6 |
| Master | 6 | 2.4 | above 11 | 32 | 13.1 |
| Total | 245 | 100.0 | Total | 245 | 100 |

Source (Research Survey, 2018)

Table 2 indicated that most participants in maintenance department were diploma holders, followed by degree holders that account 80.8% and 16.7% respectively. Master's Degree holders cover the least total and this is because vehicle maintenance educations is mostly provided in vocational training centers and are not given in master's level most importantly. Additionally majority of the respondents have one to five years of experience (45.7%) followed by 6-7 years of experience (39.6%) and finally above eleven years' experience, which comprises 13.1%.

The light vehicle preventive maintenance department should employ Professionals. This intern will enable the staff to understand why failures occur, what the problem is and to gain an understanding of maintenance concern. The aims and objectives of professionals at the maintenance center is to reduce accidents and equipment damage.

## 4.2 Practices of Light Vehicle Maintenance in Maintenance and Recovery Center

This research assessed the practice of light vehicle maintenance in terms of timely check of vehicles, preventive maintenance and documentation of light vehicle.

**Table 3: Regular Maintenance of Vehicles**

| Is light vehicle preventive maintenance conducted timely? | Frequency | Percent |
|---|---|---|
| Yes | 243 | 99.2 |
| No | 2 | 0.8 |
| Total | 245 | 100.0 |

Source (Research Survey, 2018)

Participants were asked, "If light vehicle preventive maintenance conducted timely?" Accordingly 99.2% of participants responded "Yes", while the rest 0.8% responded "No". Hence the National Ministry of Defense have conducted vehicle maintenance regularly despite insignificant number of participants responded in contrary. On the other hand, the data obtained through key informant interview indicated that majority of the respondents replied that the preventive process is conducted regularly while very few indicated on the contrary.

Key informant participants stated that some drivers brought vehicles with regular basis while others brought vehicles for maintenance when damage happened. Therefore, the data obtained through open-ended questionnaire support the data obtained through close-ended questionnaire who said "yes" and "no". Generally it is concluded that the National Ministry of Defense have conducted vehicle maintenance regularly. The light vehicle preventive maintenance today will help to increase production efficiency continuously in order to be competitive. Unplanned maintenance activities should be minimized and the organization should strive towards zero failure and breakdown losses (Sasaya, 2009).

**Table 4: Preventive Maintenance**

| Does light vehicle preventive maintenance conducted regularly. | Frequency | Percent |
|---|---|---|
| Yes | 178 | 72.7 |
| No | 67 | 27.3 |
| Total | 245 | 100.0 |

Source (Research Survey, 2018)

Participants were asked does light vehicle preventive maintenance conducted regularly. Accordingly, 72.7% of participants believed that ministry of defense were conducted regular preventive vehicle maintenance. On the other hand, 27.3% of participants did not agree with the former respondents. Hence, it is possible to conclude that mostly light vehicle preventive maintenance have conducted regularly, even if there are some disagreements.

On the other hand, the data obtained through open-ended questionnaire stated that light vehicle preventive maintenance has conducted regularly and not regularly. Participants stated that some drivers brought vehicles with regular basis while others brought vehicles for maintenance when damage happened. Therefore, the data obtained through open-ended questionnaire support the data obtained through close-ended questionnaire who said "yes" and "no". Preventive maintenance schedule may include things such as cleaning, lubrication, oil changes, adjustments, repairs, inspecting and replacing parts, and partial or complete overhauls that are regularly scheduled (Moubray,2007).

**Table 5: Documentation of Maintained Vehicles**

| Is there a preventive maintenance documentation system? | Frequency | Percent |
|---|---|---|
| Yes | 149 | 60.8 |
| No | 92 | 37.6 |
| Missed | 4 | 3.6 |
| Total | 245 | 100 |

Participants were asked about the availability of documentation system in the National Defense Force. In addition 60.8% of participants agreed that there was system of documentation during preventive light vehicle maintenance. the data obtained through key informant interview also

supports this and stated that documentation of maintained vehicles have recorded carefully which includes when the vehicle entered, when it has to be maintained, what the problem is and other information. In the contrary, 37.6% was not believed in the presence of documentation system in the Defense force. Other key informant respondents stated that the maintenance department had not well-organized documentation system. They stated that, even the amount money required for spare parts were not well recorded and the information about vehicles were not found when required.

It is possible to generalize that the National Defense Force have had in good practice related to regular check of light vehicles, regular preventive maintenance system and documentation system. Of course, the above tables also indicated that there were some problems in regular preventive maintenance system and documentation system of light vehicle maintenance.

