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QUALITY ASSURANCE IN ETHIOPIAN AIR LINES GROUND SUPPORT EQUIPMENT AND FACILITIES MAINTENANCE

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St. Mary's University
Institute of Quality & Productivity Management

Quality Assurance in Ethiopian Air lines Ground Support Equipment & Facilities Maintenance

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APPROVAL BY BOARD OF EXAMINERS

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ENDORSEMENT

This is to certify that Mr. Abdella Siraje has completed his thesis work entitled *"*Quality Assurance in Ethiopian Air lines Ground Support Equipment and Facilities Maintenance*"*. I have evaluated, his research is original work and appropriate to be submitted for assessment.

Asnake Gudisa (PhD).

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DECLARATION

I the undersigned declare that the thesis entitled **"**Quality Assurance in Ethiopian Air lines Ground Support Equipment and Facilities Maintenance**"** is my original work under the guidance of Dr. Asnake Gudisa All sources of materials used for the thesis have been acknowledged. I further confirm that this study has not been submitted in part or full for any degree completion to any University or Collage.

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List of Abbreviations

ACE……..Achieving Competitive Excellence

EASA ……..European aviation safety audit

E.F.M. …….. Equipment and facility maintenance

ETAG ……..Ethiopian Aviation Group

GSE/GTV. ……Ground support equipment/Ground transport vehicles

G. H. …….. Ground handling

GOM. ……. …… Ground operation Manual

ICAO …….. International Civil Aviation Authority

IATA…….. International air transport association

MRO……..Maintenance Repair and Overhaul of an Aircraft

Q.A…….. Quality Assurance

QMS…….. Quality Management System

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ABSTRACT

Maintenance quality and safety specifically in aircraft Ground handling operations and related support activities is the primary issue for the industry. Various international regulatory bodies assess these service providers directly /indirectly.

The aim of this paper is to identify factors affecting Quality assurance in equipment and facility maintenance that could have potential impact for decertification of the air line and cause restriction from getting permit due to non-compliance to safety standards. This was mainly because of the repetitive reports from internal micro Audit report by the strategic business units Quality assurance sections. The findings indicated that some equipment serving at the air sides were found with overdue maintenance schedule, missing safety items, which could hamper the operational dependability and on time performance.

The research method used included literature review, data collection, interviews and observation. A total number of 105 questionnaires were distributed. The collected 95 questionnaires replies were analyzed. Factor analysis was used in determining the significance of the variables collected as per the Likert scale. Relative importance index was also computed to identify the most important factors. The study noted that improve the quality assurance for maintenance service requires policy & strategic objectives, to elevate employees' role and participation through the formation of quality team that ultimately contribute for the development of organizational culture and maintenance quality. Also re reward and recognition of employees performance measurement techniques and methods need to formulated better way that addresses quality. Quality assurance department dedicated to the maintenance section that independently audit the quality assurance for internal customers for the ground handling support services is part of the recommendation.

Key Words: Quality assurance, GSE Maintenance, Ethiopian air lines

CHAPTER ONE: Introduction

1.1 Background of the Study

Keeping the standards of Quality and safety in the aviation industry ground handling and related support activities is vital to stay in the business. For the maintenance quality, standards and flight/ ground safety, the need of TQM to Engineers, Maintenance planners, and Maintenance crew enhance the technical skills of staff in respective maintenance departments.

A search for continuous improvement on the performance of an organization is one of the biggest challenges for present-day leaders. In an airline industry this challenge is directly related to Safety, on time performance and customer satisfaction. These are prerequisites for an airline to stay in the business competitive and grow. The Quality Assurance in Air craft Ground support Equipment and Facility maintenance is required to meet Standard of regulatory bodies like IOSA,EASA, as well as ISO 6966-2:2014, which in-detail explains about Air craft Ground Equipment dependability and the related safety requirements in the Air craft maintenance support and Ground handling Operations. Ground Handling is an integral part of an air line operation and the back bone for an Air line passenger and cargo Transportation service. The safety and operational efficiency must be maintained per standards. The Equipment involved in the operation has to be well maintained to be operationally dependable. According to European Plan for Aviation Safety (EPAS) , the directive states the required serviceability standards of vehicles (motorized GSE) (SI-1034) in detail. The serviceability of vehicles/motorized airport GSE including belt loaders, baggage, trucks, catering trucks, and pushback equipment, etc. must meet the required safety standard, since it may cause damage and/or injuries if not maintained properly. In a well-functioning operational environment, the serviceability and maintenance of vehicles/motorized airport GSE are performed effectively and thus would facilitate safe operations of vehicles/motorized GSE. (European plan for Aviation Safety (EPAS), 2021–2025, Page 24). The safety of an air craft can be exposed to an accident due to human factor occurred while it is parked on the ground or during the ground handling service provision. These Equipment and machineries that interact directly or indirectly with the aircraft on ground could be a leading factor for the incident. The quality of maintenance performed on the machines and equipment has to be set per expected standards. International Air Transport Association (IATA) released data in the final quarter of 2019

with estimates that 7,000 ramp accidents and incidents — one per 1,000 departures — occur worldwide every year, although thre could be mentioned several causes. This indicates that ground handling operations can bs considered as a significant and persistent source of avoidable accidents, injuries and deaths that continue to endanger airport staff and passengers while also impacting on time performance of the operation. Safe ground handling operations with an established culture of rigorous safety starts from providing quality maintenance. (https://www.theairportshow.com)

The purpose of this research is to examine the existing Ground support Equipment and machineries maintenance quality management systems, its implementation, sort out and prioritize the factors affecting their implementation in Ethiopian airlines. This will help researchers and the organization in taking corrective measures on the gaps and setting priorities of action to the subject which can expose the organization safety to decertification due to non compliance of safety requirements.

1.2 Background of the Organization

As per the information pertained from the company website; Ethiopian Air lines S.C., was established on The carrier, originally called Ethiopian Air Lines (EAL),was founded on 21 December 1945, with an initial investment of ETB 2,5 million, divided in 25,000 shares that were entirely held by the government. The company was financed by the Ethiopian government but managed by Trans World Airlines (TWA). At the beginning, it relied upon American pilots, technicians, administrators and accountants; even its General Managers were from Trans World Airways.

Ethiopian Airlines (Ethiopian) is the flag carrier of Ethiopia. During the past seventy plus years, Ethiopian has become one of the continent's leading carriers, unrivalled in Africa for efficiency and operational success, turning profits for almost all the years of its existence. Operating at the forefront of technology, the airline has also become one of Ethiopia's major industries and a veritable institution in Africa. It commands a lion's share of the pan African network including the daily and double daily east-west flight across the continent. Ethiopian currently serves 100 international and 21 domestic destinations operating the newest and youngest fleet. (Ethiopian Fact sheet, April 2022).

According to the company organizational structure, Equipment and Facility Maintenance section is Structured under Chief operation officer being led by a Director accountable for Ground support Equipment, Transport Vehicles, Machineries, and Facility maintenance. There are Four Managerial Positions under the Director of Equipment and Facility Maintenance. Manager Facility Maintenance, Manager GSE/GTV (Ground support Equipment/Ground Transport Vehicles) maintenance, Mgr. Engineering Planning & Inspection, and Mgr. Civil work. In this study the first Two sections under respective Managers are mainly focused.

The maintenance of Work Shop support machineries in MRO, Food production Machineries in In-flight catering, loading and unloading Machineries at Cargo and Logistics, Passenger service Equipment and Machineries at the Air port, and all equipment attached to the facilities is handled by five sections which are directly and functionally reporting to Mgr. Facility Maintenance. The maintenance of Motorized and Non-motorized Equipment required for Aircraft Maintenance Hangars, line maintenance as well as Ground handling operation is provided by four sections which are directly reporting to Manager GSE/GTV Maintenance. On the other side, the section under Manager Planning, Engineering and inspection provides technical and back office support to the maintenance sections, being staffed with Engineers, Planners, and inspectors. In general, the maintenance sections under the three managers have currently about 144 Permanent employe**es** on Various Positions.

Figure-1 Equipment & Machineries in ETAG

Category	Location of Equipment	Eqpt. Description	Machineries /Eqpt. (Quantity)	Total
Shop Service Machineries	MRO Shops Machineries	Machineries	533	973
		A/C Maintenance work stands	434	
		Stand By Gen.	6	
	Domestic & HO Facilities Maintenance and baggage Dolly & Carts	Machineries	175	1881
		Stand By Gen.	6	
		Baggage Cart, Container Dolly	1700	
	ET inflight Catering Facility Equipment	Catering machineries	280	281
		Stand By Gen.	1	
	ET Cargo Facility Machineries & Ware house facility	Cargo facility Machineries	215	220
		Stand By Gen.	5	
	Ethiopian Aviation Academy Facility Equipment	EAA Facility Eqipment	97	97
	Airport Security, passenger Terminal & Airfield Ground Lighting Equipment	Airport Terminal facility Equipment	159	438
		Airport Ground Lighting Equipment	123	
		Airport Security & Automation Equipment	153	
		Stand By Gen.	3	
Fire Extingusher	MRO Facility Fire Fighting Eqpt	Fire Extigushers	247	288
	Head Office Facilities		41	
Transport Vehicles & Ground support Equipment	Motorized Equipment Maintenance	Ground Support Equipment	547	1372
		Transport Vehicles	492	
		Stand by Generators	84	
		Jack & Tow Bars	249	
Total				**5,550**

Therefore, this study focuses on Quality assurance in the section since it has direct and indirect impact over the operation on time performance as well as Customer satisfaction of the Strategic business units.

1.3 Statement of the Problem

Quality Assurance in the aviation industry is directly tied to safety. Having a quality assurance system is non-negotiable let alone in the Air craft maintenance, it also extends to the Aircraft maintenance repair shops and the ground handling operation support. Quality assurance in Ethiopian air lines is embedded with strict discipline and work culture that is seriously audited by external regulatory bodies besides to the internal micro audits performed by sections dedicated to ensure Quality assurance across the air line strategic business units. In the operation support, Equipment and facilities maintenance section plays a vital role for the safety, Quality and on-time performance of the service provided by strategic business units,

In this regard, although Ethiopian Aviation group (EAG) has established TQM in its various strategic business units playing significant role in keeping the industry standard based on international regulatory body requirement, the internal micro Audit report of strategic business units Quality assurance sections repeatedly indicated findings and remarks on Equipment and Machineries maintenance quality. However the remarks are immediately rectified before external regulatory bodies started their audit. ADD HUB QMS & SMS reports, MRO Quality and Safety audit reports, Cargo Quality and Safety reports were some to mention few in this regard. The findings indicated that some equipment serving at the air sides were found with overdue maintenance schedule, missing safety items, compromised maintenance qualities and occurred sudden breakdowns which could hamper the operational dependability and on time performance.

The same pre audit inspections and recommendations were forwarded by MRO quality assurance regarding machineries maintenance on being overlooked and escaped, although scheduled and reminded to get maintenance. Besides this, unexpected breakdown raised several complains from MRO Maintenance sections & users. The reports could potentially expose the company to external Audit finding as well as de-certification, if left neglected.

This study tried to identify how quality assurance was implemented and what factors were affecting its implementation in Equipment and facilities Maintenance, as per International standards. It reviewed the company Policy and procedures, employees and their involvement in Quality assurance, the established communication methods and employee's involvement in the company growth strategy. More over the paper tried to assess the maintenance management role in the sections to implement TQM per expected standards to build good work culture based on IOSA, EASA, FA and ICAO Policies and procedures. This is mainly because of the fact that the section quality service is an inputs for the strategic business units in their certification for Standards. Failure in keeping the maintenance Quality and standard can lead to decertification of the license as well as flying permit revocation which can shake the strong bases of the company in the journey for sustainable growth, at any point of time.

1.4 Objective of the study

1.4.1 General objective

The general objective of this study is to investigate factors affecting Quality assurance implementation in Ethiopian Airlines Equipment and Facility Maintenance section while providing maintenance service to the strategic business units and assess their threat before the company quality certifications are revoked. It shall recommend what should be done to improve the quality assurance factors.

1.4.2 Specific Objectives

The study will achieve the following specific objectives:

1. To examine the current status of Quality Assurance in Equipment and Facility Maintenance while providing maintenance service to the strategic business units.
2. To investigate the major factors: organizational, structural and cultural barriers that affect Quality Assurance in EFM service provision which could be contributing factors for decertification due to non compliance of safety standards.
3. Identify Company policies, Procedures and programs implementation gaps to avoid micro audit findings and keep Maintenance Quality in Ethiopian Air lines, EFM.

