



**ST.MARY'S UNIVERSITY
SCHOOL OF GRADUATE STUDIES
MASTERS OF GENERAL BUSINESS
ADMINISTRATION**

**AN ASSESSMENT OF ASSET MANAGEMENT PRACTICES:
CASE STUDY OF ADDIS ABABA LIGHT RAIL TRANSIT
PROJECT**

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This thesis has been submitted to St. Mary's University Collage, School of Graduate studies for examination with my approval as a university advisor.

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January,2019

DECLARATION

I, the undersigned, declare that this thesis is my original work, prepared under the guidance of Asmamaw Getie (associate professor). All source of materials used for the thesis have been duly acknowledge. I further confirm that the thesis has not been submitted either in part or in full to any other higher learning institution for the purpose of earning any degree.

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Jaunary 2019

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LIST ACRONYMS

AM	Asset Management
AALRT	Addis Ababa Light Rail Transit
CREC	China Railway Group Ltd
ERC	Ethiopian Railway Corporation
FHI	Family Health International
FHWA	Federal Highway Administration
FDRE	Federal Democratic Republic Of Ethiopia
IOAM	Institute Of Asset Management
ISO	International Standard Organization
IPWEA	International Public Work Engineering Australia
NPWC	National Public Works Councils
QDA	Qualitative Data Analysis
TAC	Transportation Association of Canada
TAM	Transportation Asset Management

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ABSTRACT

The purpose of this study is to assess the asset management practices on of Addis Ababa light railway network. To achieve this, a total of 96 questionnaires were distributed to employees as one of primary data collection method. Out of which 80 usable questionnaires were collected back and the total response rate for the study was 83.3 % in total. As a result, the paper's findings were drawn from the 80 questionnaires. The study has been conducted based on the case study research design. Interview, observation and secondary data were also among the tools used for gathering qualitative and quantitative data in this research. The qualitative data are presented using narrative and also the quantitative data presented using frequency of response mean and standard Deviations. Results in general indicated that 60% of employees have positive response to the question raised about asset management elements. There are variations on the level of employee's position towards each question. It is found that there is some indication of asset management practice in the organization. However, it isn't well-built to put the organization on competitive and profitable situation. The key challenges to implement asset management in this organization are found as: lack of well educated engineers/ expertise, no proper system, material mismanagement and improperly recorded information. It is recommended that the organization should build the capacity of its employee with continuing professional's development program to develop their competence. Also, the organization should have its own information management system, planned operation and maintenance strategy for successful asset management practice.

Key words: *Asset Management, Operation and Maintenance phase*

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Now a day organizations face continuously competitive marketing environment, to retain in this environment the organizations expected to operate with high product/service quality, lowest prices and short delivery time. To overcome such difficulty, the organizations are compelled to search for better strategies that improve their business (Schneider et al., 2006). Among those strategies is asset management (AM) hereafter, a systematic process of maintaining, upgrading and operating physical assets cost effectively. It harmonizes engineering and economic principles to make beneficial business practices. In order to reduce life cycle costs and contribute to effectiveness of organizations, it is essential to manage the physical asset through its acquisition, operation, maintenance and disposal phases. Asset Management, referring to physical equipment and structures, can be best described on a high level as the management of these physical assets through its entire life cycle (Mollentze, 2005).

The effective execution of physical asset management is the anchor for success and future growth of many organizations (Woodward, 1997). The importance of asset management is increasing due to service level requirement, stakeholder change and competitive business environment (Institute of Asset Management [IOAM], 2004).

The attractiveness with asset management is that it considers all important aspects that need to be managed in the life cycle of an asset, right from inception to disposal. One important phase within an asset's life-cycle is the operational and maintenance phase (O&M) here after. Recent studies indicate that depending on the business context, operation and maintenance constitutes between 15 and 70 % of the total cost of ownership as seen in (Koronios, Nastasie, Chanana & Haider, 2007). An assets of an organization must perform throughout their life cycle if the organization is to receive maximum benefits. In order to maximize benefits, minimization of down time and maximization of usage must be managed physical asset correctly (Thomas. A⁰, 2008).

It is well known that railway plays a great role in relieving the business pressure of the transport sector through transporting passenger and goods with comfortable, safe, low price and short delivery time. Hence, there is a growing need to shift a substantial volume of

freight and passenger traffic to rail. Asset maintenance plays a strategic role in sustaining railway organizations competitiveness through enhancing equipment availability, reliability and productivity (Peter, Liliane And Adriaan, 2013).

The asset management framework adopted by industrial asset owners was developed in 1990s. It was including industry strategies, enterprise management, supply chain management, manufacturing, and plant operations management Stapelberg (2006). Hardwick (2008) highlighted the manufacture adopt technology based frame works which includes; demand management, system engineering, configuration management, integrated (logistic) support and total quality management. Infrastructure Asset Management is a strategic and systematic process of optimizing decision-making in resources allocation with the goal of achieving planned alignment of an infrastructure asset with corporate goals throughout its lifecycle Vladimir, Lin Ma, and Wasana (2010). Infrastructure organizations adopt frame life cycle/phase which includes asset planning, asset creation, asset operations, and asset maintenance and asset performance (Vladimir, Lin Ma and Wasana, 2010). According to Mollentze (2005), high-level framework for AM will include the four phases that are asset acquisition, asset operation, and asset maintenance and asset disposal. In addition other scholars also agrees on four phase of asset management frame works.

The Ethiopian government aims to establish a modern and reliable railway system in the country to address constraints in the transport services (limited connectivity, outdated railway network, high transport cost, poor quality of transport services, growing mobility needs of people & increasing transport demand due to economic growth). To realize this vision the government established the Ethiopian Railways Corporation. This organization undertakes the objective of government by overseeing the construction of the infrastructure and providing service on completed railway lines. For the reason of inexperience in railway technology, the organization is facing various problem related to asset management. This affect overall operation of the organization in all aspects.

This conceptual study focuses on assessment of asset management practice of the railway in Ethiopia (Specifically Addis Ababa light railway transit service) to improve overall operation of the organization.

1.2. Company profile

In order to satisfy the demand of the economy for bulk cargo transport and enhanced socio-economic services, the government of the Federal Democratic Republic of Ethiopia (FDRE) established the Ethiopian Railways Corporation (ERC) by Regulation Number 141/2007

enacted by the Council of Ministers. The Corporation is mandated to build railway infrastructure and provide cargo and passenger rail transport services. It is accountable to Board of Management and supervised by the public enter enterprise.

To realize its objective, ERC has laid down a master plan to build 5,000Km railway network that connects the country’s development corridors and increase accessibility to sea-port and neighbouring economies.

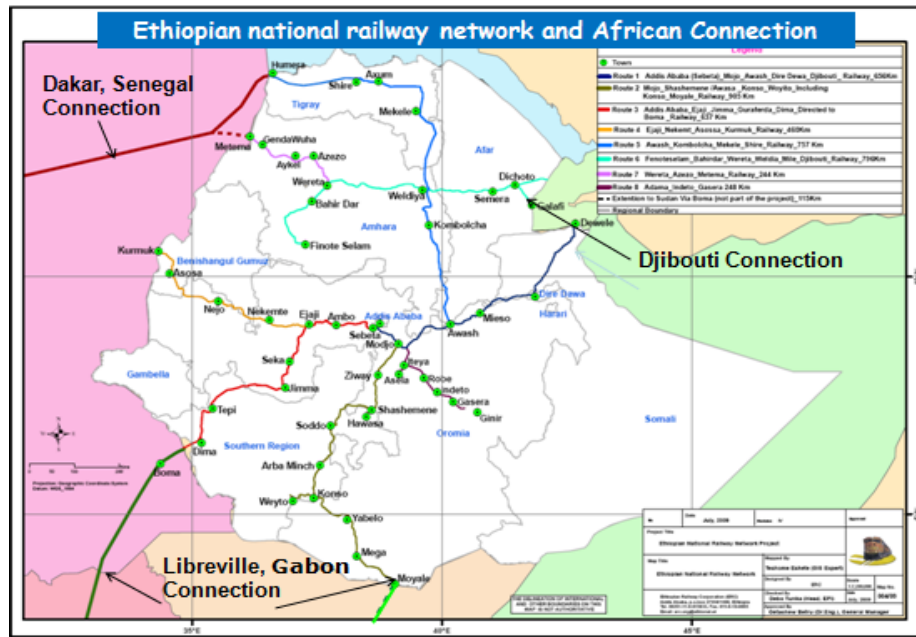


Figure 1: National railway network of Ethiopia.

Addis Ababa light railway project profile

The Addis Ababa Light Rail Transit project which has a total of 34 km has been completed and began passenger operation in September 20, 2016. The Project consists of railway lines aligned from north to south (Menilik square to quality) and east to west (Torhailoch to Hayat) sharing the stretch from Stadium to Lideta stations. The construction of the project has been completed and it has solved great deal of transportation problem in the capital. Addis Ababa Light Rail Transit Project won the 2016 C-40 cities award in transportation category, a prestigious world standard award.