According to Brian (2010), Documentation of Maintained Vehicles Well-managed programs are extremely important in any business that operates motor vehicles. Reduced operational costs, reduced wastage from vehicle defects, and improved public opinion are direct benefits of a well-implemented maintenance policy.

## 4.3 Competency of Light Vehicle Preventive Maintenance Employees

**Table 6: Knowledge Based Competency**

| Items | Very Poor | Poor | Satisfactory | Good | Very good | Mean | Standard deviation |
|---|---|---|---|---|---|---|---|
| I have good knowledge on light vehicle preventive maintenance | 0 | 3.7 | 30.6 | 51.8 | 13.9 | 3.76 | .732 |
| I had knowledge on light vehicle maintenance to control accidents | 2 | 4.9 | 29.8 | 51.8 | 5.3 | 3.57 | .772 |
| I have taken enough preventive maintenance training | 3.7 | 4.5 | 28.6 | 37.6 | 25.7 | 3.77 | 1.002 |
| I always strived to develop my maintenance profession | 3.3 | 11.8 | 16.3 | 37.6 | 31 | 3.81 | 1.1 |
| I had knowledge of documenting maintained vehicles | 0 | 13.5 | 35.5 | 26.1 | 24.9 | 3.62 | 1.003 |
| I am confident that I can be example for others | 0 | 2 | 34.3 | 32.2 | 31.4 | 3.93 | .858 |
| I had knowledge for creating new ideas to organizational change | 6.1 | 13.9 | 24.1 | 30.2 | 25.7 | 3.56 | 1.1 |
| I had knowledge of rule and regulation violations | 6.1 | 13.9 | 15.9 | 37.1 | 26.9 | 3.65 | 1.1 |

Source (research survey, 2018)

In table 6, Participants were asked to express their level agreement on the knowledge they hand about knowledge of preventive maintenance. Accordingly, most participants of 51.8% agreed that they had "good" knowledge followed by 30.6% who said "satisfactory" In contrary 3.7% of participants had "poor" knowledge on vehicle preventive maintenance.

Hence, most workers of National Defense Force in vehicle maintenance department had "good"

knowledge on light vehicle preventive maintenance, though some workers had poor knowledge on preventive maintenance.

Concerning control of accidents, most participants who accounted for 51.8% believed they had "good" knowledge followed by 29.8% who said having "satisfactory" knowledge accounted 29.8%.on the contrary 2% and 4.9% of participants stated the knowledge regarding controlling accidents through preventive maintenance were "very poor" and "poor" respectively. Therefore,most workers in the vehicle maintenance had "good" knowledge, followed by "satisfactory “in controlling accidents through preventive maintenance.

Regarding trainings received by the participants, 37.6% believed the trainings taken were "good", followed by 28.6% "satisfactory". In addition, 25.7% of participants were agreed that the trainings received were "very good”. However, 4.5% and 3.7% of participants agreed the training were"poor" and "very poor" respectively, which showed the inadequatcy of trainings. Therefore, the trainings delivered to workers in the maintenance department had, according to most respondents were "good" followed by "satisfactory.”

Participants were asked to state their level of effort in developing in profession. Accordingly, most participants, who accounts for 37.6" believed they strived to develop the profession which leveled "good”, followed by 31% who stated "very good." In the contrary, some others were not believe they are developing their profession, this group constitutes 11.8% and 3.3% who said "poor" and "very poor ",respectively. Therefore, most of the National Defense Force, light vehicle department workers had strived to develops their profession.

Table 6, showed that most workers of maintenace department had "satisfactory" followed by" good" which were 35.5% and 26.1% of participants respectively. In addition, 24.9% of respondents were said the documentation system of the department was "very good.” however 13.5% of respondents were believed, the documentation system was "poor."

The table also discussed about how they were example for others in the profession. Hence, 34.3% of participants responded "satisfactory", followed by 31.4% "very good" and 32.2% "good". However, 2% of participants were stated the exemplary showed by workers were "poor." Therefore, workers of the vehicle maintenance department were confident for been exaplary in their proefeesion.

In table 5, participants were asked to level the knowledge on creating new knowledge for organizational development. Therefore, 30.2% of participants were believed the knowledge was “good", followed by 25.7% "very good. “However, significant number of participants that accounted for 13.9% and 6.1% were believed the knowledge were "poor" and "very poor",

respectively. Hence this data explained that more workers were been able to create new ideas for organizational change,despite significant number of workers lacked it.