1.5 Research Questions

1. What is the current status of quality assurance implementation in Equipment and facility maintenance, while providing maintenance service to the strategic business units?
2. Do organizational structure; Organizational cultural barriers affect the quality assurance implementation in EFM?
3. Do the factors related to company policies, procedures and program implementation have gaps in implementation of Quality assurance and keeping standards in EFM?
4. Are there strong relationships among these factors across the maintenance section activities?
5. What should be done to improve the factors affecting Quality assurance in Equipment and facility maintenance?

1.6 Significance of the Study

This study offered the researcher an opportunity to focus on the assessment of factor that affects Quality assurance in Ethiopian air Lines EFM. The study will serve as an input for the organizations to re-examine Quality assurance implementation improvement in the section. The study focused on how Employees, leadership, Policies and procedures interact in establishing good communication, working culture, building teams towards the intended quality standards. The study was worth doing because it can be helpful for the company to look at the problems, to take in to the alternative consideration, and it will help as a source of reference and a stepping stone for those researchers who want to make further study on the area afterwards. It will also help to open windows for Ethiopian Air lines to standardize the Equipment and facility maintenance Service provision in the sector to Partnership and Other Air lines Ground handling Operation support, across the African Continent.

1.7 Scope of the Study

The study is delimited to identify factors affecting Quality Assurance in Equipment and Facility Maintenance section mainly in the sections under Manager Facility Maintenance and Manager GSE/GTV (Ground support Equipment/Ground Transport Vehicles) maintenance, which are directly, involved in the maintenance support activities. This is, because the researcher has better information access, access, opportunity and knowledge of

the study area, which helps the researcher to get relevant information about the problem. The researcher used the resources, like Internal QA sections Micro Audit reports, on-time Performance reports and unpublished documents.

1.8 Limitation of the Study

The researcher had limitation of time, resource, constraint; respondents could not fill the questionnaire properly and return on time, these were some of the problems. Mainly, no similar research was conducted earlier in the field to cite as reference. Also it was difficult to collect the entire questionnaire as planned because of the respondents were in different sections, Shifts, tasks and some unwillingness to answer the questionnaire. There was challenge to get access of confidential documents. Besides this, the researcher encountered knowledge gap on exhaustive usage of SPSS package.

However, with all kinds of limitation mentioned above, the results of the study generally indicated that further improvements are required in improving the maintenance Quality Assurance of the section.

1.9 Operational Terms and Definitions

ACE: Achieving Competitive excellence is a proprietary continuous quality improvement system developed by united technologies corporation adopted by ETAG as a continuous quality improvement tool .

Air side: the side of an airport terminal beyond passport and customs control

Audit Finding: A written explanation of errors , non compliance with legal requirements and standards set.

Aviation Quality Assurance : A system for monitoring aviation Equipment ,programs and procedures to ensure that the ICAO and state civil aviation regulatory quality standards are being met.

European aviation safety audit : An agency of the European union responsible for civil aviation safety and standardization. It makes regulations and performs investigation and monitoring in implementing ICAO standards**.**

Equipment and Facility Maintenance: A section handling the maintenance of Ground support Equipment and facilities Maintenance in Ethiopian Air lines addis Abeba Airport terminal

Ethiopian Aviation Group : Ethiopian state owned corporate entity which is a provider of aviation services including cargo, MRO, Aviation training, Ground handling, and Catering services.

Ground support Equipment: Equipment used in Ground Handling operation of an air line.

Ground handling: The servicing of an air craft while it is on the ground and parked at the terminal gate of an air port.

International Civil Aviation Authority: The only world leader in international aviation which creates regulation for aviation safety ,security ,efficiency and regularity environmental protection

International air transport association: A trade association for the world air lines which plays a major role to support aviation standards for the air line interms of safety, security, efficiency and sustainability.

Maintenance Repair and Overhaul: Repair service or inspection of an aircraft or aircraft component to ensure safety and air worthy ness of an aircraft.

Quality Assurance: is any systematic process of determining whether a product or service meets specified requirements and expectations

Quality Management System: A means of ensuring that an organization meets the requirements and continuously improves its processes.

Ramp: is the area of an airport where aircraft are parked, unloaded or loaded, refueled, or boarded.

1.10 Organization of the Study

The study Contains Five chapters:

- The first Chapter presents the study by discussing the introduction to the study, brief discussions about Quality Assurance, statement of the problem, purpose of the study, research objectives, research questions, the scope of the study, significance of the study, and limitations of the study and organization of the Paper.
- The second chapter: presents the literature review part of the study which includes the theoretical review in its first section followed by the review of the previous studies related to the area.
- Chapter Three: discusses the methodology that was used by the researcher to collect data, in order to achieve the objectives of the study. It describes the research design, study area and population, the sample size and sampling technique, data sources and collection instruments, as well as methods of presenting, interpreting and analyzing for findings.
- Chapter Four: The fourth chapter concentrates on the data presentation, analysis and interpretation and
- Chapter Five: the last chapter presents the summary, conclusion and recommendations. Finally, list of reference, bibliography and appendix is included as supplemental part of the paper.

CHAPTER TWO

2. Literature Review

2.1 Meaning and Concept of Quality

Total Quality Management (TQM) is an enhancement to the traditional way of doing business. It is a proven technique to guarantee survival in world-class competition. Only by changing the actions of management will the culture and actions of an entire organization be transformed.

According to Oakland, Quality assurance is the prevention of Quality problems through planned and systematic activities (John S.Oakland, 2014).

ISO 9000: 2000 defined quality as "the degree to which a set of inherent characteristics fulfil requirements". "Quality is safety". Quality management includes the functions like planning, organizing, staffing. Directing and controlling for the management of TQM in the organization.

The ISO 9000 definition of quality management is, a coordinated activity to direct and control an organization with regard to quality. Also the ISO 9000 definition for quality assurance (commonly abbreviated to QA) states that it is part of quality management focused on providing confidence that quality requirements will be fulfilled.

TQM (Total quality management) is a management philosophy and company practices, that aim to harness the human and material resources of an organization in the most effective way to achieve the objectives of the organization. (BS 7850: 1992). TQM is the highest level of quality. It is the integration of all functions and process within an organization in order to achieve continuous improvement of the quality of goods and services aiming its goal for customer satisfaction.

Quality Assurance (QA) activities include a planned system of review procedures conducted by personnel not directly involved in the inventory compilation/development process. Reviews, preferably by independent third parties, should be performed upon a finalised inventory following the implementation of QC procedures.

2.2 Quality Assurance in Air craft Ground handling & Maintenance

QA in aviation industry directly is related to the question of safety. Thus, a quality assurance system is non-negotiable to release an Air worthy and a safe aircraft for passenger as well as Cargo Transport services. Safety is not only a cluster of regulations on

a paper that needs to be implemented co-ordinately by a team. According to Oakland,(2014 Page 17) there are two distinct but inter related aspects of Quality: design and conformance to design. Asking the question have we done the job correctly? Should be replaced by asking" are we capable of doing the job correctly"? in this regard unless team coordinate for conformance of standard with the required capability to do the job correctly, the intended quality cant be achieved.

The European Plan for Aviation Safety Manual, (EPAS 2021-2025- Volume III, directive (SI-1034) states that the safety and serviceability of motorized Equipment (ground support equipment and ground transport vehicle operating at ramp area has to be primarily evaluated before being dispatched to the operation support activity. The safety and serviceability status of equipment like: belt loaders, baggage trucks, catering trucks, and pushback trucks, etc. rely on the maintenance. This will create safety and reliability in using the GSE/GTV at the air side operation support. (EPAS) 2021–2025, Page 23). On the other hand, Ground operation safety manual of European Air Transport Command (EATC) indicates that equipment availed in the ground handling operation must be functionally checked and operationally fit in keeping the safety standards. (EATC Manual, 2019).

The maintenance quality and safety standards stated in the above manuals mainly rely on the operator. This could need secondary check and balance by air side safety officers to perform surprise check on equipment used ,whether operators regularly check what is expected before providing the required support.

The international Ground operation Manual (GOM) that Ground Support Equipment (GSE) used for handling of all flights must be serviceable and in good mechanical condition. It also recommends a corresponding maintenance program to be in place, which include the records of maintenance completed on GSE. (Ground Operations Manual GOM/A (Part A) AOC B-3010 and AOC L-13 and AOC MT-16 Version: 4.3 - Issue: 10-JAN-2018) Similarly, IOSA (International Air Transport Association.) audit hand book indicates , the Ground support Equipment (GSE) allocated in the ground handling operation has to be serviceable/in good mechanical condition and completed maintenance recorded. (IOSA Audit Hand book , 14th Edition ,2021)'. Checking maintenance data record of the equipment specially the scheduled maintenance record is vital and focal point of control whether the equipment custodian is following the manufacturer recommendation and

maintenance manual. Usually external regulatory bodies crosscheck the applicable maintenance records if it seem doubtful and some gaps are observed.

Based on External regulatory bodies requirement, mainly EASA, Ethiopian air lines Ethiopian MRO Maintenance organization exposition Manual indicate Manual, all tools and equipment that need periodic servicing and maintenance shall be recorded in the respective user department. (Ethiopian Part 2-Maintenance procedures, section 2.4 ,Acceptance of tools and Equipment.). This is mainly applied on Equipment and tools used in the aircraft Maintenance activity.

According to European commission regulation (EU) no.2015/1018 and AMC 20-8, accident /incident occurrences shall be reported to EASA, Manufacturers and operators by the maintenance organization. Serious damage caused to an aircraft due to incorrect maintenance or use of inappropriate or un serviceable ground support equipment that requires additional maintenance, the occurrence has to be reported. (Ethiopian MRO Maintenance organization Exposition Manual ,section 2.18, 2020). This practice mainly rely on the strict follow up and implementation of company safety rules and regulations, since accidents or incidents could sometimes be covered from being reported, which could result consequential damages. Encouraging employees not to hide their error has tremendous benefits in this regard.

According to Ethiopian Civil aviation general policies, Failure to provide adequately for proper servicing, maintenance, repair, and inspection of facilities and equipment in the air line industry will result to Maximum civil penalty even to suspension from flight until proper servicing maintenance, repair, and inspection of facilities and equipment is provided. More over the Failure to ensure correct calibration of all inspection and test on equipment is accomplished at prescribed intervals will result penalty stated in the minimum to Maximum range. (CIVIL AVIATION RULES AND STANDARDS, Page 63)

2.3 Factors affecting Quality Assurance implementation

2.3.1 Organizational Structure

The organizational structure is a framework of rules and power relations that exist to formally control and coordinate the activities in an organization since it has direct impact on individuals' motivation and performance it is a cornerstones to achieve the organization goals. It is also one of the important aspects that must be considered in the development of maintenance culture is the organization structure.

Organization structure is vital as a guideline to clarify the sense of duty and activities for everyone in an organization. According to John Oakland, Defining the corporate vision, strategies and Critical Success Factors might make it necessary to review the organizational structure. Directors, Managers and other employees can be fully effective only if an effective structure based on process management exists. This includes both the definition of responsibilities for the organization's management and the operational procedures they will use. These must be also agreed best ways of carrying out the core processes in an intact organizational structure. (Oakland, 2014 Page 41)

It typical hierarchy, an organization arranges its lines of authority and communications, allocates responsibilities and duties that has been illustrated by the organizational chart. The process in the development for maintenance culture requires a comprehensive organizational management and a structure to represent the practice of the work that should be executed by each member in the organization. Objectively aligned organizational structure is the result of accurately reflected organizational values aligned with the overall mission of the organization. The interdependent relationship between Organizational structure and organizational culture even stretch in determining the attitudes, behaviors, characters and ethics that create the work culture.