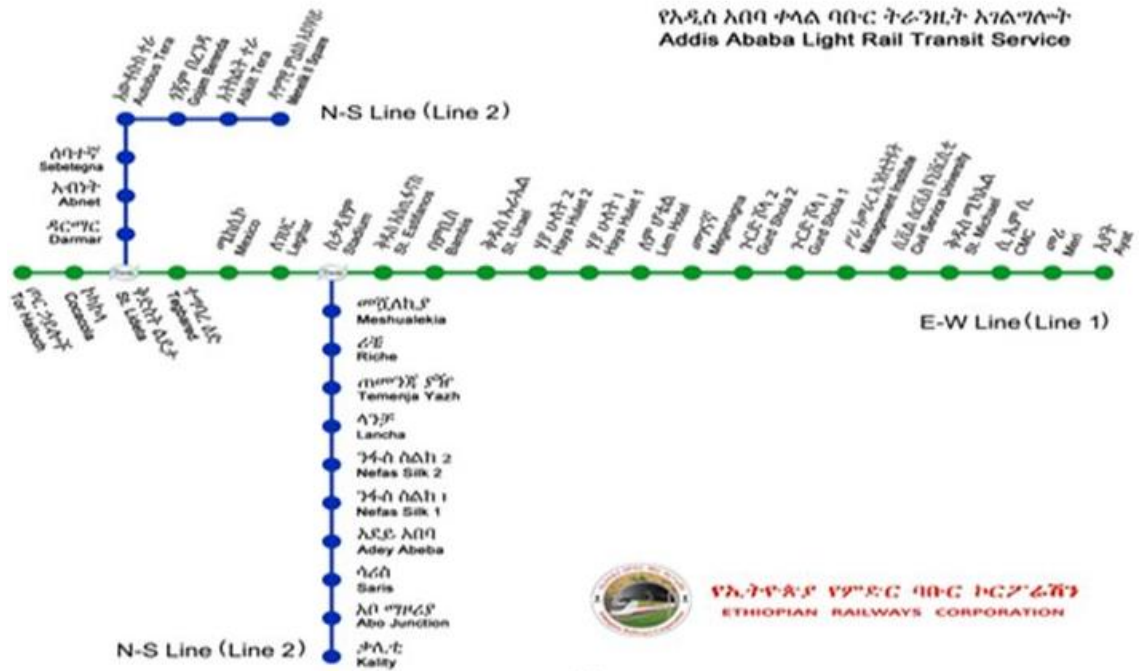


Figure 2: AALRT operation line.

A total of 41 trains are available for the operation and they are marked with different colors so that passengers can identify them easily. Trains with Green and White color provide service from East-West and trains with Blue and White color run from North to South direction. There are 39 stations that include escalators, lifts and stairs constructed to make stations accessible for persons with disabilities, aged people, and for those who are in need of it. Two depots are constructed at Kality and Ayat where the trains get maintenance. The Kality depot also serves as the head quarter for the Addis Ababa Light Rail Transit.

The operation and maintenance will be managed by a Chinese company called Shenzhen Metro Group, responsible mainly for the management. The North-South line began operation revenue service on September 20, 2015 and the East-West line began operation on November 10, 2015.

1.3. Statement of the Problem

In today competitive business environment, organizations are expected to operate continuously in competing market. To achieve a set of organizational goals and objective, they are expected to develop a strategy, which tackles these challenges. One of such strategy is asset management (AM) hereafter (Schneider et al., 2006). Asset Management is a term that describes the set of activities associated with asset related tasks such as, acquiring assets, providing logistic, maintaining assets, disposing and renewing assets, so as to effectively

and efficiently meet the desired objective (Nicholas & John, 2010). Asset management plays a strategic role in sustaining the organization's competitiveness through enhancing equipment availability, reliability and productivity. Without an asset management, organization can drift away from its customer and become uncompetitive within its environment this can cause unprofitability and bankruptcy of the organization.

Transportation organizations are nowadays confronted by challenges such as changing market dynamics and shifting consumer preferences. Consumers always prefer quality product/ service with lower price. To fulfill the consumer expectation the organizations anticipate to change their old strategy. Lack of asset management in transportation organizations to manage their huge physical infrastructure possibly will cause unavailability, unreliability and unproductivity of physical assets. This has an impact on their profit and to achieve organizational objectives and goals.

Among the vast modes of transportations available nowadays, railway transportation has an expensive infrastructure, operation and maintenance cost. Asset management plays a critical role in ensuring profitability of the railway industry by providing proper utilization of assets and resources. Asset management is important in order to achieve the business goal to meet the growing demand for improved overall operation of the organization. It enables the railway industry to achieve its goals and objectives with minimum wastage of cost and within a short period. This conceptual paper (thesis) focuses on assessment of asset management practices in ERC. The study also addresses the gap in the asset management system and it will give an idea on how to improve their asset management system.

1.4. Research Question

The following research questions are formulated to achieve the purpose of this study, as well as to serve as cardinal points around which the research is centered.

1. What are the currently existing asset management practices of the company?
2. How does the operation and maintenance dimension of asset management affect the operation of the company?
3. How does asset management contribute to improve operation?
4. What measures should the organization take to improve the asset management system?

1.5. Objectives of Study

1.5.1. General Objective

The purpose of this study is to assess the asset management practice on of Addis Ababa light railway network.

1.5.2. Specific Objectives

The objectives of the research work in precise terms are listed below:

1. To find out the trends of asset management practices in Addis Ababa light railway network.
2. To explore how operation and maintenance dimension of asset management day to day operation.
3. To indicate how asset management can contribute to improve over all operation.
4. To show which measure helps organization to improve the asset management system

1.6. Significance of the Study

This research has a great role in future analysis and uses of asset management to infrastructure maintenance (decision making), in general for AA-LRT and railway projects which are on pipe lines to give passengers and freight service by filling knowledge gap in such area. Railway infrastructure asset management helps to make reliable decision when, how, what and whom to perform the infrastructure maintenance to improve the capacity and service quality of the infrastructures. Therefore, the findings of the study are expected to promote the knowledge of asset management in relation to capacity and service quality of the infrastructure. On top of this, it may also serve as a valuable source of information for further studies.

1.7. Scope of the Study

The research is limited to asset management of railway infrastructure within operation and maintenance phase. It focuses only on the AALRT railway network while the national railway networks are not considered. Aspects like train system, power system, track, station lifts and escalators and communication system are considered.

The case studies are limited to assessment, with the primary aim of verifying the of asset management practice (operation and maintenance) and its impact on service delivery. This study does not utilize asset management models. It attempts to explain how the

operation and maintenance phase of asset management affect the organization's overall strategy.

1.8. Organization of the Paper

The body of this study is divided into five main chapters. The first chapter discusses background, objectives and methodology of the study. The second chapter covers the review of some of the journal articles, conference papers and publications which were referred to during the study. Also, in relation and comparison with previous works, what is done in this study will be stated. Research methodology is discussed in the third chapter. In addition, Research design, data collection method, and data analysis will be discussed in detail in this chapter. The results obtained from the qualitative data analysis of asset management of operation and maintenance and discussions based on these results are included in the fourth chapter. Finally, the fifth chapter cover conclusions drawn based on the results of the analysis, recommendations and future work.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

This section of the paper reviews previous researches that are essential to address the current study. Some of them are direct while others are indirectly related to the current study. The main principles and approaches used to formulate the previous studies are included in this section. There are many books, journals, conference papers; thesis and dissertations that are used to back –up the current paper.

2.2. Theoretical Review

2.2.1. General Concept of Asset Management

2.2.1.1. Asset

The standard ISO 5500 defines an asset as “an item, thing or entity that has potential or actual value to an organization” (Nicholas & John, 2010). From this definition it can be classified in to five types which are physical asset, financial asset, human asset, information asset and intangible asset. This paper mainly focuses on physical assets rather than other types of asset. Physical assets are items such as plant, machinery, buildings, roads, vehicles, railways, aircraft, pipes, wires, communications equipment, and other infrastructure.

2.2.1.2. Asset Management

Asset Management is a term that describes the set of activities associated with asset related tasks such as identifying funding requirements, acquiring assets, providing logistic, maintaining assets, disposing and renewing assets, so as to effectively and efficiently meet the desired objective (Nicholas & John, 2010). Similarly Nydot (1998) also defined asset management as a systematic process of operating, maintaining and upgrading transportation assets cost effectively. It combines engineering and mathematical analyses with sound business practice and economic theory. The total asset management concept expands the scope of conventional infrastructure management systems by addressing the human element and other support assets. The asset management is a combination of management, financial, economic, and engineering and other practices applied to physical assets with the objective of providing the required level of service in the most cost effective manner for present and future customers (International public work engineering Australia [IPWEA], 2006). (Institute of Asset Management [IOAM], 2008) & Victorian Government (1995) also define asset management is a systematical process of coordinated activities, such as planning, scheduling,

maintaining and controlling, to manage the assets that an organization owns. By managing its assets, an organization expects to deliver a certain level of service in a cost-effective manner and with low risks. It is the set of disciplines, methods, procedures and tools to optimize the whole life business impact of cost, performance and risk exposures of the company's physical assets (IAM, 2008). The above definitions and also other scholars' definitions agree on the upgrading, operating maintaining process of asset management. Moreover, many literatures highlighted asset management capacitate huge and complex organizations to provide the required level of service in the most cost effective and with short time IPWEA (2006), Austroads (1997), (National Public Works Council [NPWC] (1996)), Kennedy (2007) & CRC for integrated engineering asset management [CIEAM] (2008).

Organizations are nowadays confronted by challenges such as changing market dynamics and shifting consumer preferences. Consumer always prefers quality product/ service with lower price. To fulfill the consumer expectation the organizations expect to change their old strategy to new one, which is asset management. Based on above definition asset management has four phase (acquisitions, operation, maintenance and disposal phase) which are important for a success of one organization. To put an organization on right track, one must understand what really asset management means. Asset related managers want and need a better understanding of its meaning, impact, and value to their organizations.

2.2.2. Purpose Asset Management

In last two or three decade, business activities are changing dynamically and organizations are facing a lot of pressure to win business games. This is forcing organizations to consider adapting asset management strategies (Peter et al, 2013). As explained in many literatures, there are many reasons why asset management has today became the more popular activities. Globalization induced competition, environmental risks, turbulence in the market, Pressure for higher profitability and return on assets, more complicated and uncertain decision environment, and increased requirements from the safety and environmental point of view added the value of maintenance.

2.2.3. Role of Asset Management

Asset management provides a systematic approach to asset-based decisions, so that asset requirements, acquisition, and disposal match the objectives of the business by effectively and efficiently delivering business capability in regard to profitability and service delivery. It also provides appropriate logistic support over the asset life cycle, creating improvements in

asset performance. In addition, it promotes effective internal processes for managing assets IPWEA (2006), Austroads (1997), NPWC (1996), Kennedy, (2007) & CIEAM (2008) .

2.2.4. Goal of Asset Management

Asset management supports the realization of value while balancing financial, environmental and social costs, risk, level and quality of service, and asset performance. The key goal of asset management is the creation of value to the organization stakeholders, (Jones, 2000 & Humprey, 2003). It is about acquiring the knowledge needed to optimize trade-offs among financial performance, operational performance and risk exposure Jones (2000) & Sklar, (2004). According to Kennedy (2007) asset management can deliver higher returns to corporate stakeholders. A sound asset-management process ensures that business units do not sub optimize by emphasizing narrow criteria at the expense of overarching corporate objectives Humprey, (2003). Generally, based on the above literature and other related studies, asset management goal can be grouped as follows: cost efficiency, extend service life, meeting customer needs/requirements, Quality Durability, availability, and reliability.