Finally, regarding the knowledge competency, participants were asked about how they were informed about the rules and regulations of the department. Accordingly, most of respondents, which accounted for 37.1% and 26.9% were stated the knowledge "good" and "satisfactory" respectively. On the other hand 13.9% of respondents believed it was "poor" and weak and 6.1% "very poor. “From this, it is possible to conclude that more workers had the understading of violations of rules and regulations despite significant number of workers in vehicle maintenance department lacked it.

**Table 8. Mean of Knowledge Based Competency**

| | N | Mean | Std. Deviation |
|---|---|---|---|
| Knowledge | 245 | 3.6816 | .70605 |
| Valid N (list wise) | 245 | | |

Source(Survey Research,2018)

Mean was employed to know how variables included in the knowledge competency generally express. Accrodingly the table showed that the mean of knowledge regarding vehicle maintenance in the national defense force was 3.68. This means the workers of maintenance department had alsmost very good knowledge to their work. This did not mean all workers had very good knowledge. Some workers in the department lacks knowledges related to the variables listed in the above tables. Therefore, it sound to conclude that workers in the maintenace department had effective for having knowledge despite with some limitations.If there is a well-developed and defined light vehicle maintenance strategy which is known to everyone then new problems instead of old recurrence ones will be solved. If one is not, measurable time will be earned from develop and define a maintenance strategy, communicate it, and last focusing on the tactical choices for how to achieve it. Tactics are the actual activities needed to implement the strategy which concerns the management of processes, people, and physical asset infrastructure (Campbell and Reyes-Picknell, 2006).

## Skill Based Competency

Skill based competency was assessed through differnt variables and were limited to technical maintenace skill,maintenance insrtument handling, preparing plan and reporting, time consumption for maintenance, working in team and leading skill. Accordingly in the above

tables by using percent and mean, assessement was made.That innovative development was called preventive maintenance as a result, plant managers were encouraged to have their supervisors, mechanics, electricians and other specialists, develop their skill for Competency of Light Vehicle Risk Preventive Maintenance Operations and making key observations to preventive damages of the equipment. It helps to reduce downtime. Preventive maintenance is a schedule of planned maintenance actions aimed at the preventive of beak dons and failures (Levitt, 2001).

**Table8: Skill Based Competency**

| Items | Very poor | poor | satisfactory | Good | Very good | Mean | Standard deviation |
|---|---|---|---|---|---|---|---|
| I had skill for technical maintenance | 0 | 5.3 | 23.3 | 44.9 | 26.5 | 3.93 | .81 |
| I had skill of handling and usage of maintenance instruments and materials | 4.5 | 1.6 | 31.8 | 24.9 | 37.1 | 3.89 | 1.07 |
| I Had Plan Preparing And Reporting Skill | 7.8 | 4.9 | 12.2 | 34.7 | 40.4 | 3.95 | 1.19 |
| I Had Skill Of Effective Time Usage For Work Accomplishment | 4.5 | 8.2 | 10.2 | 38.4 | 38.8 | 3.99 | 1.1 |
| I had Skill Of Leading By Organizing Groups | 4.5 | 0 | 4.9 | 42.4 | 48.2 | 4.3 | .922 |
| I had the skill to provide encouragement so as to making effective team work | 4.5 | 0 | 19.6 | 43.7 | 32.2 | 3.99 | .962 |

Source (Research Survey,2018)

From table 8, the table stated that 44.9% of respondents agreed "good" for having the skill of technical maintenance followed by "very good" and "satisfactory" which accounts 26.5% and 23.3% respectively. Insignificant number of respondents believed "poor" in their technical skill.Accordingly, most workers in the maintenance department had technical skill in vehicle maintenance.

Table 8 stated that most respondents which accounts 37.1% believed "very good" in handling and usage of instuments materials necessary for maintenance, followed by 31.1% believed "satisfactory" and 24.9% "good". On the contrary,4.5% believed" very poor" and 1.6% "poor".

Therefore, most workers in the maintenance department had the skill of handling and usage of materials necessary for maintenance despite some others believed it was weak

The other skill for vehicle maintenance profession was planning and reporting. Table 8, clearly stated that 40.4% of respondents believed "very good" in instrument and material handling skill followed by 37.7% "good" and 12.2% "satisfactory". On the other hand 7.8% and 4.9% believed the skill of instrument and material handling "very poor" and "poor "respectively. Therefore, it is possible to conclude that most workers in the vehicle maintenenace department had more than "good "skill, even though some workers had lack it.The light vehicle preventive maintenance department should be Professional is to understand why failures occur, what the problem is and to gain understanding of maintenance issues. The aims and objectives of professional maintenance are to optimize equipment with respect to availability, reliability and financial aspects. Unplanned maintenance activities should be minimized and the organization should strive towards zero failure and breakdown losses (Sasaya, 2010).