2.3.2 Team Organized for Quality improvement

2.3.2.1 Quality circles

On challenging Jobs like maintenance, TQM program Quality circles are most beneficial to employees. Employees' participation in a quality circle can contribute both to quality and productivity, because it enables them to pool their knowledge and solve interesting problems. It also tends to be most successful when it enriches jobs and improves employee motivation. In addition, when participating in the TQM program, it improves workers'

problem-solving skills. Finally, a Quality Circles program will open windows for better chance of creating success in a corporate culture that values quality and stresses continuous improvement. Quality circles offer one technique for implementing TQM and include groups of 6 to 12 volunteer employees who meet regularly to discuss and solve problems affecting the quality of their work. (Daft,2014, Page 676). Quality circles are usually supported by

Total Quality Control (TQC). This will help in developing management attitudes and practices oriented towards quality of processes and creating a culture conducive to defect free operations. The team could face several obstacles till better mutual understanding and management support is secured. Once a suitable atmosphere is created within the organization. The Quality Circle creates Discussions platform between different layers of organizational structure: with higher Management, department heads, section heads, and supervisors or team leaders. The very important activity is gathering feedback from participants and Clearing the doubts in everybody's minds to make them interested to the concept. Quality circles usually form a Steering Committee to give overall direction towards quality improvement. The team raises and discusses about Best Practices, Point out major Issues, Collaborate Solutions, Brain storm Ideas and Streamline how a problem can be fixed.

2.3.2.2 Self-directed/managed Team

A self-directed team is a set of individuals in an organization who incorporate various abilities and talents in coordinating their effort to work toward common objective with out violating the standards set. Self-directed team have a stated mission and the company encourage them to do whatever is required to be done, including big decisions. Self-directed teams add value in most organization, but it is not easy to put them in place. However, the teams could be in a better position if they are responsible for the entire work process as well. This will enable them to independently manage without interference of other work units, which has ultimate result of interdependence to achieve the common goal. The main empowerment tool for self directed team is granting them full autonomy and making them equipped with technology to support their communication and coordination. (Principles of Management, 2006, P.261). However, it is important for the

management to support the team, and provide proper knowledge on the boundaries, regulations and principles of the company.

Self-directed team has five features that are integral to assemble: Collective Responsibility, Harmony, Encouragement, Shared Goals and Communication. Communication is vital that will leave no room for error and a means to facilitate success. These teams usually develop more effective decision-making practices that combine considering different viewpoints, incorporating the principles of give-and-take, and moving toward action by remove problems and obstacles to stay focused on the shared outcomes to be achieved.

2.3.2.3 Process & Quality improvement Team

A process improvement team is team or group of people that is organized to improve a selected process within an organization. The team is organized by a process owner and team leader, and consists of those in the workforce who are involved directly or indirectly with the process. This team is sponsored by the management to improve the gaps and obstacles in the process.

Quality needs a mindset that has to be assimilated into the organization operations to get executed by the management teams at all levels of the organization. According to the American Quality Guru Deming, he compared the degree of senior management for being responsible to 94% of quality problems that occurred in an organization. On the other hand, according to Juran's view the role of employee have also a share to Quality problems that reach up to 20%. (Oakland, 2014) . Although according to Deming the degree of responsibility for senior management is high, the bedrock of its implementation is the employee, mainly the maintenance crew in such organizations.

Contrary to organization structure, Quality improvement teams do not appear visible on the organization chart. Each "floats" has no personal boss. Instead, the team is supervised impersonally by its mission statement and by the quality improvement roadmap. The Quality team does have its own internal organizational structure. This structure invariably includes a team leader which could be chairperson and team secretary. In addition, there is usually a facilitator. (Juran, 1979)

Fig.-2 Quality Team Layer

2.3.3 Employees Motivation

The motivation process begins with proper leadership that lead to an appropriate motivating environment that provides consistency, in purpose and sincerity, and where goals are realistic and there are no hidden agendas. Management needs to be aware that each individual has different needs depending on his/her stage in life and that should be treated accordingly. Operator dissatisfaction will be reflected in his/her work when these needs are not recognized. When management communicates in only one direction to employees, mostly through threats and very few rewards, employees will form informal objectives that are diametrically opposed to those of the organization, resulting in ever-decreasing levels of output value. Employees' motivation has three foundations which their immediate supervisors /managers have to discover what really drives. It can be the employees, Individual drives and needs, or the goals, expectations, and feedback that he/she requires from the manager. The other foundation can be extrinsic/intrinsic rewards that influence employee motivation. (Principles of Management,2006, P.339)

In this regard, the motivation of employees as a driving force in the provision of quality products and services that should be incorporated in the quality management for all sectors in all functions. Motivation is an obligation of top management therefore, appropriate incentives for more efficient and more productive work of employees on different levels in the organizational structure should be granted. In order to effectively design and implement the TQM (Total Quality Management) system, an atmosphere of trust and motivation is needed, both for employees and for managers.

2.3.4 Work Place Policy and Procedure Manuals

Every organization should develop and state its policy on Quality together with its arrangement. Although maintaining all elements together is not that easy, the dream of every business Management is to have efficient employees, effective communication, and growth. The more companies grow, the harder they get to effectively communicate, and eventually more difficult it becomes to ensure that employees carry out their tasks efficiently aligned with their objectives.

Documentation is the foundation of all human progress. When people cannot read or write, their ability to teach and retain skills is limited to whatever they can transmit through oral tradition. To standardize a method is to choose out of many methods the best one, and use it. What is the best way to do a thing? It is the sum of all the good ways we have discovered up to the present. Today's best, which superseded yesterday's, will be superseded by tomorrow's best. (Levinson, 2013, Page 128-129)

In this regard, documenting the best work practices in a company and keeping them recorded in a better way will help the organization to transfer Knowledge.

According to John S. Oakland, Every chief executive must accept the responsibility for commitment to a quality policy that deals with the organization for quality, the customer needs, and the ability of the organization, supplied materials and services, education and training, and review of the management systems for never-ending improvement.
(Oakland, 2014).

To maintain a successful cycle of activities for a smooth workflow, a company needs rules and guidelines to manage employees. However, accomplishing all this can be devastating without creating a policies and procedures manual. Every company needs a policies and procedures manual to guide its operations, strategy, and workflow. Where policies set the expectation for employee behaviors, the procedures outline the steps for it. This ensures consistency in practice and helps in maintaining quality output.

Employee behaviour depends on the objectives needed to be achieved, if the policy system, strategy and work planning are clear and easy to understand. This enables each employee is expected to be more motivated to carry out maintaining the quality standards.

The preparation and implementation of a quality policy, together with continuous monitoring, made for smoother production or service operation, will minimize errors and reduce waste.

According to John S .Oakland, Management should be dedicated to the regular improvement of quality, not simply a one-step improvement to an acceptable plateau.

The quality policy should be the concern of all employees, and the principles and objectives have to be communicated as widely as possible, so that it is understood at all levels of the organization. (Oakland, 2014)

The Policy owner in the organization has to establish a procedure for controlling the new and revised documents required for the operation of the quality management system.

Documents of external origin must also be controlled. These procedures should be designed to ensure that the documents have to get approval, periodically reviewed and revised when found necessary. Besides this the documents has to be distributed and must be available at all responsible locations for effective functioning.

2.3.5 Planning and Scheduling

Quality planning consists of the activities carried out during the product/Service development and design stages. Also during process engineering, before the product/service is put into production, These activities start from identifying customers, their needs, developing features of the product /service, developing processes and transferring the palns and features to the production. In order for an organization to achieve its objectives effectively, it needs to have a proper integration of maintenance planning and scheduling with policies in place. (K. S. Krishnamoorthi, V. Ram Krishnamoorthi, Arunkumar Pennathur, 2019)

The road map for quality planning, according to Dr. Juran, is first to identify the customer. The customer is someone who is impacted by the product/service. A customer can be external or internal. It can be someone outside the organization or someone inside the organization, who further processes the product/service to be delivered. Maintenance Planning is part of an organised and structured process to achieve the efficient and effective implementation of maintenance tasks scheduled. Maintenance planning starts from a clear understanding and reviewing of the company's corporate policy, strategy and Maintenance service delivery plans. In order to develop effective equipment and Maintenance plans to ensure maintenance priorities, Strategic Plans are relevant and should align with business directions. Maintenance planning involves the collection and analysis of all relevant data, strategy and available resources then deploy a process to develop a plan for the short-term, medium Term and long-term maintenance practices.

The Management activities focusing to meet the organization's objectives are achieved through an effective planning. The Maintenance planning provides appropriate maintenance programme and procedures for execution of tasks based on frequent basis (daily, weekly, monthly, yearly etc), depending on available maintenance Manuals, where the planning standard and procedures are laid down.

2.3.6 Organizational Culture

Richard L. Daft Defined Culture as a pattern of shared values and assumptions about how things are done within the organization. He also stated that this pattern is learned by members as they cope with external and internal problems and taught to new members as the correct way to perceive, think, and feel. (Daft and Lane, 2014 Page 89)

The underlying beliefs and values help members deal with problems of survival in the external environment and problems of internal integration. The culture may be strong or weak, and there may be one dominant culture for the organization or several different cultures within subunits. An organization's culture is a situational influence on leaders, but over time leaders can also influence culture. (Yukl, 2013, Page 286)

According to Richard L. Daft, an organization Culture can be analysed at two levels. At the surface level, where visible artefacts that include: manner of dress, patterns of behaviour, physical symbols, organizational ceremonies, and office layout. These are Visible artifacts and things that one can see, hear, and observe by watching Employees of the organization. Where as, at a deeper and less obvious level, the values and beliefs which are not observable but can be recognized from how people explain and justify. (Daft and Lane, 2014, Page 90)

Organizational Culture is the "social glue" that bonds people together and make them feel part of the organizational experience. This social glue can be the main motivating element in attracting new staff and retaining high perform, when if it is maintained and institutionalized.

2.3.7 Leadership

Leaders can influence the culture of an organization in a variety of ways. Written values statements, charters, and philosophies can be useful, but they will have little credibility unless supported by the leaders' actions and decisions. A strong corporate culture can be a weakness rather than an advantage, if shared beliefs and values are not consistent with the strategies necessary for the organization to prosper and survive. On the other side, it is

sometimes difficult for leaders to change culture in a mature organization but easy to create it in a new ones'. This could occur because many of the underlying beliefs and assumptions shared by people in an organization are implicit and unconscious. (Yukl, 2013. Page 305)

Richard L. Daft mentioned in his book, that Creating and maintaining a high-performance culture is not easy in today's turbulent environment and changing workplace. But cultural leaders, through their words and particularly their actions let everyone in the organization know what really counts. (Lane , 2014 , Page 100)

Maintenance culture determines the values, way of thinking, behavior, perception, and the underlying assumptions of employees that consider maintenance as a matter that is important (priority) and practices it in their life. When Maintenance personnel have maintenance culture, shaped and developed by their leaders, it does mean that they would have the attitude to maintain, preserve and protect the company's Property. Maintenance culture is usually followed or learned through a person making maintenance through his natural daily practice that can be followed and emulated by others. (Florence, 2011).

On the other side, Maintenance cultures are not easy to develop. It takes time and occurs in response to changes by the individuals. In fact it is not something that is impossible to implement, if the determinant factors of maintenance culture development are identified. Total Quality Management implementation requires an organizational culture accessible to changes. The key advantage of giving quality as a cultural variable is that, it will diminish the ambiguity associated with the multiple definitions and dimensions of Total quality management.

2.3.8 Employee Engagement

Employee engagement enables employees of an organization to be emotionally involved in their jobs and make them satisfied with their work conditions, contribute enthusiastically to meet organizational goals, and feel a sense of belongingness and commitment to the organization and its mission. To engage employees, managers unite people around a compelling purpose that encourages them to give their best.(Daft, and Lane, 2014, Page 63)

2.4 Review of QA in Ethiopian Aviation Group and EFM

Ethiopian air lines established Quality management system, for the purpose of ensuring and monitoring compliance with international regulatory bodies as well as maintaining safety and quality. The Group CEO is the prime responsible person for the Quality system of the company, that ensure periodic verifications of quality achievements to be carried out and to take any corrective and /or preventive actions against quality deficiencies being clearly defined and effectively implemented. Ethiopian air lines have associated Quality Management system for accountabilities, resources, and processes necessary to establish and promote a system of continuous quality assurance and improvement, while delivering a product or service. The Quality Policy of Ethiopian air lines reflects achievement and continued compliance with all regulatory bodies requirement as well as Ethiopian Civil aviation rules. Per the Air line Policy; all sections indicated in the structure including all operational managers are responsible to implement Quality management System Company wide. (Ethiopian Air lines Group QMS Manual, 2021, Chapter 2).

Considering Equipment and Facility maintenance section as part of the Aviation Groups support service provider, the Corporate QMS, SMS and Compliance section took the responsibility to monitor its quality assurance and quality management issues along with other activities of safety management and environment management system. Due to this , EFM has no independent quality assurance section unlike other strategic business units .