2.2.5. Infrastructure Asset Management

The development infrastructure is one of the main drivers behind its economic development and the most important factor for successful global development in the world. Infrastructure supports the nation's economy and lifestyle, enabling mobility while providing an acceptable level of speed, safety, security, comfort, and reliability. Therefore, developing countries turn their attention on infrastructure expansion and rehabilitate the existing infrastructure after once it reaches the end of service life. This is cost the country to pay more dollars to renewal of the existing infrastructure. It is better to adopt asset management strategies to reduce extravagancy of the countries. Traditional management methods will no longer be sufficient to meet economic development and political demands of the countries.

Infrastructure Asset Management is a strategic and systematic process of optimizing decision-making in resources allocation with the goal of achieving planned alignment of an infrastructure asset with corporate goals throughout its lifecycle Vladimir, Lin Ma, and Wasana (2010). Asset Management is a strategic approach to the optimal allocation of resources for the management, operation, maintenance, and preservation of transportation infrastructure (Federal Highway Administration [FHWA], 1999). Based on the above definition the asset management is a vital to infrastructure organization to achieve established goals.

2.2.6. Transportation Asset Management

Transportation Asset Management is the strategic and systematic process of operating, maintaining, upgrading, and expanding physical assets effectively throughout their life cycle. It is focused on the business and engineering practices for resource allocation and utilization with the objective of better decision making based upon quality information and well defined objectives AASHTO (2013). Asset Management is a framework for making cost-effective resource allocation, programming and management decisions. It combines engineering principles with sound business practices and economic theory, and provides tools to facilitate a more organized logical and comprehensive approach to decision making (Transportation association of Canada (TAC), 2016). Transportation asset management (TAM) is a strategic approach to managing physical assets throughout their life cycle. TAM capacitates organizations to extend asset life, reduce operation and maintenance cost and meet a required level of service, in the most cost effective manner, through the management of assets for present and future customers. There are different types of transportation such as road, air, water and railway transportation. This study mainly focuses on the railway transportation. The railway transportation is discussed as the following:

2.2.7. Railway Transportation

The massive fiscal stimulus in the wake of the global financial crisis has refocused the international community onto the nature and role of infrastructure spending. Although this type of spending can provide a short-term demand stimulus to an economy, in the medium to longer term it can form a critical part of a successful economic growth strategy. Well designed infrastructure facilitates economies of scale, reduces costs of trade, and is thus central to specialization and the efficient production and consumption of goods and services. It is a vital ingredient to economic growth and development, which is the key to raising living standards (Timo, 2010). Rail transport has increased over the last decade and it is likely to further increase as passenger and cargo transportation shift from road and air to rail, due to rising energy costs, congestion of roads, and the demand to reduce CO₂ emissions. Railway transportation is an important mode of transportation for reasons of safety, cost, carbon emissions and energy requirements. It is a sustainable mode of transportation that can support the expansion of industrial activities and people's mobility through freight and passenger services (Patra, 2010). Railway transport is preferable transportation system than other mode of transportation due to, the technical demand on the railway system is increasing; there is a

drive for an increase in speed, axle load, volume of traffic and other essential operational requirements.

To meet the demand for enhanced railway infrastructure capacity, large modification of the infrastructure, improvement of traffic planning process and improvement of maintenance and renewal process are required. The obvious solution would be capital expansion of infrastructure but this is a long-term cost-intensive approach for improving railway transport performance. This therefore, makes successive improvement of maintenance and renewal (M&R) process an ideal and feasible way of improving availability, capacity and service quality of existing railway infrastructure (Stephen et al; 2015) . As railway infrastructure and their components have a long life span, their management requires a long term sustainable strategy. Ongoing technical and economic assessments are necessary to optimize the performance of railway infrastructure and receive the return on investment (ROI) in a manageable timeframe. Long-term asset management objectives and strategies are developed to steer the operation and maintenance activities in the right direction. These objectives need to be broken down into quantitative operation and maintenance objectives to achieve a high level of robustness, punctuality and capacity within the operational budget, at the lowest life cycle cost, with no or an acceptable level of risk. Asset management is a term that has rapidly gained influence in the rail industry. The basic defining principle, of an often complex system, is a group of co-ordinate activities that optimize asset performance to help deliver a business' objectives (Stenström, Parida, and Galar, 2012).

2.2.8. Railway Infrastructure Asset Management

Rail infrastructures are large, geographically spread out technical systems, also known as linear assets. Rail infrastructure includes system, subsystem and component levels (Christer, 2014). A railway infrastructure has usually a wide geographic extension and it is composed of many and heterogeneous items (tracks, bridge, tunnels, electrical transformation and conversion stations, electronic devices and stations for remote traffic regulation, etc.). The railway infrastructure is characterized by the presence of a huge number of items, each of them playing different functions for trains' circulation: i.e. electro-mechanical and electronic devices (railway track circuits, automatic controls, etc.) and mechanical items (railway switches, sentry box, etc.). Railway infrastructure maintenance plays a crucial role for rail transport. It aims at guaranteeing safety of operations and availability of railway tracks and related equipment for traffic regulation. Moreover, it is one major cost for rail transport operations. Thus, the increased competition in traffic market is asking for maintenance

improvement, aiming at the reduction of maintenance expenditures while keeping the safety of operations (Marco, 2012).

Railway transport system requires effective maintenance to achieve the business goal of safe, economic and sustainable transportation of passengers and goods. The growing demand for improved service quality and capacity target by railway infrastructure managers requires appropriate maintenance analysis to facilitate continuous improvement of infrastructure performance (Stephen, 2015). The maximum opportunity to reduce maintenance expenditure exists within the area of maintenance management of the overall operation and maintenance phase. The need to deliver maintenance is a fundamental requirement for any infrastructure organization. The ability to deliver the required maintenance can have a significant impact on cost and operations. It is a business objective for any asset owned organization to focus on investing the minimum levels of maintenance dollars to deliver the services desired by the customer. Rail infrastructure may be defined as delivering of Reliability, Availability, Maintainability, Safety, riding comfort, Health and Environmental friendliness and With minimized Life Cycle Costs / affordability or Durability. Establishing a maintenance frequency helps to preserve the inherent levels of service of an asset, including reliability and safety, at minimum cost.

Railway infrastructure is a key element for the economic growth and development of Ethiopia. Efficient and effective transport (railway) infrastructure is to provide access between spatially separated locations for the business and household sectors for both commodity and person movements. For the business sector, this involves connections between businesses with input sources, other businesses, and markets. For the household sector, it provides people with access to workplaces education facilities, shops, recreational, community and medical facilities.

Railway infrastructure can be measured according to the availability of infrastructure during hours of operation, time it takes to repair or replace failed infrastructure components and assets, Safety, comfort, Environmental friendliness, Affordability and Durability.

2.3. Empirical Literature Review

Organizations embark on an improvement plan they should have a frame work to perform task. This frame work helps the organization to identify strengths and weaknesses of the present system. The asset management framework adopted by industrial asset owners was developed in 1990s. It was including industry strategies, enterprise management, supply chain management and manufacturing and plant operations management Stapelberg (2006).

Hardwick (2008) highlighted the manufacture adopt technology based frame works which includes; demand management, system engineering, configuration management, integrated (logistic) support and total quality management. Infrastructure organizations adopt frame life cycle/phase which includes asset planning, asset creation, asset operations, and asset maintenance and asset performance (Vladimir, Lin Ma and Wasana, 2010). According to Mollentze (2005), high-level framework for AM will include the four phases that are asset acquisition, asset operation, and asset maintenance and asset disposal. In addition other scholars also agrees on four phase of asset management frame works.

According to Koronios (2013) asset management lifecycle can be classified in to five stages such as, asset commissioning, operation, maintenance, decommissioning and replacement. Asset management also can be grouped as planning, acquisition, operation/maintenance and disposal (PECB, 2016). El-Akruti & Dwight (2013) & Clarke (2002) in the same way categorizes the asset management life cycle /phase in to four stages that are acquisition, deploying, operation/ maintenance and retirement. Moreover, other scholars' agreed on the acquisition, operation/ maintenance and disposal phase of asset management.

The specifications developed during acquisition phase relate to the physical characteristics and capabilities of the required assets. During the Operation and Maintenance Phase the business goals define the operating environment for the assets and the performance goals needed. Operational performance is defined as a combination of production rate, quality and yield targets. Also maintenance must be defined and managed as a process. Processes need to be established in order to effectively manage maintenance activity. At the Disposal Phase, the end of the asset life cycle is reached when the asset is no longer capable of delivering the required operational performance, or cannot be cost effectively maintained to achieve the required levels of dependability. The options are either modification or disposal and replacement of the asset.

Operational and maintenance (O&M) costs are increasingly becoming an important aspect that cannot be ignored. Indeed research shows that the O&M cost constitutes as much as 70% of the asset's total cost of ownership (Koronios et al, 2007). Hence, the operation and maintenance phase of asset management get more attention. However, it still need more research to escalate attention to a single step of asset management of an organization.

In the last two decades organizations faced challenges from competitive business environment and shifting consumer preferences. The rising cost of doing business coupled with a fast changing competitive business environment is forcing organizations to consider

operation and maintenance phase of asset management strategies, not just as a cost saving measure, but also to remain competitive. Implementing an efficient and effective maintenance program is one way of achieving this desired competitiveness (Peter et al, 2013). Physical asset management in the process industry has primarily focused on maintenance management models Charles (2007). Asset maintenance plays a strategic role in sustaining the organization's competitiveness through enhancing equipment availability, reliability and productivity (Stephen et al, 2015). The costs for maintenance, repair, and renewal are substantially reduced with availability of asset information for asset manager at the right time Faiz and Eran (2009).