Giving service with specific time is important for any work. Therefore, table 8, stated that 38.8% respondents believed they had "very good" time usage while providing service followed by 38.4%"good" and 10.2%"satisfactory". On the contrary 8.2% and 4.5% had limitations in time management which said"poor" and "very poor" respectively.

Therefore, most national defense forse workers had morethan "good" time management skill, even some others had limitations.

Table 8, explained that most respondents which accounts for 48.2% believed that their skill of leading team works was" very good" followed by 42.4% "good" and 4.9% "satisfactory" respectively. On the other hand, 4.5% believed their skill of leading teamwork was "very poor". Therefore, workers of national defense force had skill leading teamwork in the vehicle maintenance department.

From table 8, 43.7% participants of the study believed that encouragement of hard workers in teamwork did exist with “very good" followed by 32.2% "good" and 19.6% of “satisfactory". On the contrary, 4.5% of participants believed they lacked the skill of encouraging teamwork’s. Therefore, most workers of national defense force, vehicle maintenance department had more than "good" level skill in encouraging hard working teams, despite some workers lost the skill. The strategy light vehicle maintenance needs to be supported by tactical plans which must be executed, without tactical plans consisting activities won’t the idea of what to do or

how to do it and be clear in the time of light vehicle maintenance skill for technical issues (Campbell, Reyes-Picknell, 2006).

**Table 9:Mean of skill competency**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Skill Mean | 245 | 1.50 | 5.00 | 4.0068 | .81730 |
| Valid N (List wise) | 245 | | | | |

Source (Research Survey,2018)

Note: Mean of (1-very poor; 2-poor; 3- satisfactory; 4-good; and 5-very good enough)

We have assessed the frequency of skill competency using percent From table 8 found the results that in most variables, respondents believed they had more than “good" skill in the variables of technical skills, time management, material and maintenance instrument handling and usage preparing plan and reporting, leading team works and appreciating hard working.

As table 9 explained the mean of the above-mentioned skills in the national defense force, vehicle maintenance department were found 4.00, which is equivalent "good”. This indicates that most workers in vehicle department had the capacity to change the knowledge to practice. Of course, some workers had limitations in changing the knowledge they had in practice due different reasons.

## Attitude Related Competency

Attitude of workers were assessed by taking in to account variables of: I am committed in respecting and implementing preventive maintenance, I am committed in implementing the principles that guide the vehicle maintenance in each day, I followed the principle of transparency and accountability, I give priority to organizational interest, I recognize diversity and live in tolerance, I work hard in case difficult situations, I am always self-reliant, smart and exemplary and I go in line with seniority.

Therefore, attitude of workers of the national defense force, vehicle maintenance department was assessed in the above-mentioned variables. Therefore, lets us look how the mean of each variable looks like. According to Jurča (2017) correct the defects to be found in the different equipment and that are communicated to the maintenance department by users of the develop

workers attitude relate to the equipment. The technical skills, time management, material and maintenance instrument handling and usage, preparing plan and reporting, leading team works and appreciating hard working.

**Table 10 Attitude Competency**

| **Descriptive Statistics for attitude** | | | | | | |
|---|---|---|---|---|---|---|
| | Level of Agreement in Percent | | | | | Mean |
| Variables | Very Poor | Poor | Satisfactory | Good | Very Good | |
| I respect my manager and senior officers | 3.3 | 2 | 8.2 | 22 | 69.5 | 4.42 |
| I can be exemplary to other workers | 0 | 0 | 16.3 | 22.4 | 61.2 | 4.45 |
| I accomplish the job in effective way even in case difficulty | 0 | 0 | 13.1 | 43.4 | 34.6 | 4.24 |
| I am committed to work preventive maintenance operations | 4 | 5 | 23.7 | 29.8 | 42 | 4.09 |
| I accept organizational rules and regulations | 4 | 5 | 12.2 | 43.3 | 40 | 4.19 |
| I accepted the accountability and responsibility principle | 8 | 2 | 7.3 | 25.7 | 58.8 | 4.35 |
| I give priority organizational interest | 2 | 14.3 | 6.9 | 35.9 | 40.8 | 3.99 |
| I accepted diversity and work in tolerance with a group | 0 | 0 | 0 | 28.2 | 71.8 | 4.72 |
| Valid N=245 | | | | | | 4.3 |

Source :( Research Survey, 2018)

The above table showed that workers of preventive maintenance department more than very enough level of attitude in the measured variables. Therefore, workers had very enough attitudes towards their profession with a total mean of 4.3 that is more than "very enough ".Attitudes workers of prevents maintenance should be clearly stated who is responsible for providing

maintenance. The attitudes for performing vehicle maintenance must be detailed and performed accordingly the rules and regulation of organization (Brian, 2010).