2.4.1 QMS Structure in Ethiopian Aviation Group

Ethiopian Aviation group (EAG) has established TQM in its various strategic business units playing significant role to keep the aviation industry standard based on international regulatory body requirement. In Ethiopian Aviation Group, the issues of Quality management system, Safety Management system, Compliance and business sustainability is directly monitored by the Group CEO. The activities are structured and managed under Vice president , Director , Divisional Managers, Team leaders and Quality auditors. With this structure, the divisional Quality Assurance and Safety sections provides auditing of all functions in the Air craft Maintenance and all related Ground handling operation business units to ensure the company compliance with applicable regulations and procedure.

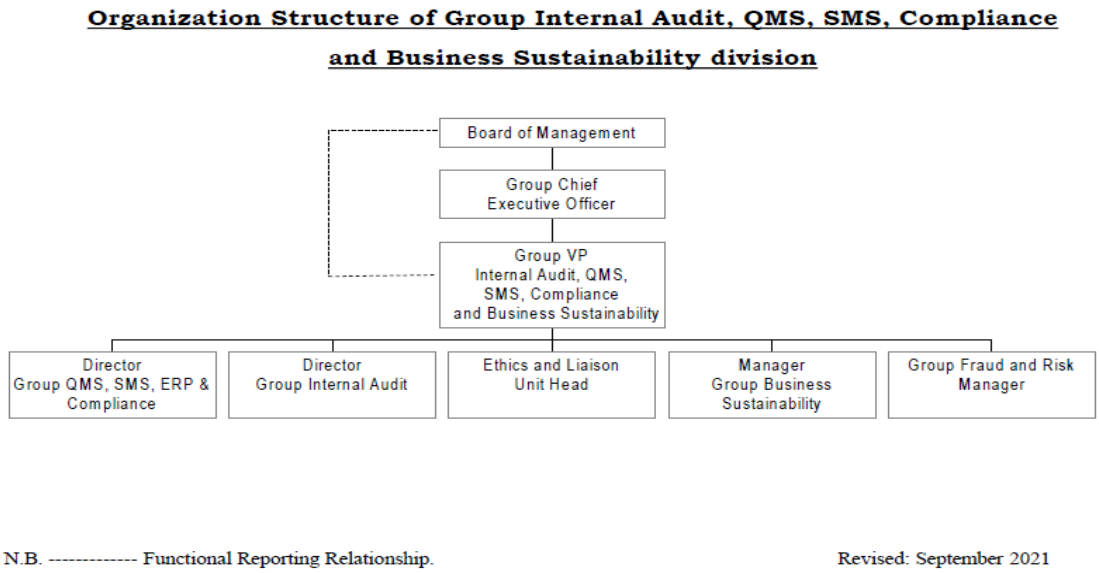

Fig.-3 QMS Organizational Structure in ETAG

The above structure indicates Ethiopian Aviation Group has given great emphasis for strict implementation of Quality and Safety Management system implementation across the air line strategic business units.

2.4.2 QMS Structure in ETAG Strategic business units

The strategic business units as well as the operation support have in total about 9 QMS Managerial and a team leader positions. All are accountable to Dir. Group QMS, SMS, ERP and Compliance to handle divisional QMS and SMS issues. Pools of auditors carry out audit activities per audit schedule. During auditing, there is no direct and scheduled audit on Equipment and Facility Maintenance. However, prior to audit of external regulatory bodies, Divisional QMS, SMS, ERP and Compliance sections conduct self assessment and Micro audit that rarely involve Equipment and facility maintenance section based on the regulatory body requirement. (Ethiopian Air lines Group QMS Manual, 2021, Page 5).

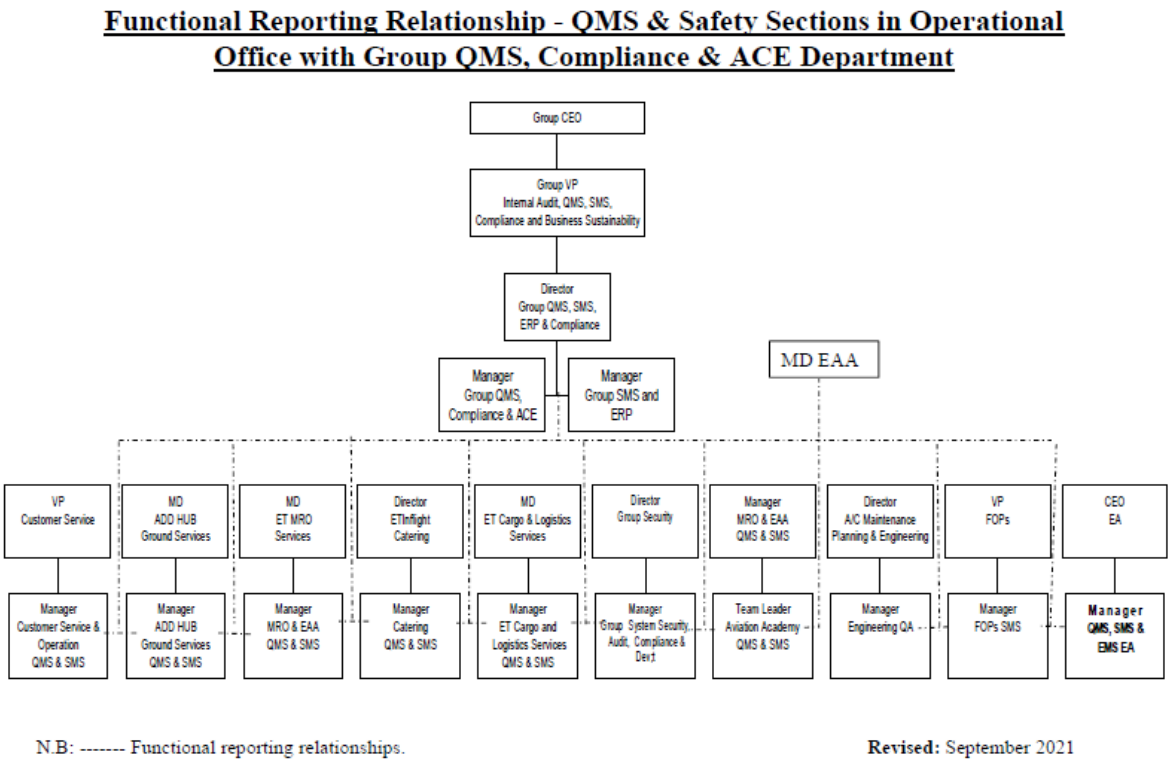

Fig.-4 Functional reporting QMS Organizational Structure in ETAG

Although there are several Quality assurance sections across the strategic business units, Equipment and facility maintenance section don't have its own quality assurance section. However, to fill the maintenance quality gaps, an inspection department provides quality control service to Motorized Equipment maintenance section only. According to David Hoyle in his book Quality Management essentials, he stated,

> What inspection does is measure quality in a way that allows us to make decisions on whether or not to release a piece of work. Work that passes inspection should be quality work but inspection unfortunately is not 100% reliable.

He also added that Most inspection relies on human judgment and this can be affected by many factors, some of which are outside our control (such as the private life, health or mood of the inspector). (Quality management essentials, 2007, Page 35)

Also according to John S. Oakland, Employing more inspectors tightening up standards, developing correction, repair and rework team does not improve Quality. (Oakland, 2014, Page 31). It is critically important to bring Quality Assurance into the workforce to deploy their skill and drive productivity.

2.4.3 Work Place Policy manuals in ETAG

As per Ethiopian air lines Company procedure, all divisional QMS and SMS sections are responsible to develop divisional QMS manual for their respective operations which is incompliance with Ethiopian civil Aviation Authority, Star Alliance (World largest global air lines alliance), ISO and industry practice. The manuals developed under each strategic business units Divisional QA plays significant role in keeping as the organization standards to supervise the synergy, since they have got regulatory bodies approval. These manuals are approved by Ethiopian Civil Aviation Authority, and regulatory bodies, as well. To mention few,

- Ethiopian MRO Maintenance Procedure Manual (MPM)
- Cargo Internal Evaluation And Audit Process Manual
- Business sustainability Manual can be taken as an example

All quality assurance departments and Safety section administers the Safety management policies and procedures so that safety policy and objectives are met. They also Ensures adequate resources are allocated for effective implementation of safety management system (SMS). The sections are check and balance point of all functions of the management system for maintenance operations to ensure Ethiopian is complying with applicable regulations and procedures of the standard, satisfying the maintenance operation's needs, identifying undesirable conditions and areas that require improvement, identify hazards in maintenance operations. In this regard all sections have the require policy and procedure manuals. The maintenance planning Scheduling requirement and implementation across the company is assessed and monitored by the respective sections.

Policy and procedure manuals across Ethiopian aviation group are controlled and revised every two years counting from the revision date. This practice is mandatory. However, the duration may not be necessarily followed when a revision/updating is recommended by safety or regulatory body. It is enforced, controlled and managed by Group QMS, SMS, and ERP and Compliance section across all operational units. The main reason for this is to incorporate changes and updates due to the dynamic nature of the Air line industry requirement on safety, service quality and standards. It also helps the company to meet regulatory bodies' requirement in the alliance which the World global air lines created.

2.4.4 Employees Motivation and reward in ETAG

The employees motivation and reward in ETAG is using a method and process that comprises of goal setting , performance review, feedback and rewarding employees. It is merely based on performance, it assesses the organizational and individual performance using the four perspectives, financial, Customer, Internal process and Human capital management. For the purpose of assuming the company's high-performance culture and motivating and recognizing employees for their effort, the company reward employees with performance related pay as specified in the company's reward strategy detailed under chapter 05 of the Corporate HRM manual. The outcome of performance review shall be used for developmental purpose like, Training, coaching, mentoring, job rotation, promotion etc.…

2.4.5 Continuous Quality Improvement Tools in ETAG

Continual improvement of the organization's overall performance should be a permanent objective of the organization. This means that everyone in the organization should be continually questioning its performance. (David Holye, 2007, Page 41)

The section under Director Group QMS, SMS, Compliance and ACE ensure such practices in all divisional areas through continuous audit and monitoring. While conducting the audit, the quality assurance objectives are achieved by using PDCA cycle along with ACE (Achieving Competitive Excellence), tools for continuous improvement. This quality management tool, ACE, is a proprietary continuous quality improvement system developed by united technologies corporation, (UTC) and adopted by Ethiopian air lines. It is a day to day operating system ensuring the company in continuously driving towards operational and quality excellence and meeting the milestones through making ACE as its working culture. The Group QMS, SMS, Compliance and ACE section, train and expose quality auditors and operational staffs of all divisions to IATA, ECAA, ISO and industry standard. In order to engage all employees in appropriate level and throughout this change management tool, ACE structure is stretched across the organization that enabled employees to carry out their assigned role within their structure.

Similar to other sections, ACE is a widely exercised quality management tool in Equipment and Facility Maintenance. The progress and continuous improvement tools in ACE are monitored on monthly basis.

CHAPTER THREE

Research Methodology

This chapter describes the methodological procedures used to answer the research questions proposed in Chapter 1. It includes six sections: (3.1) Description of the study area, (3.2) Research Design and approach, (3.3) Target population, (3.4) Sampling design, (3.5) Sample size determination (3.5) Data source and instrument (3.6) Sources of data (3.7) Dependant and independent Variables (3.8) Data analysis (3.9) Ethical considerations.

3.1 Description of the Study Area

The study was conducted in Ethiopian Aviation Group S.C, which is located in Addis Ababa at Bole Sub City. Ethiopian Aviation Group S.C head office is organized by Nine Strategic Business units which have 16,002 Employees (Ethiopian Fact sheet, April 2022). The specific area where the study focused was Equipment and Facility Maintenance that provides Maintenance service for all Ethiopian Aviation Group strategic Business units in providing maintenance service to Ground Support Equipment, Shop service Facilities and machineries maintenance at the head office and regional Airports. The study mainly focused on factors that affect Quality Assurance in the section while providing Maintenance service. The total number of employees in the section is 144, which was used as the sampling frame of the study.