Organizations are increasingly working on operation and maintenance phase of asset management to lead the competitive business environment by giving what the consumer/customer expected with cost effective manner by achieving organizational objectives. Asset operation and maintenance frame work model. (Mollentze, 2005) highlighted asset operation and maintenance frame work should contain technology, maintenance tactic, human resource, operating procedure, system and information, material management, and performance management indispensable to reach operational excellence/ to continue in competitive market environment and to achieve organization goal. Furthermore, many literatures explained that maintenance and operating procedure, skilled labor, technology, system and information, material and performance management are very important for organizations to offer quality service with lower price.

Based on explanation of Peter et al, (2013), Charles (2007), Stephen et al, (2015), Eran (2009). & (Mollentze, 2005) the asset management operation and maintenance phase consist of the elements: maintenance and operating procedure, skilled labor, technology, system and information, material and performance management. Each element are discussed below.

Maintenance system is a process to analyze and understand failure modes of assets and the application of appropriate maintenance strategy / procedure to prevent these failures. This includes the system and processes as well as the supporting tools and techniques to be used to prevent the failures of asset to achieve and sustain an inherent reliability of an organization's asset. It involves the application of the optimum maintenance mix on the assets to ensure the lowest total cost of Preventive, Predictive, Corrective, Emergency or Deferred, Breakdowns and non-breakdown Maintenance.

Operating system is a very important element to ensure the correct operation and care for the asset. Operators take a charge of a multi- million dollar asset. This mean the operator should

be well trained/ instructed based on operating procedure before he/she starts to operate the asset. If the operator of the asset does this correctly the asset can be expected to perform well. This diminishes unnecessary wastage and maintenance cost and breakdown time.

If the organizations need to succeed and retain for long time in this competitive business environment, they require skilled, high performing and competent staffs. The organizations that have superior staffs can easily win the competition by reducing unwanted expense.

Technology is a vital backbone for any type of organizations to stay in business and to meet objective/ goal. Updated technology is required to improve the way doing business in an organization. It can help organizations with improved business processes, improved equipment, improved systems and even improved human development. This is an important part of Asset Management as a whole.

Systems are installed to support and enable the execution of business processes within an organization. If there is a system in the organization, it is easy to access data important for asset management. It may include operating parameters, resource usage, maintenance tasks performed, materials or capital consumed by an asset and procedure and process followed by staff.

Information is a crucial instrument for the organization to perform their task and to make valuable decision based on reliable data. A system is important to acquire useful information with recording available data timely. Data has to be recorded in a proper format so that it allows easy extraction and manipulation to provide the required information. It is also important to ensure integration between the different disciplines and departments to consolidate information.

Proper materials management processes ensure the availability of the correct spares and materials with acceptable quality for timely execution of the operation and maintenance activities. This means there is no break down time and delay on service delivery due to unavailability of materials and spares for operation and maintenance.

Performance management/measurement is a process for measuring the effectiveness of the asset management purpose. This process includes the identification of measurements, the setting of targets, the measurement and displaying, as well as the analysis and interpretation of measured results. The objectives of Performance Measurement are to develop and drive the correct performance management practices within asset management.

Based on the above review there is still the gap in the area of asset management to improve the service quality in all level. The study shows the relationship between asset management

operation and maintenance with infrastructure (railway) service quality and capacity dimension. To this end the objective of this section is to summarize the idea got from previous work and to bring out the contributions with idea generated.

As discussed on pervious literatures, asset management has a direct relation with railway infrastructure operation. The operation could be evaluated with the use of asset management elements ; maintenance system, operating system, skilled employment, technology, system and information, material management and performance.

This paper focuses on an organization called Ethiopian Railway Corporation. The paper is done by acquiring data from interviewing top managers and by distributing questionnaires to employees who are posted on operation and maintenance tasks.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1. Introduction

This study was intended to be carried out at Ethiopian Railway corporation specifically railway infrastructure of Addis Ababa Light Railway Transit Service. The study was designed as qualitative and quantitative study, which is used to gather the relevant and pertinent information with regard the asset management practices of the organization.

The research is a survey research in type. This method is best suited due to its quick, inexpensive, efficient and accurate means of assessing relevant information of a population. The research method involves the use of questionnaires and interviews to collect data that are suited for remotely collecting data about a population. Most of the time questionnaire surveys are preferred than other methods because they are economical in terms of researcher time, effort and cost.

3.2. Research Design

Research design means a framework or blue print for conducting business research project in an efficient manner. It details the procedures necessary for collection, measurement and analysis of information, which helps the researcher to solve business research problems. It includes four important considerations: the conceptual framework, the strategy, the identification of whom and what to study on and the tools and procedures to be used for collecting and analyzing data. The research design basically is divided into several types' qualitative research vs quantitative research, applied vs fundamental, descriptive vs analytical and theoretical vs empirical (Kothari, 2004).

In this study, the researcher was used quantitative and qualitative research method. Quantitative research is characterized by its aims, which relate to understanding some aspect of social life, and its methods, which generate numbers rather than, words, as data for analysis (Michael & Michael, 2002).

For the reason of the Railway infrastructure is a cost incentive investment, the researcher is exercised a case study to do the research. Yin (2009) suggests that there are five reasons for a single case design, namely when case is critical in some way, unique or typical, revelatory (previously inaccessible to researchers) or study is longitudinal, comparing the case at

different points in time. The case study method in research demands a high degree of depth, breadth and rigour, with careful attention to showing the way in which evidence supports the conclusions reached. According to Yin (2014) a research question starts with: how, what and why, the case study method is particularly appropriate. A research question starting with what is also accurate especially for a relativist approach.

Case study was employed as research design to do this descriptive quantitative research due to the technology new and unique for the country. Accordingly, Survey questionnaires, interviews and secondary data were used to collect quantitative and qualitative data from respondents.

3.3. Population And Sampling Techniques

3.3.1. Population

Population is “a set of elements that the research focuses upon which the results obtained by testing the sample should be generalized” (Bless & Higson, 1995). The study’s research objectives and the characteristics of the study population determine which and how many people to be selected.

The study is conducted on Ethiopian Railway Corporation Addis Ababa Light Railway Transit Service which is located in Addis Ababa near to kality subcity. The head office is the place where all the work process such as the core process, the support process and the other management process is found. All the working units of the organization presented in the organization. For this study, the population from which the samples will be drawn consists of the Addis Ababa Light Rail Transit Service maintenance team, Addis Ababa light rail transit service operation team, Addis Ababa light rail transit service Planning team, the Procurement committee, the warehouse workers. The reason for selecting these participants of interviews and questionnaire filling is because they are directly engaged to the asset management job.

3.3.2. Sampling Techniques

In this study, the researcher employed the purposive sampling method for the selection of the participants / interviewees and questionnaires. According to Michael and Michael (2002) Purposive sampling, one of the most common sampling strategies, groups participants according to preselected criteria relevant to a particular research question. Purposive sample sizes are often determined on the basis of theoretical saturation. Purposive sampling is therefore most successful when data review and analysis are done in conjunction with data

collection. Purposive sampling refers to intentionally chosen sample according to the needs of the study. Purposive sampling was applied to make the sample representative of all participants.

The study is a purposive type of study. Hence, 96 questionnaires were distributed to each employees that were on duty in two shifts were selected from the total population of 420 employees by applying the below statistical formula. Also, 5 managers were interviewed to collect information from manager side to balance data collection and achieve research objectives.

$$n = \frac{N}{1 + N * e^2}$$

where ;

n= Sample size

N= population size

e= level of precision ,yemane (1967)

$$n = \frac{420}{1 + 420 * 0.08^2}$$

Sample size (n)=96 participant

3.4. Source of Data and Data Collection Tools

The data collection is done by conducting interviews and distributing questionnaires as a primary source of data. Also, secondary sources of data such manual, software, website, books, research finding, external sources will be employed and Archives from data collecting institutions were used as an input for data collection.

The interviews were conducted with AALRT manager, maintenance director, planning director, customer service manager, and warehouse manager. The questionnaires were distributed amongst the planning team, maintenance team, train master team, customer service team, maintenance manager and warehouse team. In this study the both set of methods of data collection have been utilized in the same emphasis and they are aimed to provide valuable information to this research.