## 4.4 Challenges Hindering Light Vehicle Preventive Maintenance Operations

Challenges of light vehicle maintenance in the national defense of Ethiopia was assessed by using variables of human resource, workers turnover, training, availability of motivational factors, written maintenance producers and maintenance materials.

**Table 11: Challenges of Vehicle Maintenance**

| Item | Yes | | No | |
|---|---|---|---|---|
| | Frequency | Percent | Frequency | Percent |
| Is shortage of human resource in the vehicle maintenance department? | 196 | 80 | 37 | 15.1 |
| It there work turnover in the vehicle maintenance department? | 126 | 51.4 | 107 | 43.7 |
| Have you taken preventive light vehicle maintenance training? | 96 | 39.2 | 126 | 51.4 |
| Have you taken on job light vehicle preventive maintenance training? | 63 | 25.7 | 160 | 65.3 |
| Are there reward and motivation systems in the light vehicle preventive maintenance? | 48 | 19.6 | 185 | 75.5 |
| Does adequate material and instruments are available in the light preventive maintenance department | 41 | 16.7 | 182 | 74.3 |

Source (Research Survey, 2018)

Table 11, stated that most respondents believed that the light vehicle preventive maintenance department had human resource shortage to carry out activities effectively. Data gathered through key informant supported this idea; the workload and human resource were not balanced and due to this overloading, became the major problem. It also stated that too much work has done by scarce human resource that resulted to burnout and stress. Accordingly, 80% of

participants responded “yes" for existence of human resource shortage, even though the rest 15.1% responded "no".

In table 11, participants were asked is there turnover in the maintenance department and 51.4% believed there were turnover and 43.7% in the contrary. Hence, most participants agreed there were turnover in the maintenance department, even though significant number of participants did not believe.

On the other hand, key informant interview respondents believed that burnout were witnessed due to different factors. Respondents stated that low salary, wanting better payment, lack for basic needs, punishing and exaggerate for minor violations, absence of reward and recognition, absence of professional fee were reasons for burnout in the national defense force, vehicle maintenance department.

In table 11, most participants who account 51.4% stated they did not take training on light vehicle preventive maintenance. Open ended respondents also stated trainings were not prepared and organized by the department and said that due to absence of trainings maintenance work has been done through knowledge they had before and through tradition. On the other significant number of participants agreed, they took trainings. Therefore, the data clarify that most workers in the vehicle maintenance department lacks trainings.

Participants were asked did they take on job training on preventive vehicle maintenance. Accordingly, most respondents who account 65.3% responded “no", while others who estimated 25.7% said "yes". Therefore, most workers of maintenance department had not taken on job training.

Reward and motivation systems have great contributions for encouraging employees. Table 11 75.5% participants said "no" for availability of reward and recognition. On the other hand, 19.6% responded "yes". Hence, most workers in the light vehicle preventive maintenance had not motivated and recognized for good work habits.

Table 11 explains most respondents have said the maintenance department had not adequate tools and materials necessary for the work, which accounts for 74.3%. On the other hand, 16.7% believed the availability of the tools. Hence, it is found that light vehicle maintenance department had scarcity of tools and materials important for vehicle maintenance.

Key informant respondents stated that the national defense force lacks materials and tools necessary for vehicle maintenance. They believed that up to data, modern vehicle maintenance

materials were not available, and due this, more labor burden was imposed on them. The respondents identified lack of spare parts, absence radiator, limitation of rolling machine, spot welding machine, press machine, shot metal cutting and original materials made workers to spend extra labor.

The national defense force had faced different challenges in the light preventive maintenance department. Human resource is a key for accomplishing any activity effectively. However, the data proved that the department had shortage of human resource and this would create burden to workers and will bring stress and burnout. Related to this, the data also confirmed that in the department workers turnover was high and most participants agreed that turnover is existed in the department. These two variables seem related each other, which means when there is shortage of human resources, burden, and burnout increases and will contribute turnover.

The other major issue considered as challenge was in absence of rewarding and motivational factors for hard workers. The data confirmed that, workers who had worked bravely were not rewarded and motivated and discourages extra effort. Among the best ways for workers retention, reward and motivation plays significant role and hence increases productivity. Therefore, expecting extra effort from workers without motivation and reward seems foolishness and the department needs to revise the rewarding and motivation systems.