3.2 Research Design and Approach

The study has adopted descriptive research design by using both qualitative and quantitative to obtain the desired results of the company and to explore about the factors affecting Quality assurance in Equipment and facility maintenance. In the course of analyzing the problems, both primary and secondary data collection procedures were employed. To achieve this goal, questionnaires, interviews and document reviews were the main tools. The reason why to combining both qualitative and quantitative research approach, and mixed research approach is, to develop and for complete understanding about the problem and is to develop measurement instrument (Creswell, 2012).

3.3 Target Population

Target population is an aggregation of elements from which sample is selected (Mugenda and Mugenda, 2008). The target population of the study was 144 (male and female) permanent employees of the section that included functionally reporting facility Maintenance teams. The sample contained employees involved in team Leadership, Maintenance Planning, Inspection, Engineering and Maintenance service provisions which currently are organized under three Managers.

3.4 Sampling Design

In order to select the appropriate representative samples of the total population and to make the research findings more relevant and accurate, the sample design would be well structured. The target population, techniques of selecting samples and sample size are clearly stated as follows:

3.4.1 Sampling Techniques

The techniques the researcher used non probability sampling technique. Therefore, it was important to divide the total population into different Sections or strata that represented of the population. Each category or strata representative was selected by Purposive sampling method. Non-probabilities sampling/ purposive sampling/ was used as a convenience of the researcher, so as to include the respective Sections' Team Leaders. It was decided to use this method in order to gain relevant data about the present status of Quality assurance in the section and was sufficient enough to provide more reliable sample for the study.

In order to strengthen the reliability of data gathered from questionnaires interview was conducted based on purposively selected two Managers. To make the data more reliable the Director of Group Facility Maintenance was also included. 15 Interview questions were prepared and conducted.

Table 3-1 EFM Employees Summary Table

Target	Total Number	Percentage
Team leaders	20	8%
Maintenance crew	114	88%
Support staffs	10	4%
Grand Total	144	100%

3.5 Sample size determination

The sample size selected was based on sample size determination from known population by (Yamane, 1967) which was based on a 5% margin and 95%level of confidence.

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

Where

N: is desired population

n: is sample size

e: is margin of error (5%)

1: is constant number $n = \frac{144}{1+((144)(0.05)2)} = \mathbf{105}$

Therefore, the total sample size of the study was 105 employees of the Maintenance sections

3.6 Sources of Data

To attain the aim of the study, to secure sufficient and relevant information the researcher used primary source of data.

3.6.1 Primary and Secondary Data Source

The main data gathering tools were both primary and secondary data sources which were used to answer research questions. Primary source data was mainly obtained through self-administering structured questionnaires, survey, and observation. Also personal interview was used in order to check the reliability of the information collected.

The researcher collection techniques used were primary collection techniques. Primary data was collected from selected representative respondents' viewpoint, information on the factors affecting Quality assurance implementation in Maintenance Sections. The interview made with the Management at the same time is believed that they have valuable insight and deep understanding about the status of Quality in the Section. The collection of secondary data was done through an extensive literature review from books, journals, archives, internet, and from different websites.

3.6.2 Instrument of data collection

Structured questionnaires and semi-structured interview data collection instruments were used to collect data. The questionnaires were adapted in two modified parts. Part one demographic information of the respondents: Personal Background: Sex , No of Service years in the section, Educational background , Position in the Section, and employee Service Stream.

The second part assessed the factors that affect Quality Assurance in Ethiopian Airlines Equipment and Facility Maintenance and the Employees role and participation in Quality Assurance improvement activities. Those questionnaires were distributed to employees who are currently working in different expertise and Team leading positions.

The degree of the factors affecting Quality assurance presents to respondents through questionnaires was rated the extent of effect on the basis of Likert scale. Semi structured interview questionnaires were prepared for the Director and Managers to collect the data.

3.7 Dependent and independent variables

Independent variable is the variable that has the presumed effect on the dependent variable which is manipulated by the researcher. There are 15 groups of predictor variables/ independent variables for this study that assumed to affect Quality assurance ,the dependant Variable. These are listed far below.

1. Employee Role and participation in the Section Quality Team
2. Organization Structure Vs the section
3. Policy and procedure
4. Maintenance Planning
5. Parts and Materials Management
6. Leadership
7. Communication
8. Reward and recognition
9. Team work
10. Training ,Knowledge Management and Development
11. Involvement of employees
12. Empowerment of Employees

13. Maintenance Management
14. Data recording and Record keeping
15. Environmental regulations

3.8 Data Analysis

The data that were collected from employees through questionnaire were analyzed by the help of SPSS software version 23. Descriptive statistics was used to analyse the demographic data of respondents. Demographic variables, reliability, descriptive statistics, correlation analysis and factor analysis testt were conducted to analyze the collected quantitative data. First, demographic information about the participants is reported. It included the frequency distribution of demographic variable such as gender, service year, education, etc. Second, Cronbach's alpha was calculated for testing the reliability of the scales used in this study. Third, descriptive statistics were calculated to get information about the means and standard deviations for each of the variables of interest. Fourth, to answer the research questions, correlation analysis was conducted. The Correlation analysis was interpreted through checking the direction and magnitude of related variables in terms of the 'r' value. Factor analysis was used to identify most influencing factors and important predictors (independent variables) correlating each other.

3.9 Ethical Consideration

In conducting this research, respondents were informed in advance that the data collection process is carried out whenever they are willing to cooperate. In addition to this, any information collected via the instruments would never be used for any other purpose other than its academic intent i.e. the data would be kept confidential.

Respondents were not required to mentioning their name, cell phone and identification (ID) in the questionnaire in which it is believed that it will help them express their idea and opinion in an unrestricted manner. Information obtained from respondents was handled confidentially. Willingness of the participants in the data gathering process was a prerequisite for the study. The data that was obtained from the participants will not be used for other purposes. All sources of data that was used and cited in this study were properly cited.

CHAPTER FOUR

4 Data presentation, analysis and interpretation

The main purpose of the study was to identify the major factors that affect quality assurance in Ethiopian Air lines Equipment and facility Maintenance and searching for solutions that can avoid internal micro audit remarks and excel the maintenance service to meet the expected requirements of the strategic business units, since Compromising the safety standards could lead to decertification/revocation of flight permit.

In order to meet the purpose of the study, this chapter presents the data analysis part of the study. The analysis presentation part is depicted in seven sections. These are (4.1) Respondents profile, (4.2) Socio demographic information (4.3) Mean values of variables (4.4) Reliability test, (4.5) Factor analysis (4.6) Relative importance index and (4.7) Results. These will be presented as follows.

4.1 Respondents' profile

A total of 105 questionnaires were distributed to employees under Equipment and facility Maintenance. According to UNIDO (2002) survey medium sized companies have 200-400 employees and have also small to medium range of products. 98 Questionnaires were returned, out of which 3 were discarded because of many missing and incomplete data. Therefore, the numbers of usable questionnaires were 95 and as a result the response rate was 90.48%

4.2 Socio-Demographic Characteristics of Respondents

One hundred five questionnaires were distributed to the Section employees of Equipment and facility Maintenance working in Addis Ababa . Out of these, 95 were returned making the response rate of 90.48%.

Table 4.1 Frequency Distributions of Respondent with respect to their Gender

Sex	Frequency	Percent	Valid Percent	Cumulative Percent
Male	90	94.74	94.74	94.74
Female	5	5.26	5.26	100.00
Total	**95**	**100.00**	**100**	

Table 4.1 indicate that the gender allocation of the sample of respondent from the section employees which the research was conducted. Out of the total respondents, 90 (94.7%) of them were males, and the remaining 5 (5.3%) were females. The result indicates that, there is gender disparity sowed in the section.

Table 4.2 Frequency Distributions of Respondent with respect to their service year

No. of Service in Years	Frequency	Percent	Valid Percent	Cumulative Percent
<5	0	0	0	0
5 to 10	48	50.53	50.53	50.53
10 to 15	33	34.74	34.74	85.26
15 and above	14	14.74	14.74	100.00
Total	**95**	**100**	**100**	

Table 4.2 indicate the employees work experience. There were no employees who worked below 5 years, However, 50.5% of them served the company 5 years to 10 years, 34.7% employees served 10 to 15 Years and the remaining 14.7% , 15 and above years. This indicate that there is potential threat that the section has to work on Knowledge transfer and build work culture on half of the employees to achieve future objectives of the company's growth strategy.

Table 4.3 Frequency Distributions of Respondent with respect to their Educational Background

Educational background	Frequency	Percent	Valid Percent	Cumulative Percent
Diploma	51	53.68	53.68	53.68
Degree	37	38.95	38.95	92.63
Masters	7	7.37	7.37	100.00
Other	0	0.00	0.00	100.00
Total	**95**	**100**	**100**	

Table 4.3 indicate 53.68% of the employees were Diploma holders whereas, 38.9% Degree holders and the remaining 7.4% were MA holders respectively. Here we can say that

respondents are educated. This implies that the company has advantage of utilizing its human resource for its long-term strategy which can give competitive advantage were ever the competition exist.

Table 4.4 Position of Employees in the section

Position in the section	Frequency	Percent	Valid Percent	Cumulative Percent
Team Leader	12	12.63	12.63	12.63
Mnt. Crew	77	81.05	81.05	93.68
Inspector	2	2.11	2.11	95.79
Planner	2	2.11	2.11	97.89
Engineer	2	2.11	2.11	100.00
Total	**95**	**100**	**100**	

Table 4.4 indicates that 81% of the employees are maintenance crew that provides the maintenance service across the section. Whereas, 12.6% of the section employees are serving in leadership, for the maintenance as well as the support service.

Table 4.5 over all respondents' distribution in EFM

Service Stream	Frequency	Percent	Valid Percent	Cumulative Percent
Motorized Eqpt. Mnt.	41	43.16	43.16	43.16
Facility Mnt.	52	54.74	54.74	97.89
Support Service	2	2.11	2.11	100.00
Total	**95**	**100**	**100**	

Table 4.5 indicate that 43.16% of the employees are under Motorized Equipment maintenance service stream whereas 54.74% of the employees are under Facility Mnt. the remaining 2.11% employees provide the maintenance support service for the later maintenance service providers. In the questionnaire, part two contains fifteen questions, in which the questions deal about Employees role and participation in Quality circle.

4.3 Mean values of variables

The means of the 15 factors stated were calculated and presented in Table 6. From this table, it can be noted that, the means scores of 13 variables are above the midpoint (3) of

the scale. The highest mean score recorded was for order related factors (M=3.4013) while the lowest score was recorded for supplier related factors (M=2.9210).

Table 4-6: Mean and Standard deviation

	Mean	Std. Deviation	Analysis N
Quality	3.4013	.66356	92
Org. Structure	3.2516	.77387	92
Policy	3.3179	.85091	92
Mnt. Plng	3.2591	.82832	92
Part and Material	2.9449	.88971	92
Leadership	3.1783	1.12999	92
Communication	3.2998	.76157	92
Reward	2.9734	1.09919	92
Teamwork	3.2364	.82489	92
Training	2.9210	.82673	92
Emp. Involvement	3.1150	.69005	92
Empowerment	3.0996	.77941	92
Mnt Management	3.1659	.79888	92
Data Rec.	3.1241	.82602	92
Envt Regulation	3.2120	.80001	92

4.4 Reliability test

For the fifteen summaries of variables in the study listed above, Cronbach's alpha was calculated to examine the reliability of all the items (68) each variable of the study. Under each variable in the Likert scale, there were four to six items presented and their Cronbach's alpha became 0.972. Usually, reliability coefficients should be at least '.70' and the higher the better (Fankel and Wallen 1996, p 163). Furthermore, as suggested by Churchill (1979), if scale item were to exhibit an item-to- total correlation of 0.25 or less, the item should not be included in further analysis. All items used in this study have greater than 0.25 an item total correlation. Reliability coefficient for items in each variable (Cronbach's alpha) is also greater than 0.7 which showed higher reliability of the items used in measurement of the variables. A number of items used on the scale usually affects the estimated reliability.

Table: 4-7 Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.972	.980	68

4.5 Factor analysis and measuring Strength of relationship.

Factor analysis is to reduce the large set of variables to smaller number of the latent factors. Like cluster analysis, grouping similar cases, it helps the researcher to validate the factor structure. In this regard the researcher used principal axis factor analysis, since it has similarity with principal component analysis.

4.5.1 Descriptive Statistics in factor analysis

The factor analysis program generated this table which indicates that there was Analyses N 95. Some items had one or two missing participants.