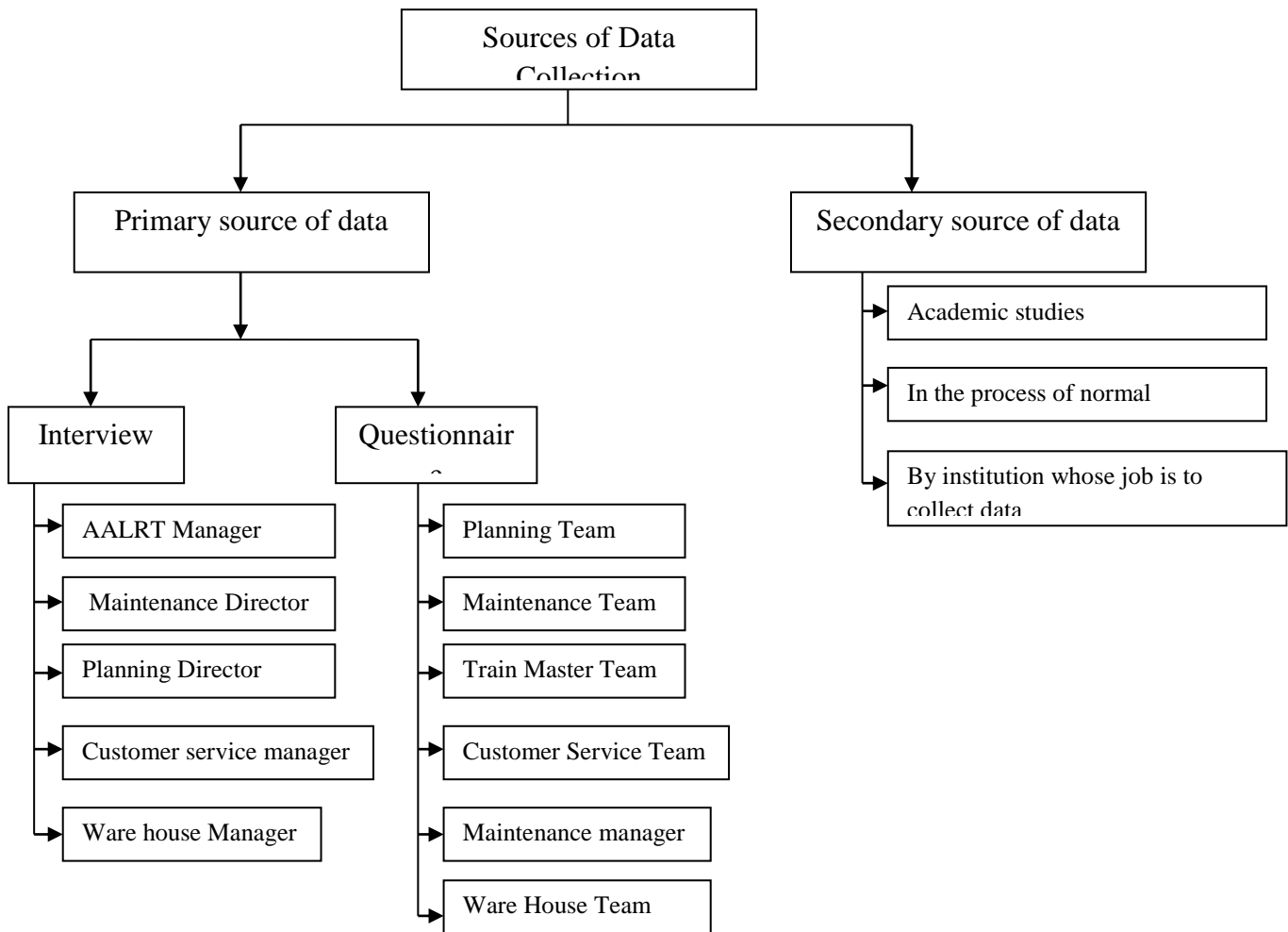


Figure 3: Data collection method.

3.5. Data Collection Procedure

3.5.1. Primary Sources of Data

The primary data are those which are collected are new and for the first time, and thus happen to be original in character. In order to obtain primary information, face-to-face interviews and questionnaire were employed.

I. Interview

Interviewing of selected individuals is a very important method often used by qualitative researchers. Interviews resemble everyday conversations while being focused on the researcher's needs for data in order to ensure that the findings reflect what the research set out to answer (Michael & Michael, 2004).

The researcher made a selection of the participants for the interview. Then used the semi-structured interview, planned and organized in line with the objective of the research. The

participants were encouraged to respond to the questions as accurately as possible. In addition, questions were designed in Amharic and English Language to ensure proper responses from the participants without any miscommunications.

II. Questionnaire

Questionnaire method is another approach through which the primary data were collected. Required information on the basis of asset management system were listed. Then, questions with suitable degree of measurement were framed and pre tested as a first draft. After making some adjustments, final draft of questionnaire was prepared. Once the questionnaire preparation was finalized it was distributed amongst the selected population sample.

3.5.2. Secondary Data

Secondary data is data which the researcher did not collect directly from respondent or subjects. It was not collected with the researcher's purpose and objectives in mind. It may have been collected by other researchers in the process of academic studies or by institutions that collect data

In this research the secondary data source were used to review the data management system of AALRT. Asset management manual, strategy, maintenance program, maintenance data and asset record were utilized to perform data collection for the study.

3.6. Data Analysis Methods

Data analysis is a process whereby researchers make search and arrange in order to enhance their knowledge of the data and to present what they learned to others. Analysis of data require a number of closely related operations such as estimation of categories, application of this categories to row data through coding, tabulation and then drawing quantitative and qualitative interpretations. These operations are taken in order to check for omissions, illegibility and consistency and making them ready for coding and storage.

Quantitative data analysis (QDA) is the range of processes and procedures where by the researcher studies quantitative and qualitative data collected and draws explanations, understanding or interpretation of a situation. It is usually based on an interpretative philosophy. The idea is to examine the meaningful and symbolic content of quantitative and qualitative data.

To analyze the collected data of this study the researcher used quantitative and qualitative data analyzing means. Data gathered from interview were edited, coded, organized, arranged and summarized in the form narrative analysis method. Also, the data gathered from respondent

through questionnaire during survey were edited, coded and entered in to Excel Software. Then, the data was analyzed using different function of excel software. Quantitve analysis of the data collected using the questionnaire is presented by the use of tabulation, piegraph and line graphs.

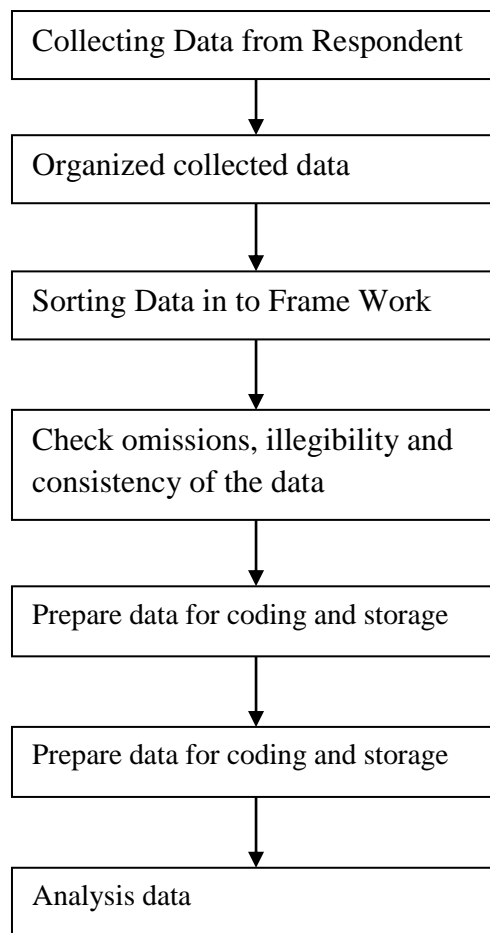


Figure 4:Qualitative data analysis method steps of this study.

3.7. Realiability And Validity of Tools

Validity defined as the extent to which data collection methods accurately measure what they were intended to measure . The study deployed a content validity to measure how well a set of scale items matches with the relevant content domain of the construct.

Numbers of different steps was taken to ensure the validity of the study:

- Data was collected from the reliable sources, from respondent who has experiences in operation and maintenance of asset management
- To avoid subjectivity and imprecise, experts were asking to give their comment on the statement of the questionnaires.

- The statements in the questionnaires adopted from different literature to meet the purpose of the research.
- A pilot test was conducted before the distribution of the questionnaire to the sampled population of the study. This is because pilot testing is considered very essential and to evaluate whether the questionnaires were appropriate or not to generate adequate information and to make the necessary modification.
- Furthermore, the study was tested and examined by the advisor and other colleagues to determine its clarity.

Reliability is the degree to which the measure of a construct is consistent or dependable. The researcher conducted a reliability test on the eight dimensions of asset management. The reliability of the research instrument (structured questionnaire) was measured by the Cronbach's alpha and all of the eight dimensions has a value greater than 0.6.

3.8. Ethical Consideration

The study took ethical issues into consideration. The researcher strongly believes that respondents are the real owners of this research. All respect should go to them and they have the right to be treated with all dignity and politeness. In line with this, the researcher has an obligation to assure the respondents of the anonymity and confidentiality of understanding the obligation of any researcher has, the researcher assured the respondents of the information they were supplied.

The researcher was selected an appropriate time to conduct the interview and to distribute the questionnaires, to avoid bias and unfocused answers. And also the researcher was explained the purpose and objective of the study, to make respondents feel secured and confidentiality. Name of the respondents' and details was not asked to write in order to increase the confidentiality of the information they give. Only the willing respondent was included.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1. Introduction

This chapter deals with presentation, analysis and interpretation of data obtained from respondents through administration of a questionnaire, interviews and secondary data reference. A total of 96 questionnaires were distributed to respondent of which 80 usable questionnaires were collected back and the total response rate for the study was 83.3 % in total. As a result, the paper's findings are made using the 80 questionnaires. Thus, the analysis is based on the valid 80 questionnaires response from employees.

The first section presents the general characteristics and demographic features of respondents which are the subjects of the study. The second section of the chapter discusses about the asset management dimension/ element based on the collected data.

4.2. General Characteristics of Respondents

In the first part of the survey questionnaire, respondents provided their profile data that include gender, age and educational background. Based on the questionnaires collected back the general characteristics of respondents presented as follows.

Table 1: Personal Information

Item No	Characteristic	Response Item	Frequency	Percent
1	Education Background	Level -1	1	1%
		Level-2	2	3%
		level-3	18	23%
		Diploma	36	45%
		BSc	17	21%
		MSc/MBA	2	3%
		other	4	5%
	Total	80	100%	
2	Age	Response Item	Frequency	Percent
		18-25	46	58%
		26-35	31	39%
		36-45	3	4%
		46-50	0	0
		above 50	0	0
	Total	80	100%	
3	Gender	Response Item	Frequency	Percent
		Male	71	89%
		Female	9	11%
		Total	80	100%

As can be observed in table 1, majority of the respondents 71(89%) are male. While the rest 9 (11%) of them are female. This indicates that, majority of the employee in an organization are dominated by the male gender.

Based on the above table, majority 46 of the respondents (57%) are found in the age group of 18 to 25. And also 31 of them (39%) are within the age group of 26 to 35 and 3 (4%) are in the age group of 36-45. There is no participant from the age group 46 and above. Hence, the employees of the organization are within the age group of 18-35. This implies that the organization have an advantage of the youth with regard to effort, knowledge and motivation.

As observed from table1 above, 36 of the respondents (45%) have diploma/ level- 4, 18 of them (23%) have a Level-3, 17 of them (21%) have a B.Sc degree, 4 of them (5%) have level 5 and 2 of them (3%) have a MSc degree. This may imply that, the respondents are capable to clearly express their view concerning the topic.

4.3. Analysis of the Finding

This section discusses the attitude of respondent regarding variables related to the asset management in organization. The researcher used an attitude scale and respondents are requested their level of agreement or disagreement about the parameters of the study. This attitude scale was the Liker's five points scale used to compare the views of the respondents to the stated variables.

Thus, each opinion provided in the questionnaire's measurement scale has the following rate.

1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

4.3.1. Employment Dimension

Table 2: Respondent position regarding employee dimension.