Trainings can be of job and on job. The research proved that challenges were observed related to trainings in the light vehicle preventive maintenance department. Training provides up to date knowledge and skill to any expertise and is mandatory to have regular schedule for providing both of and on job trainings. However, most participants of the study agreed that trainings were scant and worked in trainings they got before joining the department.

The light vehicle preventive maintenance department should be Professional is to understand why failures occur, what the problem is and to gain understanding of maintenance issues. The aims and objectives of professional maintenance are to optimize equipment with respect to availability, reliability and financial aspects. Unplanned maintenance activities should be minimized and the organization should strive towards zero failure and breakdown losses (Sasaya, 2009).

# CHAPTER FIVE

## 5 SUMMARY, CONCLUSION AND RECOMMENDATIONS INTRODUCTION

This chapter summarizes and concludes the entire study. It presents recommendations and the direction for future research. The purpose of the research was to assess the practices and challenges of light vehicle preventive maintenance of Ethiopian Nation Defense maintenance and recovery center.

### 5.1 Summary of Major Findings

Participants were asked, is light vehicle maintenance conducted timely? Majority respondents responded that 99.2% of participants responded, “Yes", hence the National Ministry of Defense has conducted vehicle maintenance regularly on time.

Accordingly majority participants say that 72.7% of believed that ministry of defense were conducted regular preventive vehicle maintenance. Henceforward, it is possible to conclude that mostly light vehicle preventive maintenance have conducted regularly.

Regarding the knowledge competency, participants were asked about how they were informed about the rules and regulations of the department. Accordingly, to most of respondents, which accounted for 37.1% is good. “From this it is possible to conclude that more workers had the understading of violations of rules and regulations despite significant number of workers in vehicle maintenance department lacked it.

According to respondents, most workers of National Defense Force in veicle maintenance department had "good" knowledge on light vehicle preventive maintenance, though some workers had poor knowledge on preventive maintenance..

The knowledge regarding vehicle maintenance in the national defense force was their mean 3.68. This means the workers of maintenance department had alsmost very good knowledge to their work.

The majority participants responded that the technical skills, time management, material and maintenance instrument handling and usage, preparing plan and reporting, leading team works and appreciating hard working have gaps the implementation in their light vehicle maintenance in their knowledge, skill and attitude of them.

The national defense force had faced different challenges in the light preventive maintenance department. However, the data proved that the department had shortage of human resources, burden, and burnout increases and will contribute turnover.

The major issue considered as challenge was in absence of rewarding and motivational factors for hard workers. Among the best ways for workers retention, reward, motivation and there is not trainings in the light vehicle preventive maintenance department at all level not implemented in this organization.

## 5.2 Conclusion

This research was conducted with the objective to assess the practice of light vehicle maintenance, to evaluate the competency and the challenges hindered the full practice of light vehicle preventive maintenance in the National Defense Force of Ethiopia.

The practices of light vehicle preventive maintenance have seen from timely service and regular check of vehicles. The survey result confirmed that most vehicles have made timely and regular maintenance while some others stated in the contrary. Data obtained through open ended also stated most vehicles have made less preventive maintenance and brought to the maintenance department when damage occurs. The open-ended response also stated that owners of vehicles were reluctant to make timely preventive maintenance as a result shorten the age of vehicles. This seems either the national defense force have not obligatory laws or follow up for implementing the laws.

The research also focused on how workers were equipped with knowledge, skill and attitude, which supports their effective accomplishment of the work. Knowledge of workers were assessed through knowledge of vehicle maintenance, controlling accidents, trainings, improvement of the profession documentation handling, being example, creating new ideas and understanding rules and regulations. These variables were computed by the mean, the result was 3.68, which was leveled between “satisfactory”, and good”, which is almost more than satisfactory” knowledge There fore, the workers of maintenance department had alsmost very enough knowledge to their work. This did not mean all workers had very enough knowledge. Some workers in the department lacks knowledges related to the above mentioned variables.

Skill of workers was assessed through differnt variables and were limited to technical maintenace skill,maintenance insrtument handling, preparing plan and reporting, time

consumption for maintenance, working in team and leading skill. In most cases, knowledge is the major input for skill and seems interrelated to each other. Hence, the mean skills of workers were found “4.00" which is equivalent "good”. This indicates that most workers in vehicle department had the capacity to change the knowledge to practice. Of course, some workers had limitations in changing the knowledge they had in practice due different reasons.