Table 4-8: Descriptive Statistics

	Mean	Std. Deviation	Analysis N	Missing N
Quality Team	3.3833	.66482	95	0
Org. Structure	3.2442	.77087	95	0
Policy	3.3079	.85167	95	0
Mnt. Plng	3.2412	.83000	95	0
Part and Material	2.9461	.88013	94	1
Leadership	3.1763	1.12399	93	2
Communication	3.2934	.75459	94	1
Reward	2.9633	1.09193	94	1
Teamwork	3.2316	.82855	95	0
Training	2.9165	.81757	95	0
Emp. Involvement	3.1140	.69094	95	0
Empowerment	3.0991	.76717	95	0
Mnt. Management	3.1616	.78700	95	0
Data Record	3.1135	.82050	94	1
Envt. Regulation	3.2021	.79504	94	1

4.5.2 Correlation Analysis

Correlation analysis is a useful way of discovering relationship among variables. The value of the coefficient (*r*) ranges from -1 up to +1 .The value of coefficient of correlation (*r*) indicates both the strength and direction of relationship. If *r* = -1, it indicates that there is perfectly negative correlation between the variables. If *r* = 0 it does indicate there is no relationship between the variable and if *r* = +1 there is perfectly positive relationship between the variables. For values of *r* between +1 and 0 or between 0 and -1, different scholars have proposed different interpretations with slight difference. However the researcher in this study used diction rule given by Bartz (1999) was used. Bartz (1999) described the strength of association among the variables as follows.

Table 4- 9: Interpretation of r *Source*: Bartz (1999)

Value of *r*	Description
0.80 or higher	Very high
0.6 to 0.8	Strong
0.4 to 0.60	Moderate
0.2 or 0.4	Low
0.20 or lower	Very low

4.5.3 Communalities

The communalities, which indicate the amount of variance in each variable is as seen in the table below. It is also the squared multiple correlation between the item and other items. As per standard the ideal acceptable communalities is above 0.7. In this case the values are acceptable cut off values, ensuring the strength of relationship between the major factors.

Table 4-10: Communalities

	Initial	Extraction
Quality Team	1.000	.570
Org. Structure	1.000	.763
Policy	1.000	.694
Mnt. Plng	1.000	.568
Part and Material	1.000	.711
Leadership	1.000	.536
Communication	1.000	.620
Reward	1.000	.510
Teamwork	1.000	.666
Training	1.000	.562
Emp Involvement	1.000	.669
Empowerment	1.000	.630
Mnt Management	1.000	.753
DATA Rec.	1.000	.571
Envt Regulation	1.000	.587

4.6 Relative importance Index

Using relative importance index was one of the analysis methods used to identify the very close factor which is most significant criteria that respondents replied. Since it is one of appropriate tool, In order to compile the relative importance index, the researcher listed out all responses from the likert scale and extracted on excel sheet. The reply was counted according to their 5 scale rank, summed and there were 95 respondents. The weight for each reply was calculated by giving 1 point to 5 point for the very poor to excellent replies respectively and multiplying each count by the rank. In this manner each reply weight is summarized. As per the response each reply relative importance index was calculated by dividing to the weight and multiplying the respondents' number by the maximum rate, which is 5.In this manner the Relative importance index is summarized as seen below.

The reference table for the RII (relative importance index)

Table 4-11: Guide for degree of significance

No.	Degree of Significance	Rating
1	Most Significant	0.76 and above
2	Significant	0.67 to 0.75
3	Less significant	0.45 to 0.66
4	Not Significant	0.44 and below

The summary of result shows that the most significant factor that affects quality assurance in EFM is employees' role and participation in the section quality team. Besides this Policy and procedure and Employees recognition and reward have significant impact over factors affecting quality assurance. The table below shows the details.

Table 4-12: Relative Importance Index (RII)

Summary	RII	Rank	Degree of significance
Employee Role & participation in the Section Quality Team	0.68	1	Most Significant
Organization Structure	0.65	3	Less Significant
Policy & procedure	0.66	2	Significant
Maintenance Planning	0.65	3	Less Significant
Parts & Materials Management	0.59	7	Not Significant
Leadership	0.65	3	Less Significant
Communication	0.61	6	Not Significant
Rewards and Recognition	0.66	2	Significant
Team work	0.58	7	Not Significant
Training ,Knowledge Management & Development	0.65	3	Less Significant
Involvement of Employees	0.58	7	Not Significant
Empowerment of Employees	0.62	5	Not Significant
Maintenance Management	0.62	5	Not Significant
Data recording & Record keeping	0.62	5	Not Significant
Environmental Regulations	0.64	4	Not Significant

4.7 Results

The above summary table of relative importance index leads to the findings that the factors that most affect /significantly affect quality assurance in Equipment and facility Maintenance section are those which are related to Employees role and participation in the section quality team. The other significant factor is the policies and procedures, its implementation and clarity in guiding the employees to the standards of regulatory bodies' requirements. Easiness of the policy to be understood by the section employees could have tremendous benefit and contribution in keeping quality per the industry standards. The remaining factor that has significant impact based on relative importance index is reward and recognition management of the employees in the section. As per the outcomes, it is understood that the employees' reward and recognition is not quality focused and does not consider and give emphasis for quality, although the company has an established system in rewarding exceptional achievements. The study also indicates that the section has gaps on performance measurement techniques that it is not considering quality as well. It is understood that the employee performance has direct relation to performance rating with the ultimate goal of rewarding the employee.

CHAPTER FIVE

5. SUMMARY, CONCLUSION AND RECOMMENDATION

Under this section of the research paper, summary of the findings, conclusion and recommendations are forwarded. Moreover, limitations of the study and directions for the future research shall be indicated as follows.

5.1 Summary of major findings

The main objective of the study was to assess the factors affecting Quality assurance in Ethiopian Airlines equipment and facility maintenance. The study was designed mainly to identify which factors are significantly affecting the quality assurance implementation and are main contributors for the repetitive micro audit finding that could have potential impact for decertification of the air line and restriction from getting permit due to non-compliance to safety standards.

To summarize this research, from the socio demographic characteristics, the researcher has identified that there is gender disparity sowed in Equipment and Facility maintenance section. Besides this, there is potential threat in EFM section for knowledge transfer and in build work culture since almost half of the employees are below ten years.

According to the survey conducted and based on the interview made with the section Director and Managers, there is no Quality circle & Teams in the maintenance section. out of the fifteen parent factors which were presented for analysis, the Employees role and participation in quality assurance was one of the most significant factor that affect Quality assurance in the section. Quality Circles give an overall direction towards quality improvement.Abscence of Cross functional team that consists of representatives from the strategic business units, engineering, purchasing, cannot bring continuous improvement.due to this there are no opportunities for the team to raises and discuss about best Practices, Point out major issues, Collaborate Solutions, brain storm ideas and Streamline how problems can be fixed. Absence of such team formation is one of the factors that highly affect quality assurance implementation in EFM.

The other significant factors affecting quality assurance are factors related to Policy and procedure and factors related to employees reward and recognition.

As per the result, the section employees has limited role over quality circle establishment and cross functional team improved activity besides to the remaining: policy and procedure and Employees reward and recognition identified gaps.

Although it is widely in practice by other strategic business units, quality assurance internal audit is not independently in practice in EFM and there is no Quality assurance section structure in EFM.

5.2 Conclusions

Ethiopian air line has a well organised and intact quality management system established across all strategic business units. However, based on the relative important index, the most significant factor affecting quality assurance in Equipment and facility maintenance is absence of employees role in the section quality team. The role of employees in quality circle , process improvement team , cross functional team in resolving the section inter departmental issues is found minimal. Although the participation of employees in this regard is the most valuable input in achieving best outcomes of Quality assurance in the section activities, the outcome of the survey and the results of interview indicate the practice is not available.

The other outcome of the survey based on relative importance index is the gaps found on the section policy. The section employees don't have clarity over the Policy core values and beliefs about common goal across the strategic business units. From this it can be understood that the available policy and procedure manual of the section does not have clarity and easiness to be understood by the employees, equivalently like other strategic business unit employees. It is worth indicating that absence of employees in understanding the core values about the common goals to be achieved as an air line strategic business unit are not well understood.

A factor that has similar significant impact is the section existing practice to reward and recognise its employees. The practice of performance measurement, the methods and techniques used by the section is reflected on the quality outcomes. Acknowledgement granted by the section to the work performed by the employees and the overall company acknowledgement for superior quality performance achievements is not motivating the employees. This situation has resulted on employees not to feel guilty even if they are rewarded. This leads to conclude that the reward and recognition practice in the section has impacted the maintenance quality, since it does not incorporate maintenance quality even on superior performance achievements. The research also showed the possible relationship that existed among the variables through correlation analysis.

5.3 Recommendations

The study identified a factor that the employees' role and participation in the section quality team is very significant in affecting the quality assurance implementation in the section.. The other two significant factors are Policy and procedure and employees recognition and reward system of the section. From this, the researcher would like to recommend the Company to review and incorporate employees quality team role and participation in its Quality policy & strategic objectives for the development of organizational culture and maintenance quality across all strategic business units, including EFM. The gaps in this regard have to be addressed well.

Based on the observation of the researcher, Equipment and Facility Maintenance section is recommended to revise its maintenance and procedure manual, in order to play an important role in improving the gaps and avoidance of factors. This will also create an opportunity to enable review and upgrade the section maintenance standards, employees' skill which is necessary training for better and strict implementation of Quality.

- The section is recommended to create better platform across sections that can build Quality circle, re-organize a process improvement team to construct strong bondage between cross functional teams. This will create opportunity in strengthening the self managed team and expand the employees' role and improve Quality assurance.
- The reward and recognition of employees using the current method is recommended to be reviewed to incorporate quality aspects. The performance measurement techniques and methods in use are recommended to be encouraging by considering quality.

- An important contributing booster for quality assurance is implementation of separate and independent quality assurance audit practice, which is widely implemented across the strategic business units, but it is not in EFM. Instead of indirect audit conducted on EFM, it is much more recommended to get the audit conducted on the section, based on the section maintenance Policy manual directly. The researcher recommends that such gaps can be alleviated through establishing QA department for the section independently.

In general, the primary requirement in air line industry is safety. Reliable maintenance quality service will make the section more dependable; therefore, keeping the standards of EFM per the industry requirement will uplift the section recognition and enable Ethiopian air lines to see other strategic business opportunities in its effort of building Aviation alliance across the African continent. The internal audit findings forwarded while conducting the micro audit are bad indications that can potentially lead to decertification of license as well as restriction of permit to fly, if neglected.

5.4 Limitations of the study and directions for future researchers

This study was conducted based on the data collected from Employees EFM. The researcher also used survey and interviews to collect data for his input. Finally, the research tried to assess the factors interrelation based on the Factors that have potential impact in affecting Quality assurance. Since there were no similar researches conducted in this regard on the section, other researchers can enrich this study by using other data gathering tools; like panel discussion. By including more channel members like Strategic business units, Corporate Quality assurance section, and other stake holders in the industry, it is possible to pin point challenges from each corner. Moreover, further studies can also be conducted by adding more factors which might be crucial in the section activity, So that the section can be a more dependable service provider for the maintenance support to all strategic business units as well as partnership air lines in the African continent.