Variable	Responses					Frequency /Percentage	Total
	Strong disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strong agree (5)		
The employee are well educated (Q1)	7	6	18	27	22	F	80
	9%	8%	23%	34%	27%	%	100%
The employee received all the necessary training before they were assigned a job (Q2)	6	20	10	26	18	F	80
	8%	25%	13%	33%	23%	%	100%
To improve knowledge and skill of the employee continues training are conducted (Q3)	17	13	12	30	8	F	80
	20%	16%	15%	38%	10%	%	100%
The employee are motivated to do their job (Q4)	12	11	10	20	27	F	80
	15%	14%	13%	24%	34%	%	100%
The employees receives bonus and benefit for good performance in their job (Q5)	50	9	6	4	11	F	80
	63%	11%	8%	5%	13%	%	100%
Total percentage	23%	15%	14%	27%	21%		
Mean	18.4	11.8	11.2	21.4	17.2		
Standard Deviation	18.202	5.263	4.382	10.383	7.791		

In order to generate the overall score of asset management employee respondents were asked to rate the level of their position on Likert's 5 point scale. The responses of the question are

shown on table 2 which indicates that 21% of the respondents strongly agreed, 27% agreed, (14 %) were neutral, 15% disagreed and 23% strongly disagreed. The largest number of respondents 27% have expressed that they are agreed. However, as shown on the above table more than 50% of the response goes to neutral and disagreed. This means that the organization must examine/review its employee and administration guide book to excel its income and delivery to the required level of service.

As we can see on above tabular analysis most of the employees agreed with the statement “ the employees are well educated. “Hence, Having an educated manpower assists the organization to realize the strategic objective with regard to having a competent employee that put the organization to the first level of business.

The majority of the respondents agreed with the statement “ the employee received all the necessary training before they were assigned a job.” This allows the organization to be more efficient and effective by avoiding unnecessary wastage of resources and errors since the employees are trained about what expected from them. As we can see on the above table most of the employees agree with them being able to do their jobs with out expecting constant supervision. However, there are no reward mechanisms to motivate the employees who performed well in thier job.

Interview results from management side implies that there are well educated, trained and motivated employees in the organization. However, as the manager of the organization explained, still they need additional expertise and engineers to achieve the starategic objective of the organization. The interview and document analysis also revealed that there is an unorganized reward system to those doing extraordinary job by saving life, minimizing cost, identifying problems and avoiding accident that cause organizational and public property damages. However, there is no regular and documented appraisal and rewarded system. As manager explained, they are working to have a regular appraisal and reward system in the organization and also punishment mechanisms for undisciplined employees.

In summary, the organization have a skilled and motivated employees that can help to attain the organizational goals. The organization shall conduct a continous training to improve skill and knowledge of the employees. Also, the organization is planning have a regular appraisal, reward and punishment mechanisis to motivate employees. This can help the organanazation to establish good asset management system.

4.3.2. Maintenance Dimension

Table 3: Respondent position regarding maintenance tactics and procedure.

No	Variable	Responses					Frequency/Percentage	Total
		Strong disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strong agree (5)		
1	There is a clearly defined procedure for maintenance (Q1)	18	14	18	16	14	F	80
		23%	18%	23%	20%	18%	%	100%
2	There are all the necessary maintenance equipment (Q2)	18	22	16	16	8	F	80
		23%	28%	20%	20%	10%	%	100%
3	Preventive maintenance is conducted periodically (Q3)	14	9	13	26	18	F	80
		18%	11%	16%	33%	22%	%	100%
4	In case of failure, immediate maintenance procedure is taken (Q4)	11	7	16	22	24	F	80
		14%	9%	20%	28%	29%	%	100%
Mean Percentage		20%	17%	20%	25%	20%		
Mean		15.25	13	15.75	20	15.5		
Standard Deviation		3.403	6.683	2.062	4.899	6.245		

As seen on literature review part of the study, maintenance of physical asset is a crucial ingredient for successful use of an infrastructure to achieve the strategic goal of owner organizations. Four questions related to maintenance procedure and tactics were included in the questionnaire. Similar to the other variables presented so far, a position scale was used and respondents were asked to provide their level of agreement or disagreement to the maintenance strategies and their views were analyzed and presented on table 3. As seen on above table (20%) respondents strongly agreed, (25%) respondents agreed, (20%) respondents were neutral, and (17%) respondents disagreed. The majority of respondents i.e. (47%) agreed with the statement of mentioned on above table. Around 37% of respondents have expressed their disagreement on statement mentioned on table. The following diagram shows the detail information related to response level.

As it can be seen on the above table, majority of the respondent disagreed with the statement “ there is a clearly defined procedure for maintenance “. This indicates that the employees assigned on maintenance do their job without guidance of the rules and regulations of maintenance tasks.

The majority of the respondents disagree with the statement “there are all the necessary maintenance equipment”. Hence, the organization’s equipment and tools to perform maintenance are not adequate. This may cause damages to parts due to lack of proper tools and equipments to repair failed parts. As can be seen on table above a large amount of the respondent agreed with the statement “Preventive maintenance is conducted periodically” and ” In case of failure immediate maintenance procedure is taken”. It shows that there is a good trend of maintenance procedure to prevent parts from being damaged.

According to analysis of interviews and other related document, the shortage of maintenance equipment and tools is as a result of majority of the equipments are imported from abroad and have some custom and logistic issues.

4.3.3. Operation Dimension

An organization to be successful, it will be expected to operate continuously in competing market with high product quality and affordable price. By principle, if the organization is able to operate with minimum wastage, it will be profitable. Accordingly, the researcher assessed operation of asset management with respect to four core dimensions: training of operator, operational manual, procedure followed by operator and accident that occur due to operators. Based on the dimensions, the following responses were collected from respondent (employees of the organization).

Table 4: Response regarding operation of asset management.

S. No	Variable	Responses					Frequency/Percentage	Total
		Strong disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strong agree (5)		
1	There are trained before assigned to a job (Q1)	7	6	14	32	21	F	80
		9%	8%	18%	40%	26%	%	100%
2	There is a fully documented operation manual (Q2)	20	9	17	20	14	F	80
		26%	12%	22%	23%	18%	%	100%
3	Operators follows procedure correctly (Q3)	10	12	13	25	20	F	80
		13%	15%	16%	31%	25%	%	100%
4	Accidents that occur due to operator's mistake is catastrophic (Q)	25	14	12	15	13	F	80
		28%	19%	16%	20%	17%	%	100%
Percentage Mean		19%	14%	18%	29%	22%		
Mean		15.5	10.25	14	23	17		
Standard Devaition		8.426	3.500	2.160	7.257	4.082		

As shown on table 4 (22%) respondents strongly agreed, (29%) respondents agreed, (18 %) respondents were neutral, (14%) respondents' disagreed and 19% strongly disagreed. The largest number of respondents 51% have expressed that they agree with operation procedure of the organization. As seen on diagram below half of the respondents agreed with idea of operators are trained properly before assigned to a job, there is a fully documented manual, and an operator follows the right procedures.

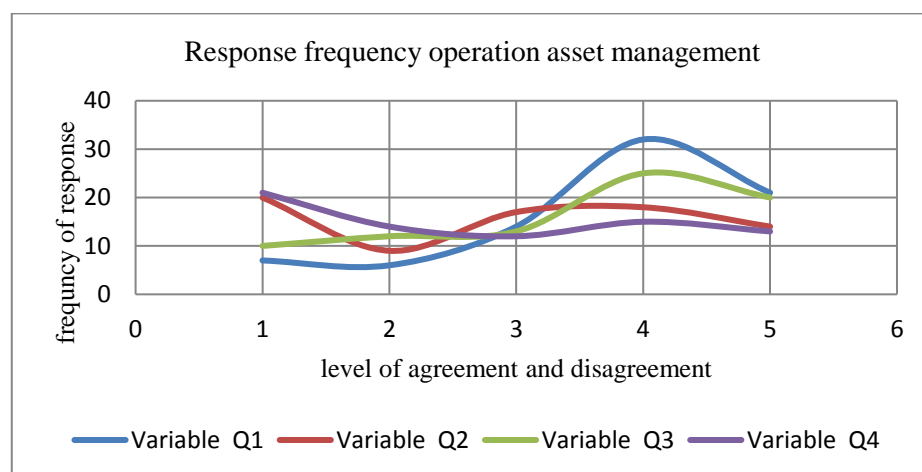


Figure 5: Respondent position concerning operation of asset management.

As it can be seen on the above figure majority of the respondent agreed with the statement of “employees are trained before assigned to an operation job”. This gives a clue to employees, what expected from them and how to perform jobs. And also this may help the employee to eliminate accidents during operation due to lack of knowledge. A large number of the respondent agree with the statement “operators follows procedure correctly”. It increases the profitability and service quality of the organization by eliminating failurity. However, as shown on the figure above, there are accidents due to the operators mistakes. This may indicate that the operators are not trained or the procedure they follow is prone to human error. According to an interview with the operation manager there is a training for operators before they are assigned to jobs. He also claims that there is no accident due to operator’s error. The contradiction observed between the questionnaire and interview analysis regarding safety may have arised from the trainings of the operators was not conducted properly.

As seen on the diagram above half of the respondents agreed with ”there is a fully documented operation manual“ and also half of the respondent disagreed with the statement. According to the interviewee and related document, there are different manuals for operation and maintenance in soft copy format. But these manuals are not organized and fully documented in hard copy format. Also, the soft copy version of manual is not available to all employees because it needs some correction and editing.

From the analysis, it can be concluded that the organization have a good trainng system on operation. However, the safety procedure is not well formed since the operation manual has never been made available properly for operators.

4.3.4. Technology Dimension

Technologies are vital for any type of organizations to stay in business and meet strategic goals through improving the way of doing business. In line with this, the researcher assessed status of technology use of AALRT as follows.

Table 5: Respondent position concerning technology.

S.No	Variable	Responses					Frequency/ Percentage	Total
		Strong disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strong agree (5)		
1	Operation and maintenance are supported by advance technologies(Q1)	14	8	12	24	22	F	80
		18%	10%	15%	30%	28%	%	100%

As can be seen in above table, in response to technologies question the majority of the respondents which is around 58% agreed with there is an advance technologies in the organization. Others also 28% of the respondent are not agreed with their organization supported by advance technologies to perform operation and maintenance of infrastructure. Some of the respondents are impartial.