Data gathered through both close ended and open-ended questionnaire stated that due to lack of human resource, the workload and human resource were not balanced and due to this overloading, became the major problem. It also stated that too much work has done by scarce human resource that resulted to burnout and stress. The research also found that turnover was the other major challenge and factors were low salary, wanting better payment, lack of fulfill support t for basic needs, punishing and exaggerate for minor violations, absence of reward and recognition, absence of professional fee were reasons for burnout in the national defense force, vehicle maintenance department. Moreover, little effort have been made for both on job and of job training, still more will be needed from the national defense force. On this regard, participants were confirmed due little trainings, work had been accomplished through trainings previously taken and through tradition. Lack of spare parts, absence radiator, limitation of rolling machine, spot welding machine, press machine, shot metal cutting and original materials made workers to spend extra labor. Therefore, lack of human resource, employee turnover, lack of reward and recognition, limited existence of tools and materials were considered as challenges that hindered the full practice light vehicle preventive maintenance in the national defense force of Ethiopia.

Generally, national defense force of Ethiopia has come through ways to achieve organizational goals. The major purpose of the defense force is to protect the country from external threat and needs to qualify in all directions. Among these, making vehicle maintenance department equipped with modern technology and having skilled human resource is the most important. Therefore, this research would have great importance for both academic and the defense force to understanding of the practices, knowledge, skill, and attitude and challenges of the vehicle maintenance department. Therefore, the researcher believed, the research is successful in addressing the objectives set by.

## 5.3 Recommendations

This research have conducted for assessing predetermined objectives and came up with different findings related to the practice, knowledge, skill and attitude and challenges of vehicle maintenance department in the national defense force of Ethiopia. Accordingly, the researcher would recommend as following by considering the findings,

- The research found that sometimes vehicles were checked regularly and timely, in most cases maintenance was done when damage happened and the national defense should formulate either obligatory laws or strictly implement if laws are available,
- It was found that documentation was handled carefully and sometimes in contrary, hence it is advisable if the vehicle maintenance department would rearrange the documentation system,
- Lack of human resource was found as challenge and both the vehicle maintenance department and human resource department needs to work together to tackle the problem,
- It was found that trainings were scant, and the vehicle maintenance department needs more effort in preparing and providing both on job and of job trainings,
- Lack of rewarding and recognition, high turnover, lack of tools and materials, were considered major challenges and needs multidimensional effort to address the problem starting from revising the strategic plan, rules and regulations and other packages that will promote employee satisfaction. Hence, vehicle maintenance department, human resource department and strategic managers will have to work together to address the challenges.

## Future Research

This research studied the practice, competency and challenges of light vehicle maintenance in the main department of Logistics in the National Defense of Ethiopia. Therefore, future researches shall conduct in maintenance and re-engineering department branches of corridors. In addition, this research concentrated on light vehicles and therefore, the researcher recommends future researches on the heavy trucks maintenance services in the logistics main department.

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# Annexes

## The Questionnaire

### Addis Ababa University School of Commerce (AAUSC)

### Department of Logistics and Supply Chain Management

Questionnaires are be filling by light vehicle preventive maintenance and transport departments. The main objective of this questionnaire is to gather data regarding the practice of Vehicle preventive maintenance problems in Addis Ababa national defense. The information you provide serves only for academic purposes. Since the success of this study directly depends up on your genuine responses to the questions, you are kindly requested to fill in the questionnaire. I assure you that your answers are fully confidential.

I would like to thank in advance for your cooperation.

**I. General Directions**

1. No need of writing your name.
2. Put "√" mark in the space provided for your answers.

**II. Part one personal & demographic data**

1. Age A. 20-30 B. 30-40 C. Above 40 ☐ ☐ ☐
2. Sex A. male B. Female ☐ ☐
3. Education- A. Diploma B. Degree C. Master ☐ ☐ ☐
4. Position in the office_____
5. Field of specialization_____
6. years of experience maintenance_____

**III. PERSONNEL**

1. Is there a shortage of qualified vehicle preventive maintenance personnel?

Yes ☐ No ☐

Other_____

2. Is there vehicle preventive maintenance categories is there a significant shortage or excess of qualified personnel?

Yes ☐ No ☐

If not, what?

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3. Is there a high turnover among vehicle preventive maintenance personnel?

Yes ☐ No ☐

Other_____

_____

4. A. Do you attend basic maintenance school?

Yes ☐ No ☐

If not why?

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5. Do you receive refresher training?