REFERENCES

- Belverd Needles, Marian Powers, Susan Crosson, 2011, Financial and Managerial Accounting, Ninth Edition, South-Western, Cengage Learning
- Charles W.L.Hills, Steven L,McShane, 2008, Principles of Management, Third Edition, McGraw-Hill
- David Holye, 2007, Quality management Essentials, First Edition, Oxford, Burlington, MA
- EASA, 2021, European plan for Aviation Safety(EPAS) -Aerodromes and Ground Handling Manual, Volume III, EUASA
- Civil Aviation rules and Standards federal democratic republic of Ethiopia part I, 2019,General policies procedures and definitions
- Gary Yukl, 2013, Leadership in Organizations, Eighth Edition, Pearson Education, Inc
- IATA, 2018, Operations Manual GOM/A (Part A) AOC B-3010 and AOC L-13 and AOC MT-16,Version 4.3,Geneva
- Jack R. Fraenkel, Norman E. Wallen, Helen H.Hyun,1996,How to design and Evaluate Research in Education, Eighth Edition, McGraw-Hill
- John S.Oakland, 2014,Total Quality Management and operational Excellence, Fourth Edition, Routledge
- Joseph M. Juran,1979, Juran's quality handbook,5th edition, McGraw-Hill
- K. S. Krishnamoorthi ,V. Ram Krishnamoorthi ,Arunkumar Pennathur,2019,A First Course in Quality Engineering Integrating Statistical and Management Methods of Quality,Third Edition, CRC Press
- Richard L. Daft, Patricia G. Lane, 2014, Management, Twelfth Edition, Cengage Learning

- William A. Levinson, 2013, Lean Management System LMS: 2012, First Edition, Taylor and Francis Group, LLC

INTERNET SOURCES

http://www.ethiopianairlines.com/

https://www.aviationhunt.com/civil-aviation-standards/#ICAO-standards

https://www.aviationpros.com/education

https://www.bspublications.net

https://corporate.ethiopianairlines.com

http://portal/COO/MntEng/Quality%20Assurance/default.aspx

https://www.skybray.aero/articles/ground operations

https://www.theairportshow.com/en-gb/industry-insights

Appendices

Appendix: A- Interview Questions Guide Line

1. Does the Organizational structure has impact on Quality assurance implementation and staff motivation?
2. Does your section have policies and procedure manual available to guide maintenance ,operations, strategy and Quality per industry standards along with regular and Independent self audit Plan in the section per your Quality Policy Manual?
3. Do all sections have got well organized maintenance planning support?
4. Do you agree that Spare part and Materials management and supply have impacted the maintenance Quality and performance?
5. Do you agree that Quality circle is well functioning in all Mnt. section to support Quality assurance?
6. Is the leadership influence on Employees has shaped the maintenance Quality Culture positively?
7. Do you agree that there is transparency in exchange of facts, ideas, suggestions and emotions across the section?
8. Do you think the reward and recognition practiced by the Company to develop maintenance quality improvement is successful?
9. Do you agree that there exists employees' dynamic interaction and interdependency toward common and valued mission and is it widely prevalent?
10. Does the Training provision enabled employees to acquire necessary knowledge for optimum performance as well as keeping Quality standards?
11. Do you have a practice to involve Employees to participate when demanded in the organization process improvement?
12. Do you empower /delegate Authority to make the work, easy, effective and fast, instead of waiting your instructions and decisions?
13. Is the maintenance Mgt. streamlined, demarcation and reporting well established?
14. Do you have easy access of Maintenance data supported by IT?
15. Is the Maintenance operation in compliance with international environmental rules and regulations that your employees are aware what is expected?

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Appendix: B -Questionnaire for respondents

Letter of Consent to participate in research

Dear Sir/Madam

My name is Abdella Siraje.. I am a post-graduate Student at St. Mary's university Institute of Quality and Productivity Management and Currently, I am doing research on the title "Quality assurance in Ethiopian Air lines Equipment and Facility Maintenance'' for the partial fulfillment of Masters of Art Degree in Quality and Productivity Management and you are requested to participate in this research by filling the following questionnaires.

The finding of the study would be very important for academician, the Company and etc. in identify the major organizational, and cultural barriers affecting Quality Assurance.Therefore, your response is highly valuable and there are no identified risks from participation in this study and participation is completely voluntarily.

The report of the study will only be communicated in aggregate form to protect the identity of the respondents and the finding of the study will be used only for academic purpose. If you wish to get the summarized finding of the study please write your email address below through which you want to be communicated. For any further information the researcher may be reached on the following addresses.

Cell Phone: 0911454595
Email: abdellahsiraje@gmail.com
ABDELAS@ethiopianairlines.com

Part I

1. Personal Background

1.1. Sex ☐ M ☐ F

1.2. No of Service years in the section

☐ <5Years ☐ 5-10years ☐ 10-15years ☐ 15and above

1.3. Educational background

☐ Diploma ☐ Degree ☐ Masters ☐ Other

1.4. Position in the Section

☐ Team Leader ☐ Maintenance Crew

☐ Inspector ☐ Planner ☐ Engineer

1.5 Service Stream

☐ Motorized Equipment ☐ Facility Maintenance ☐ Support Service

Part II

Please take a few minutes to give your most thoughtful answers. You can treat 1 as the lowest rating and 5 as the highest rating.

1- Very poor:	practice not implemented
2- Poor:	practices do not add value
3- Good:	it is in practice but not very effective
4- Very Good:	it is in place and very effective
5- Excellent:	it is in place, in practice, very effective

No.	Factors affecting QA	1- Very poor	2- Poor	3- Good	4- Very Good	5- Excellent
1	**Employee Role and participation in the Section Quality Team**					
	My role in Quality Circle					
	My role in Process Improvement Team					
	My role in Cross functional Team					
	My role in Self-Managed Team					
2	**Organization Structure Vs the section**					
	The Organizational structure serves as a framework of rules and relations to achieve the goals.					
	Organization structure guide and clarify activities of everyone in the organization.					
	Convenience of organizational structure to formally control and coordinate the section activities					
	Section role in Defining the corporate vision, strategies and Critical Success					
	Organizational structure Impact on individuals' motivation and performance.					
3	**Policy and procedure**					
	Available Policy and procedure manuals to guide Maintenance operations, strategy, and work-flows					
	Policy system, strategy and work planning clarity and easiness to understand					
	Established controlling Systems status for New and revised Policy documents.					
	Clarity of core values and beliefs in the Policy about common goals to be achieved.					
4	**Maintenance Planning**					
	Planned maintenance and Scheduled activity in Practice					
	Planned Maintenance activities organization and structure					
	Maintenance planning starts from clear understanding and reviewing of the company's corporate strategy.					
	Planning activities focus to meet the organization's objectives effectively					

No.	Factors affecting QA	1- Very poor	2- Poor	3- Good	4- Very Good	5- Excellent
5	**Parts and Materials Management**					
	Spare part and Materials management and supply in the maintenance Quality and performance					
	IT system under use for Materials management					
	Ease of tracking of Spares and materials movement.					
	Effect of Service level agreement to control quality of spares parts and other services per the specifications.					
	Quality of spare parts and Materials provided for Maintenance.					
6	**Leadership**					
	Leadership influence on employees to enable employees understand and agree about what and how to do.					
	Leadership facilitation for individual and collective efforts to accomplish shared objectives and to keep corporate culture					
	Leaders effort in develop of attitude of employees to perform and understand the maintenance tasks very well.					
	Leaders effort in making employees perceive tasks not to be regarded as a burden, but as a good practice.					
	Leadership influence exerted over employees in creating Quality culture					
7	**Communication**					
	Availability of formal transfer of information from one person to another.					
	Information transparency in exchange of facts, ideas, suggestions and emotions between employees					
	Communication clarity in delivering information on work practices for all members of the Section					
	Employees' performance status information transfer in the Section					
8	**Rewards and Recognition**					
	Rewards and recognition practiced by the section to develop the maintenance quality					
	Section's Employees performance measurement methods andTechniques.					
	Acknowledgment the section granted to the work performed by employees					
	Companywide acknowledgement for superior quality performance activities granted and rewards provided					

	Impact of Company reward on employees motivation and making feel guilty to perform the work in earnest.					

No.	Factors affecting QA	1- Very poor	2- Poor	3- Good	4- Very Good	5- Excellent
9	**Team work**					
	Team work occurrence across group of employees in working together to achieve a goal.					
	Employees interaction and interdependently toward common and valued mission					
	Feeling of individuals in the section while sharing their opinions					
	Role of Engagement team collaboration to increase effectiveness of Team work in the section.					
10	**Training ,Knowledge Management and Development**					
	Training provision to develop attitudes, knowledge and specialized skills required by the employees.					
	Training provision to acquire knowledge necessary for performance improvement.					
	Training provision as an ongoing practice to improve skills and knowledge of workers to increase productivity					
	Availability of resource and platform for experience and knowledge sharing.					
	Training provision to improve knowledge about Quality policy , Quality assurance and Quality improvement					
	Training provision to improve Knowledge in the maintenance Process and activities					
11	**Involvement of Employees**					
	Section employees participation in the organization process demand					
	Section employees level of understanding about tasks they are performing are not imposed on them					
	Employee's involvement that enables them develop through commitment.					
	Employee involvement in the organization created a desire to lead the larger staff in taking decisions					

No.	Factors affecting QA	1- Very poor	2- Poor	3- Good	4- Very Good	5- Excellent
12	**Empowerment of Employees**					
	Section Delegation of authority to lower levels in the organization enabled them to make decision.					
	Section Encouraging employees to take the initiative and expand their scope					
	Section delegation practice created commitment in the minds of employees to achieve goals and targets.					
	Section delegation of authority made execution of maintenance work, easy, effective and fast, instead of waiting instructions from management.					
13	**Maintenance Management**					
	Identification of maintenance tasks is well defined to be performed					
	Demarcation of maintenance responsibilities in the section					
	Section identification of tools and Parts required to carry out maintenance					
	Section usage of work order management as a communication tool					
	Requested Maintenance Management in the section after reviewing the eligibility					
	Maintenance management reports generated from the section in identifying areas of improvement					
14	**Data recording and Record keeping**					
	Keeping record and Proper storage of maintenance data					
	Technology and IT usage in Maintenance data record management (CMMS)					
	Accessibility of Maintenance data record for further processing and getting accessed as required					
	Equipment data registered status and equipment historical record handling,					
15	**Environmental Regulations**					
	Section Environmental policies in place					
	Section environmental policies effective implementation status					

	Section employees awareness and involvement in environmental mgt.					
	Compliance of Maintenance Operation activities in the section with environmental rules and regulations					

If you have comment

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Inter Item correlation Matrix

	Quality	Org.Structure	Policy	Mnt.Plng	PartandMaterial	Leadership	Communication	Reward	Teamwork	Training	EmpInvolvement	Empowerment	MntManagement	DATAREC	EnvtRegulation
Quality	1	0.54	0.54	0.49	0.28	0.42	0.42	0.4	0.41	0.46	0.41	0.43	0.51	0.33	0.46
Org.Structure	0.54	1	0.78	0.7	0.5	0.56	0.61	0.58	0.55	0.52	0.57	0.62	0.65	0.47	0.6
Policy	0.54	0.78	1	0.67	0.63	0.52	0.65	0.49	0.59	0.54	0.66	0.54	0.65	0.43	0.52
Mnt.Plng	0.49	0.7	0.67	1	0.48	0.38	0.59	0.31	0.45	0.48	0.55	0.53	0.7	0.51	0.52
PartandMaterial	0.28	0.5	0.63	0.48	1	0.45	0.6	0.31	0.67	0.46	0.65	0.5	0.6	0.54	0.48
Leadership	0.42	0.56	0.52	0.38	0.45	1	0.48	0.39	0.34	0.42	0.38	0.45	0.54	0.33	0.6
Communication	0.42	0.61	0.65	0.59	0.6	0.48	1	0.47	0.62	0.52	0.52	0.64	0.61	0.51	0.52
Reward	0.4	0.58	0.49	0.31	0.31	0.39	0.47	1	0.41	0.44	0.35	0.48	0.38	0.36	0.37
Teamwork	0.41	0.55	0.59	0.45	0.67	0.34	0.62	0.41	1	0.54	0.64	0.63	0.63	0.48	0.5
Training	0.46	0.52	0.54	0.48	0.46	0.42	0.52	0.44	0.54	1	0.6	0.67	0.68	0.49	0.55
EmpInvolvement	0.41	0.57	0.66	0.55	0.65	0.38	0.52	0.35	0.64	0.6	1	0.59	0.59	0.52	0.46
Empowerment	0.43	0.62	0.54	0.53	0.5	0.45	0.64	0.48	0.63	0.67	0.59	1	0.61	0.5	0.65
MntManagement	0.51	0.65	0.65	0.7	0.6	0.54	0.61	0.38	0.63	0.68	0.59	0.61	1	0.73	0.69
DATAREC	0.33	0.47	0.43	0.51	0.54	0.33	0.51	0.36	0.48	0.49	0.52	0.5	0.73	1	0.5
EnvtRegulation	0.46	0.6	0.52	0.52	0.48	0.6	0.52	0.37	0.5	0.55	0.46	0.65	0.69	0.5	1