As shown on the table above majority of the respondents agreed that there is an up to date technology to perform the maintenance and operation jobs. According to analysis of interviews, the interviewees explained and document seen there are up to date technologies involved in operation and maintenance works. They also explained how these technologies assisted them to achieve operation excellence to delivery service.

In summary, the organization have an excellent operation and maintenance asset management regarding technologies.

4.3.5. System Dimension

Systems are installed to support and enable the execution of business processes within an organization. If there is a system in the organization, it is easier to access data and it helps staffs to identify their role in the organization.

Table 6: Respondent position concerning System

S · N o	Variable	Responses					Frequen cy/Perce ntage	Tota l
		Strong disagre e (1)	Disagre e (2)	Neutra l (3)	Agree (4)	Strong agree (5)		
1	Operation and maintenance is supported by system (Q1)	15	11	20	22	15	F	80
		19%	14%	25%	28%	15%	%	100%
2	The system make the service adequate (Q2)	18	9	18	21	14	F	80
		23%	12%	23%	27%	15%	%	100%
3	All the necessary information are available when need (Q3)	18	14	13	21	10	F	80
		24%	18%	17%	28%	13%	%	100%
	Percentage Mean	22%	15%	22%	28%	14%	100%	
	Mean	17	11.33333333	17	21.333333	13		
	Standard Deviation	1.732	2.517	3.606	0.577	2.646		

As shown in table 6 Q1 around 43% (35) of the respondents i.e. majority said there is a system in organization. While the remaining 33 % (26) answered there is no system in the organization to perform operation and maintenance. In conclusion, the organization has a system but it is unknown by some employees. This might affect effectiveness of the system in the organization.

As Q2 of the same table indicates that, majority of the respondents i.e. 42% (33) agreed with the statement 'the system make the service adequate' while the remaining 35% (27) of them disagreed with 'the system make the service ample'. Some of them 23% (18) positioned on the middle of both thoughts. This indicates that the organization should be creating awareness to it staff about the importance of the system to make its business competitive.

As Q3 of the same table points out that, 41% (31) of the respondents agreed with there is a well prepared and documented data available in organization. While the remaining 42% (32) of them did not agree with all the necessary information are available when needed. Some of 17% (13) respondents position on impartial.

Based on the analysis, there is a system in organization. However, the organization does not have an adequate and organized system to manage its tasks.

According to the interview and observation with the managers, there is no compiled system within the organization yet. But top managers are trying to provide a system in the organization by implementing MIS management system.

4.3.6. Information Dimension

Data is generated continuously from the assets and activities performed on and around assets. It can include data concerning operating parameters, resource usage, maintenance tasks performed and materials of an asset. This data can be transformed into usable information assisting in the decision making. Data has to be recorded in a proper format so that it allows easy extraction and manipulation to provide the required information.

Table 7: Respondent position concerning information.

No	Variable	Responses					Frequency/Percentage	Total
		Strong disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strong agree (5)		
1	Information related to maintenance and operation is available when it need (Q1)	11	11	16	24	18	F	80
		14%	14%	20%	30%	23%	%	100%
2	Recorded information can be used as an input for improving maintenance and operation tasks (Q2)	10	14	16	30	10	F	80
		13%	18%	21%	37%	12%	%	100%
Percentage mean		14%	16%	21%	34%	18%		
Mean		10.5	12.5	16	27	14		
Standard Deviation		0.707	2.121	0.000	4.243	5.657		

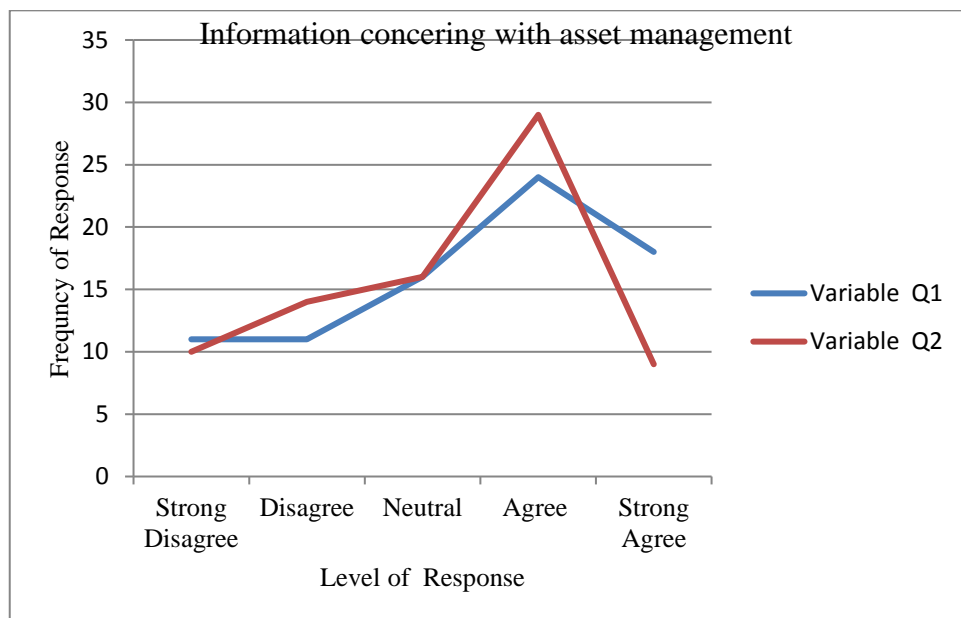


Figure 6: Information concerning with asset management

As can be seen on the above table and diagram for questions 1, 42 of the 80 respondents (53%) agree with all operation and maintenance difficulties are logged and recorded. While, (11) of the respondents 28% disagree. Although for that of question 2, 13 % of the respondents strongly disagree and only 12% of them strongly agree on recorded information can be used as an input for improving maintenance and operation tasks. Majority of respondent that is 37% agreed on it.

As we can see on the above table majority of the respondent agreed with the statements of “all operation and maintenance difficulties are logged in record“. It creates an opportunity to employees to learn from past experience and also it can helps them take a lesson how to correct similar difficulties. As shown on diagram, large number of the respondents agree with the statement of “recorded information can be used as an input for improving maintenance and operation tasks ”. This indicate that there is a regular improvement in the organization.

From analysis of interview and secondary data, there is information management tools in the organization such as wechat group, QQ and email to exchange instant, daily, and weekly reports. Based on the information obtained from those channel, responsible manager or experts take action if any problem occurs. If the problem is beyond his/her capacity, he/she shall report to higher official on time. As the interviewees said, this way of information exchanging helped them to get information timely and communicate with accountable personnel but the country’s inefficient internet networking system poses a difficulty. Other way of information transmission method is regular weekly meeting with the executive group. As a result of this, communication is limited to manager and experts while lower employee does not recieve information timely. This may affect the performance and service delivery of the organization.

Generally , from the collected data it can observed that the organization have the information management tools. This can assist the organization in recording, preparing and organizing data and improve maintenance and operation phase of asset management.

4.3.7. Material Management Dimension

Material management is the systems and processes for the provisioning, stock holding, issuing of materials and spares as well as optimization of the holding facilities. Proper materials management processes and systems should ensure the availability of the correct spares and materials to the operations and maintenance for the timely execution of activities. Maintenance and operation activities should order what materials and spares will be kept available and in what quantities according to the maintenance and operations plans. Therefore, material management is a backbone to maintenance and operation of asset management.

Table 8: Material management dimension

No	Variable	Responses					Frequency/Percentage	Total
		Strong disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strong agree (5)		
1	Spare parts are available in storage (Q1)	28	20	17	7	6	F	80
		36%	26%	22%	9%	8%	%	100%
2	parts that need replacement can be replaced from stock without bureaucratic (Q2)	26	20	20	8	8	F	80
		32%	23%	25%	10%	10%	%	100%
Mean		27	20	18.5	7.5	7		
Percentage mean		34.0%	24.5%	23.5%	9.5%	9.0%		
Standard Deviations		1.414	0.000	2.121	0.707	1.414		

As can be seen from table 8, for question 1, 28 of the 80 respondents or 36% strongly disagree with its availability while 8% of them strongly agree on spare parts available in storage. Though for that of question 2, 32 % of the respondents strongly disagree on it and only 10% of them strongly agree. Generally 68% of the respondents answered that there is no spare part in ware house of the organization.

As can be seen from analysis largest number of the respondent disagreed with availability of spare parts in ware house.

Interview and secondary data results from the management side indicate that material management is not effective in the organization due to lack of foreign exchange, spare part supplier shortage and the contractor unable to meet contractual obligation to provide a one year warranty. This caused delay on maintenance and down time on operation. It tremendously affected operation and maintenance asset management.

4.3.8. Performance Evaluation Dimension

Performance evaluation is the structured process for measuring the effectiveness of the operation and maintenance asset management. Objectives of Performance evaluation are to develop and drive the correct performance management practices within asset management. In this research, three questions raised that have a direct relation with performance management practice in any organization.

Table 9: Respondent position concerning performance

No	Variable	Responses					Frequency/Percentage	Total
		Strong disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strong agree (5)		
1	Operational and maintenance works evaluated periodically	14	10	17	25	14	F	80
		18%	13%	21%	31%	18%	%	100%
2	Corrective measure are taken using evaluation feed back (Q2)	19	9	20	21	11	F	80
		24%	12%	26%	26%	13%	%	100%
3	Performance management contributed to good result(Q3)	19	11	23	17	10	F	80
		24%	14%	28%	22%	13%	%	100%
Percentage		22%	13%	25%	26%	15%		
Mean		17.33	10	20.00	21.00	11.67		
Standard Deviations		2.887	1.000	3.000	4.000	2.082		

As shown in table 9 Q1 around 49% (39) of the respondents i.e. majority said there is a periodically operational and maintenance works evaluation in organization. While the remaining 31 % (24) answered there is periodically operational and maintenance works evaluation in organization. In conclusion, the organization has a periodically operational and maintenance works evaluation but it is unknown by some employees. This might affect effectiveness of the system in the organization.

As Q2 of the same table indicates that, the respondents 39% (30) agreed with the statement ‘Corrective measure are taken using evaluation feedback’ while the remaining 36% (27) of them disagreed . Some of them 26% (20) positioned on the middle of both thoughts. This indicates that the organization should be creating awareness to it staff about the importance of the periodically operational and maintenance works evaluation to make its business competitive.