Yes ☐ No ☐

A. If not how do you, fill the gap?

_____

_____

__

A. Are there effective rewards for exceptional work and incentives?

Yes ☐ No ☐

B. If no, why?

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A. Do you perform periodic preventive maintenance?

Yes ☐ No ☐

B. If yes are the present preventive maintains schedules for vehicles adequate?

Yes ☐ No ☐

**I. Section B. Preventive knowledge, skills and attitudes Policy:**

Preventive health professionals make a "X" mark by checking the "X" mark in your checkbox number in the Measuring Criteria that corresponds to the Expert's Skills, Skills, Attitudes, and Prospects.

The numbers saved by the qualitative scale indicate the following definition. 1 = Very Poor 2 = Poor 3 = satisfactory 4 = very Good 5 =Good

## Rating level

| | **Affiliate issues** | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 1 | I have a good knowledge of easy car insurance | | | | | |
| 2 | have expertise in managing emergency situations | | | | | |
| 3 | will always work to grow the profession. (Eg, experience ...) | | | | | |
| 4 | 'm willing to be a model role model | | | | | |
| 5 | have the ability to create new ideas for a radical change. | | | | | |
| 6 | have the capacity to understand different rules and regulations. | | | | | |

| | **Skills related issue** | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 1 | I have technical skills. | | | | | |
| 2 | I have enough skills to use repair tools | | | | | |
| 3 | I have the ability to plan and report. | | | | | |
| 4 | I have Time management skills to perform maintenance tasks | | | | | |
| 5 | It has the skills to manage teamwork. | | | | | |
| 6 | It has the skills to do an effective job by masquerading members | | | | | |

| Matters related to attitude | | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 1 | I am committed to respecting and protecting the precautionary process | | | | | |
| 2 | I am committed to implementing the principles of daily life | | | | | |
| 3 | Transparency and accountability follow the principle of thinking | | | | | |
| 4 | Being secret guard is being faithful | | | | | |
| 5 | It has a tendency to prioritize the interests of both nations | | | | | |
| 6 | Accepts tolerance by accepting diversity | | | | | |
| 7 | I try to work without hindering difficult circumstances | | | | | |
| 8 | In any circumstance, I can be hard, capable, and self-employed | | | | | |
| 9 | Respects the Superintendents and seniors | | | | | |

## II. Preventive maintenance Equipment Tools

1. Do you have adequate tools to undertake preventive maintenance?

   Yes ☐ No ☐

2. Are the required tools always available to the preventive maintenance crews?

   Yes ☐ No ☐

3. If not, why?

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## III. Test, Measurement and Diagnostic equipment (TMDE)

1. Are the diagnostic equipment's (TMDE) adequate?

   Yes ☐ No ☐

2. If TMDE are inadequate, why?

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3. Is TMDE almost always available to the mechanic?

   Yes ☐ No ☐

4. If not why?

5. Is available TMDE actually used?

6. Yes ☐ No ☐

7. If not why?

## IV. FACILITIES

1. Are shop facilities adequate for proper support of vehicle preventive maintenance?
   Yes ☐ No ☐
2. Are proper storage facilities provided for parts?
   Yes ☐ No ☐

## V. Vehicle Users (Drivers and Crews)

1. Do drivers usually perform check their Vehicles?
   Yes ☐ No ☐
2. If not, why?

3. Do drivers receive adequate training vehicle maintenance?
   Yes ☐ No ☐

4. If not, what areas are they lacking in?

## __Maintenance documentation and forms

1. Do you have the culture of maintenance documentation?
   Yes ☐ No ☐
2. Do you have maintenance documentation almost always available?
   Yes ☐ No ☐

3. Is available document usually referred?

Yes ☐ No ☐

4. If unavailable why?

Yes ☐ No ☐

## VI. Maintenance Management

1. Is there sufficient command interest in and emphasis on preventive maintenance?

Yes ☐ No ☐

2. Is the command interest usually evident (by commander's presence etc.)?

Yes ☐ No ☐

**Addis Ababa University School of Business and Economics Logistics and Supply chain Management.**

**Interview guide**

Introduction

This interview is designed to look at the performance and competency of Preventive Maintenance competency of light road vehicles in the ministry of national defiance Ethiopia. The information collected will not be used for any purpose other than for this study. Thank you for your patience and cooperation for the success of the project.

**An interview questioner prepared for service users**

1. What challenges you observed in preventive maintenance of Light Vehicles?
2. How do you see the competency of preventive maintenance in terms of knowledge, skill and attitude of workers in the light preventive maintenance?
3. Is the information management system of preventive maintenance established?
4. Will you please tell us what to do in the future so that maintenance can be further enhanced?