Item Statistics

	Mean	Std. Deviation	N
My role in Quality Circle	3.4478	.74434	67
My role in Process Improvement Team	3.4478	.80309	67
My role in Cross functional Team	3.3731	.79460	67
My role in Self Managed Team	3.5821	.76176	67
The Organizational structure serves as a framework of rules and relations to achieve the goals.	3.2836	.83132	67
Organization structure guide and clarify activities of everyone in the organization.	3.1791	.88635	67
Convenience of organizational structure to formally control and coordinate the section activities	3.1642	.89776	67
Section role in Defining the corporate vision, strategies and Critical Success	3.3731	.93478	67
Organizational structure Impact on individuals' motivation and performance.	3.2388	.95488	67
Available Policy and procedure manuals to guide Maintenance operations, strategy, and work-flows	3.3731	1.02744	67
Policy system, strategy and work planning clarity and easiness to understand	3.3881	.93671	67
Established controlling Systems status for New and revised Policy documents.	3.1642	.84561	67
Clarity of core values and beliefs in the Policy about common goals to be achieved.	3.4179	.95583	67
Planned maintenance and Scheduled activity in Practice	3.2090	.91349	67
Planned Maintenance activities organization and structure	3.2090	.91349	67
Maintenance planning starts from clear understanding and reviewing of the company's corporate strategy.	3.3134	.94081	67
Planning activities focus to meet the organization's objectives effectively	3.2388	.92260	67
Spare part and Materials management and supply in the maintenance Quality and performance	2.8209	.99887	67
IT system under use for Materials management	3.0448	.99137	67
Ease of tracking of Spares and materials movement.	2.9104	.98059	67

Effect of Service level agreement to control quality of spares parts and other services per the specifications.	2.9104	1.11098	67
Quality of spare parts and Materials provided for Maintenance.	3.0746	1.03446	67
Leadership influence on employees to enable employees understand and agree about what and how to do.	3.3881	2.50427	67
Leadership facilitation for individual and collective efforts to accomplish shared objectives and to keep corporate culture	3.6269	3.74504	67
Leaders effort in develop of attitude of employees to perform and understand the maintenance tasks very well.	3.0746	.90977	67
Leaders effort in making employees perceive tasks not to be regarded as a burden, but as a good practice.	3.0000	1.00000	67
Leadership influence exerted over employees in creating Quality culture	3.1343	.96759	67
Availability of formal transfer of information from one person to another.	3.4478	.85783	67
Information transparency in exchange of facts, ideas, suggestions and emotions between employees	3.3881	.83403	67
Communication clarity in delivering information on work practices for all members of the Section	3.2537	.85888	67
Employees' performance status information transfer in the Section	3.2239	.91818	67
Rewards and recognition practiced by the section to develop the maintenance quality	2.7015	.98496	67
Section's Employees performance measurement methods andTechniques.	2.9254	.90977	67
Acknowledgment the section granted to the work performed by employees	2.9851	1.03708	67
Companywide acknowledgement for superior quality performance activities granted and rewards provided	2.9254	.94249	67
Impact of Company reward on employees motivation and making feel guilty to perform the work in earnest.	2.9851	.99228	67
Team work occurrence across group of employees in working together to achieve a goal.	3.3731	.95085	67
Employees interaction and interdependently toward common and valued mission	3.2388	.95488	67
Feeling of individuals in the section while sharing their opinions	3.1045	.90678	67
Role of Engagement team collaboration to increase effectiveness of Team work in the section.	3.1045	1.01704	67
Training provision to develop attitudes, knowledge and specialized skills required by the employees.	2.6866	.90803	67
Training provision to acquire knowledge necessary for performance improvement.	2.8955	.97132	67

Training provision as an ongoing practice to improve skills and knowledge of workers to increase productivity	2.9851	.99228	67
Availability of resource and platform for experience and knowledge sharing.	2.9552	.87789	67
Training provision to improve knowledge about Quality policy , Quality assurance and Quality improvement	2.9403	.88558	67
Training provision to improve Knowledge in the maintenance Process and activities	2.8507	.94153	67
Section employees participation in the organization process demand	3.1045	.76146	67
Section employees level of understanding about tasks they are performing are not imposed on them	3.1194	.82613	67
Employee's involvement that enables them develop through commitment.	3.2090	.80787	67
Employee involvement in the organization created a desire to lead the larger staff in taking decisions	3.0746	.80366	67
Section Delegation of authority to lower levels in the organization enabled them to make decision.	3.1045	.85519	67
Section Encouraging employees to take the initiative and expand their scope	3.0746	.92627	67
Section delegation practice created commitment in the minds of employees to achieve goals and targets.	3.0299	.86987	67
Section delegation of authority made execution of maintenance work, easy, effective and fast, instead of waiting instructions from management.	3.2537	.78515	67
Identification of maintenance tasks is well defined to be performed in the section	3.2388	.92260	67
Demarcation of maintenance responsibilities in the section	3.2537	.91027	67
Section identification of tools and Parts required to carry out maintenance	3.1940	.89169	67
Section usage of work order management as a communication tool	3.2090	.89675	67
Maintenance request Management in the section after reviewing the eligibility	3.0896	.90002	67
Maintenance management reports generated from the section in identifying areas of improvement	3.0299	.88712	67
Keeping record and Proper storage of maintenance data	3.1343	.81456	67
Technology and IT usage in Maintenance data record management (CMMS)	3.1194	1.00788	67
Accessibility of Maintenance data record for further processing and getting accessed as required	3.1343	.93575	67
Equipment data registered status and equipment historical record handling,	3.1343	.81456	67

Section Environmental policies in place	3.3582	.79203	67
Section environmental policies effective implementation status	3.2239	.91818	67
Section employees awareness and involvement in environmental management	3.4627	.91002	67
Compliance of Maintenance Operation activities in the section with environmental rules and regulations	3.1940	1.01860	67

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
My role in Quality Circle	211.6567	1743.289	.310	.	.972
My role in Process Improvement Team	211.6567	1729.592	.492	.	.971
My role in Cross functional Team	211.7313	1734.199	.428	.	.971
My role in Self Managed Team	211.5224	1738.284	.382	.	.971
The Organizational structure serves as a framework of rules and relations to achieve the goals.	211.8209	1722.392	.580	.	.971
Organization structure guide and clarify activities of everyone in the organization.	211.9254	1711.252	.697	.	.971
Convenience of organizational structure to formally control and coordinate the section activities	211.9403	1707.966	.732	.	.971
Section role in Defining the corporate vision, strategies and Critical Success	211.7313	1707.260	.712	.	.971
Organizational structure Impact on individuals' motivation and performance.	211.8657	1702.482	.758	.	.971
Available Policy and procedure manuals to guide Maintenance operations, strategy, and work-flows	211.7313	1700.715	.724	.	.971
Policy system, strategy and work planning clarity and easiness to understand	211.7164	1704.146	.751	.	.971
Established controlling Systems status for New and revised Policy documents.	211.9403	1714.178	.689	.	.971
Clarity of core values and beliefs in the Policy about common goals to be achieved.	211.6866	1704.097	.736	.	.971
Planned maintenance and Scheduled activity in Practice	211.8955	1714.246	.635	.	.971
Planned Maintenance activities organization and structure	211.8955	1718.489	.578	.	.971
Maintenance planning starts from clear understanding and reviewing of the company's corporate strategy.	211.7910	1710.380	.666	.	.971
Planning activities focus to meet the organization's objectives effectively	211.8657	1712.057	.658	.	.971

Spare part and Materials management and supply in the maintenance Quality and performance	212.2836	1716.449	.552	.	.971
IT system under use for Materials management	212.0597	1703.087	.722	.	.971
Ease of tracking of Spares and materials movement.	212.1940	1703.825	.721	.	.971
Effect of Service level agreement to control quality of spares parts and other services per the specifications.	212.1940	1706.431	.604	.	.971
Quality of spare parts and Materials provided for Maintenance.	212.0299	1709.545	.614	.	.971
Leadership influence on employees to enable employees understand and agree about what and how to do.	211.7164	1711.479	.219	.	.974
Leadership facilitation for individual and collective efforts to accomplish shared objectives and to keep corporate culture	211.4776	1687.829	.199	.	.978
Leaders effort in develop of attitude of employees to perform and understand the maintenance tasks very well.	212.0299	1705.454	.756	.	.971
Leaders effort in making employees perceive tasks not to be regarded as a burden, but as a good practice.	212.1045	1700.822	.743	.	.971
Leadership influence exerted over employees in creating Quality culture	211.9701	1702.575	.747	.	.971
Availability of formal transfer of information from one person to another.	211.6567	1712.986	.696	.	.971
Information transparency in exchange of facts, ideas, suggestions and emotions between employees	211.7164	1719.024	.628	.	.971
Communication clarity in delivering information on work practices for all members of the Section	211.8507	1716.341	.647	.	.971
Employees' performance status information transfer in the Section	211.8806	1713.804	.638	.	.971
Rewards and recognition practiced by the section to develop the maintenance quality	212.4030	1710.456	.635	.	.971
Section's Employees performance measurement methods andTechniques.	212.1791	1708.119	.720	.	.971
Acknowledgment the section granted to the work performed by employees	212.1194	1703.834	.680	.	.971
Companywide acknowledgement for superior quality performance activities granted and rewards provided	212.1791	1706.967	.710	.	.971
Impact of Company reward on employees motivation and making feel guilty to perform the work in earnest.	212.1194	1701.167	.745	.	.971
Team work occurrence across group of employees in working together to achieve a goal.	211.7313	1716.957	.574	.	.971

Employees interaction and interdependently toward common and valued mission	211.8657	1713.815	.612	.	.971
Feeling of individuals in the section while sharing their opinions	212.0000	1711.030	.683	.	.971
Role of Engagement team collaboration to increase effectiveness of Team work in the section.	212.0000	1703.667	.696	.	.971
Training provision to develop attitudes, knowledge and specialized skills required by the employees.	212.4179	1713.641	.647	.	.971
Training provision to acquire knowledge necessary for performance improvement.	212.2090	1713.895	.600	.	.971
Training provision as an ongoing practice to improve skills and knowledge of workers to increase productivity	212.1194	1715.531	.567	.	.971
Availability of resource and platform for experience and knowledge sharing.	212.1493	1712.402	.688	.	.971
Training provision to improve knowledge about Quality policy , Quality assurance and Quality improvement	212.1642	1710.957	.701	.	.971
Training provision to improve Knowledge in the maintenance Process and activities	212.2537	1707.616	.702	.	.971
Section employees participation in the organization process demand	212.0000	1727.455	.554	.	.971
Section employees level of understanding about tasks they are performing are not imposed on them	211.9851	1720.076	.618	.	.971
Employee's involvement that enables them develop through commitment.	211.8955	1719.943	.635	.	.971
Employee involvement in the organization created a desire to lead the larger staff in taking decisions	212.0299	1722.242	.603	.	.971
Section Delegation of authority to lower levels in the organization enabled them to make decision.	212.0000	1716.576	.647	.	.971
Section Encouraging employees to take the initiative and expand their scope	212.0299	1704.242	.759	.	.971
Section delegation practice created commitment in the minds of employees to achieve goals and targets.	212.0746	1712.888	.687	.	.971
Section delegation of authority made execution of maintenance work, easy, effective and fast, instead of waiting instructions from management.	211.8507	1720.432	.646	.	.971
Identification of maintenance tasks is well defined to be performed in the section	211.8657	1702.876	.780	.	.971
Demarcation of maintenance responsibilities in the section	211.8507	1704.614	.767	.	.971
Section identification of tools and Parts required to carry out maintenance	211.9104	1709.295	.719	.	.971

Section usage of work order management as a communication tool	211.8955	1710.004	.705	.	.971
Maintenance request Management in the section after reviewing the eligibility	212.0149	1707.773	.733	.	.971
Maintenance management reports generated from the section in identifying areas of improvement	212.0746	1706.525	.762	.	.971
Keeping record and Proper storage of maintenance data	211.9701	1720.545	.620	.	.971
Technology and IT usage in Maintenance data record management (CMMS)	211.9851	1711.621	.605	.	.971
Accessibility of Maintenance data record for further processing and getting accessed as required	211.9701	1714.817	.612	.	.971
Equipment data registered status and equipment historical record handling,	211.9701	1721.423	.607	.	.971
Section Environmental policies in place	211.7463	1717.647	.683	.	.971
Section environmental policies effective implementation status	211.8806	1714.440	.629	.	.971
Section employees awareness and involvement in environmental management	211.6418	1710.355	.690	.	.971
Compliance of Maintenance Operation activities in the section with environmental rules and regulations	211.9104	1711.083	.605	.	.971