As Q3 of the same table points out that, 33% (27) of the respondents agreed with the performance management contributed to good result while the remaining 48% (32) of them disagree. Some of 28% (22) respondents position on impartial.

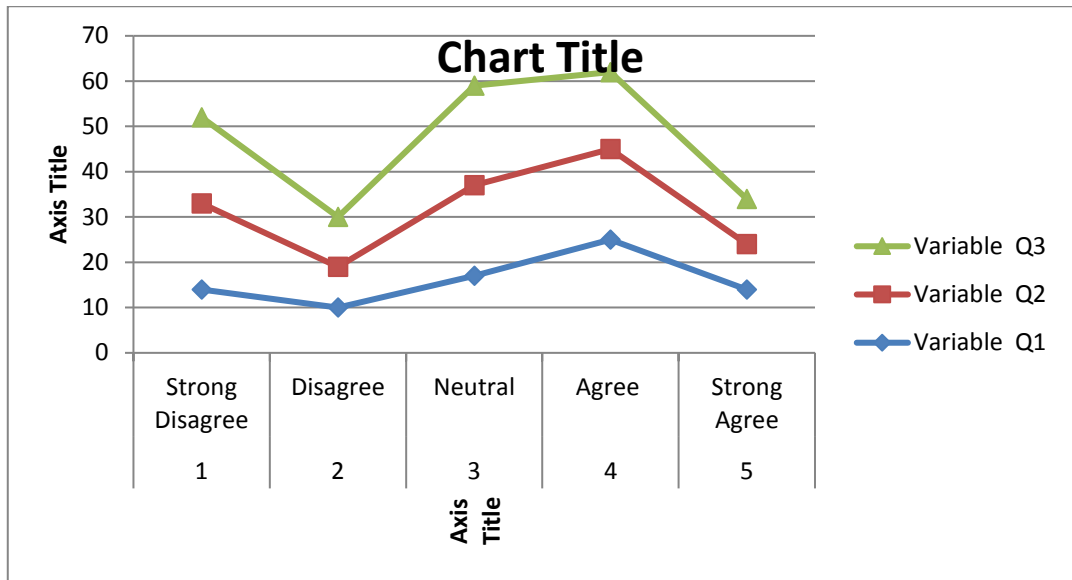


Figure 7: Respondent position concerning performance

As can be seen from table and diagram majority of questionnaire respondent agreed with statement “there is a performance evaluation in the organization”. According to interview and secondary, analysis there are different mechanisms to evaluate the performance of operation and maintenance such as evaluating daily activities, service delivery, maintenance failure per day, effectiveness of the time table schedule, employee performance and satisfaction customer and employee. However, the evaluations were not utilized to make the necessary improvement. These might be related to the fact there is no regular appraisal, reward and punishment system in place.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

Based on the data gathered, analyzed and interpreted in the fourth chapter the study is summarized, necessary conclusion was drawn and a possible recommendation was provided to the respective body of the organization.

5.1 Summary of the Major Findings

- According to the study majority of the employees are diploma/ level- 4 holder and some of them have BSc degree. This implies that there is a scarcity of higher-level expertise and specialist in organization.
- The study indicated that, majority of the employee's categories between 18-25 ages. This indicates that the organization has an opportunity to use these young generations as competitive advantage to excel service quality and profitability.
- Based on the study, majority of the respondents replied that there is no continuing professional development training to improve knowledge and skill of the employees. Also there are no bonuses and benefits for good performance in their job.
- According to the analysis majority of respondents replied that there are not a clearly defined procedure and all the necessary equipment for maintenance.
- From analysis, majority of respondents are agreed that there is periodical Preventive maintenance. It indicates that there is preventive maintenance in the organization. In addition, largest number of respondents replied that immediate maintenance procedure is taken in case of failure.
- According to the analysis, majority of the respondents have agreed that there are trainings before employees assigned to jobs, and there are partly documented operations manuals. And also operators follow procedure correctly.
- The analysis indicated that, largest number of respondents replied that there is an advanced technology which helps the operation and maintenance strategies.
- According to the analysis, majority of respondents replied that there is no system in the organization to handle jobs and data.
- Majority of the respondent replied that there is no material management practice in the organization.
- As seen on analysis of interview and secondary data there is an information management in organization such as wechat group for exchange information

associated with maintenance failure and operation, and QQ for reporting. There are also four different weekly meeting to exchange information.

- According to analysis of interviews and observation data there are up to date technologies which are used to operation and maintenance job.
- From analysis of interviews and secondary data there are motivation mechanisms to perform jobs by saving life and avoiding property damage.

5.2 Conclusion

The paper discussed literature review, data collection, data analysis and interpretation before coming to this conclusion. The discussion of the literature review has revealed the importance and different concepts of operation and maintenance phase of asset management which is one of the four asset management cycles/phase. As discussed on literature review part of the paper asset management is directly proportional to service capacity, quality and delivery. If an organization has excellent asset management strategies, it is relatively easy to retain a competitive marketing environment through operating with high product/service quality, lowest prices and short delivery time.

In this study, the operation and maintenance phase of the asset management was assessed by studying the variables including: Employee, Maintenance tactics, Operation producer, Technology, System, Information, and Material management. Based on the data collected form employees, managers and archival documents, asset management in the AALRT is conducted in detached way. This can have negative impact to productivity and profitability of the organization by reducing the service capacity and delivery. As seen on analysis, the organization shall expect to put its huge effort to achieve operation and maintenance excellence.

Shortage of maintenance equipments and spare parts is observed because of foreign currency shortage which in turn impacts asset management of the organization with regard to operation and maintenance.

The organization's lack of appraisal, reward and punishment system may have affected the motivation of employees to improve themselves in operational tasks with regular trainings. Also, the operational manuals' being not available to operation employees affects their capability in conducting operation tasks properly.

5.3 Recommendation

Based on the findings of the study the following recommendations are forwarded to improve the operation and maintenance asset management concerning service quality and delivery.

- It is recommended that the organization should build the capacity of its employee with continuing professional's development program to develop their competence.
- It is recommended that the organization should have its own data and information management system, and strategies intended for operation and maintenance of asset management program.
- To perform emergency and regular maintenance there should be spare part in store for reserve.
- There ought to be fully documented manuals for employees and instructed how to follow operator's procedure correctly.
- There should be formal and written performance evaluation, appraisal and motivation mechanisms for employees' to increase their productivity.
- It is recommended that the organization should conduct training before assigned to a job.
- It is recommended that the organization should have operational and maintenance works evaluated and take measure to correct with evaluation feedback.

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APPENDIX

APPENDIX I



St. Mary's University School of Graduate Studies (General MBA)

Assessment of Asset Management practices : Case Study of Addis Ababa Light Rail Transit Project

This questionnaire is prepared to provide input data for MBA research paper at St. Mary University, school of post graduate studies. The aim of the research is to study the relationship between asset management and service delivery of AALRT operation division at Ethiopian Railway Corporation. The research is intended to assess the asset management practices in order to identify beneficial procedure with regard to service delivery and cost minimization.

This questionnaire shall be filled by railway operation staffs. The questionnaire is filled properly the results obtained from the research will benefit the railway sector in many aspects. Hence in order for the aim of the research to be fulfilled, provide your answers truth fully and honestly.

I. Instruction

- No need of writing your name.
- Your confidentiality maintained sincerely.
- Use \surd up on given choices alternatives.

Part one: - Personal Information

1. Gender Male Female
2. Age 18-25 26-35 36-45 46-50 Above 50
3. Education background
Level-1 Level-3 BSc
Level-2 Diploma MSc/MBA writes other __

Part Two:- Questionnaire Related to the AALRT

This part of the questionnaires is provided to collect data from staff member of AALRT operation, maintenance, and related divisions. The respondent shall provide “√” sign in the box that best describe the selected aspects of operation and maintenance phase of asset management in the division.

II. Instruction Description of a numbers

1. Strong disagreed
2. Disagreed
3. Neutral
4. Agreed
5. Strong agreed

No	Dimension	Asset Management Practice of the Organization				
		1	2	3	4	5
A	Employee	1	2	3	4	5
1	The employee are well educated					
2	The employee received all the necessary training before they were assigned a job					
3	To improve knowledge and skill of the employee continues training are conducted					
4	The employee are motivated to do their job					
5	The employees receives bonus and benefit for good performance in their job					
B	Maintenance	1	2	3	4	5
1	There is a clearly defined procedure for maintenance					
2	There are all the necessary maintenance equipment					
3	Preventive maintenance is conducted periodically					
4	In case of failure , immediate maintenance procedure is taken					
C	Operation	1	2	3	4	5
1	Operators are trained before assigned to a job					
2	There is a fully documented operation manual					
3	Operators follows procedure correctly					
4	Accidents that occur due to operator's mistake is catastrophic					
D	Technology	1	2	3	4	5
1	Operation and maintenance are supported by advance technologies					
E	System	1	2	3	4	5
1	Operation and maintenance is supported by system					
2	The system make the service adequate					
3	All the necessary information are available when need					

No	Dimension	Asset Management Practice of the Organization				
		1	2	3	4	5
F	Information					
1	Information related to maintenance and operation is available for employees					
2	Recorded information can be used as an input for improving maintenance and operation tasks					
G	Material	1	2	3	4	5
1	Spare parts are available in storage					
2	Parts that need replacement can be replaced from stock without bureaucratic difficulty					
H	Operation	1	2	3	4	5
1	Operators are trained before assigned to a job					
2	There is a fully documented operation manual					
3	Operators follows procedure correctly					
4	Accidents that occur due to operator's mistake is catastrophic					
I	Technology	1	2	3	4	5
1	Operational and maintenance works evaluated periodically					
2	Corrective measure are taken using evaluation feedback	1	2	3	4	5
3	Performance management contributed to good result					

Thank you for taking your time to fill in this survey!

APPENDIX II

INTERVIEW QUESTION

1. What do you think the relationship b/n asset management and service delivery?
2. How do you express operation and maintenance phase dimension in organization?
3. Do you think that your organization has a good asset management? Why?
4. What are the techniques applied to measure operation and maintenance works in organization?
5. What are the elements to measure service delivery in your organization?

APPENDIX III



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