



**Effects of Supply Chain Integration and Inventory Management
Practices on Operational Performance: The Case F.D.R.E Air Force**

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Declaration

I, the undersigned, hereby declare that the work contained in this thesis is my original work and that I have not previously in its entirety or part submitted at any university for a degree. All sources of materials used for this thesis has been properly cited and acknowledged.

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Abstract

The purpose of this study is to get in-depth insight and investigate the effect of supply chain integration and inventory management practices on operational performance. To address the research objective, a mixed research approach is used to collect the relevant data from the target population of the study which includes Ethiopian Air Force Air Logistics units and first tire of both operational units and MOND Procurement Directory. The primary source of data was collected by using a five-point Likert scale questionnaire and semi-structured interviews. To analyze the data this study applied descriptive and inferential statistics including multiple linear regression that will help to understand which predictor is a statistically significant contributor to the study. The result indicates that 44.1% of the variation in operational performance can be explained by variation in the Supply Chain Integration and Inventory Management Practices have taken together. This leaves 55.9% unexplained. Also, the magnitude of the unique contribution, that is, for one percent increase in the rate of Supply Chain Integration, Operational Performance will increase by 31.6 percent. Similarly, one percent increase in the rate of Inventory Management Practices, Operational Performance will increase by 57.1 percent. Besides, 0.025 value of constant.

Keywords: Supply Chain Integration, Inventory Management Practices, Operational Performance, Ethiopian Air Force

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Acronym

AMISOM: African Union Mission in Somalia

ANOVA: Analysis of Variance

AOG: Aircraft on Ground

CPFR: Collaborative Planning Forecasting and Replenishment

EOQ: Economic Order Quantity

ERP: Enterprise Resource Planning

F.D.R.E: Federal Democratic Republic of Ethiopia

ICT: Information Communication Technology

IIOT: Industrial Internet of Things

JIT: Just in Time

MOND: Ministry of National Defense

NFC: Near Field Communication

OEMs: Original Equipment Manufacturer

OP: Operational Performance

RFID: Radio Frequency Identification

ROP: Reorder Point

SC: Supply Chain

SCM: Supply Chain Management

SPSS: Statistical Package for Social Science

ToC: Theory of Constraints

UN: United Nation

U.S: United States of America

VIF: Variance Inflation Factor

VMI: Vendor Managed Inventory

CHAPTER ONE: INTRODUCTION

1.1 Background of The Study

Supply chain management (SCM) has become a new and promising way of achieving competitive advantages in the market (Shepherd & Gunter, 2006). To optimize this competitive advantage Lambert and Cooper (2000), advocate successful SCM requires a change from managing individual functions to integrated activities within key supply chain business processes.

As Christopher, (2005) notes that the term supply chain refers to the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer. Further asserts, the highly competitive firms are those that have carefully linked their internal processes to external business partners within their respective supply chains. To achieve a competitive advantage, supply chains need to be managed appropriately (Bode et al, 2011).

In this case, firms are anticipated to consider supply chain integration as one corporate objective to excel in their operational performance. Shen, (2005) states that the purpose of supply chain integration is to break down ‘silos’ across the whole supply chain, allowing the firms to move closer to overall optimized rather than sub-optimized management. Further assert that supply chain integration includes supply-side collaboration such as information sharing, internal integration through cross-functional process teams, and customer side collaboration through the integrating customers’ needs and wants in the whole supply chain process. consequently, supply chain integration can be a source of competitive advantage leading to superior performance through enhancing firms’ operational performance (Atnafu & Hussen, 2017).

The management of the supply chain study emphasizes how to maximize the overall value of the firm by better using and deployment of resources across the whole of the firm. Even though the Manager must understand their businesses are only part of the supply chain that they participate and it is the supply chain that wins or loses the competition. Naliaka & Namusonge, (2015) study shows that effective inventory management provides opportunities to create sustainable competitive advantage and enhance the competitive position of companies. This entails a reduction in the cost of holding stocks by preserving just enough inventories, in the right place and the right time and costs to make the right number of needed products. Further asserts that high

levels of inventory held in stock affect adversely the procurement performance out of the capital being held which affects cash flow leading to reduced efficiency, effectiveness, and distorted functionality.

As a rule of thumb, Quayle (2006) confirm expenditure on purchasing goods and services in a company may account for between 30 to 75 percent of total costs. Additionally, emphasize that expenditure on storing and distributing materials may absorb a further 10 to 20 percent of total costs. Although, the goal of Supply Chain Management (SCM) is to integrate both information and material flow seamlessly across the supply chain as an effective competitive weapon to create value to end customers and reduce the overall cost of the supply chain (Childhouse, 2003).

1.1.1 Background of Ethiopian Air Force

Ethiopian Air Force is one of the Defense forces, has more than eighty years of combat and training experience, and one of the pioneers Air Force in Africa. The year 1903 marks that the Wright brothers invented the first successful airplane. After twenty-six years in 1929 was the birth of the Ethiopian Air Force which in that time Ethiopian bought three airplanes from France company and one airplane landed from Djibouti to Ethiopia, this moment was a turning point for Ethiopian to join the aviation world (Ayelegn, 2015). The main mission Ethiopian Air Force partake was to protect Ethiopian air sovereignty.

During the Ogden war, Ethiopian Air Force shows the world its fighting capability by quickly destroying its huge Somalia counterpart and also in 2006 by launch airstrikes on main Islamist fighters' high-value targets to fight against terrorism and to protect sovereignty. In the Ogden war, there was a high shortage of spare and air ammunition due to no support from the U.S., because of many reasons. In that time Air Force was fighting by few aircraft with huge Somalia Air Force. Even though, Ethiopian Air Force highly trained and patriot airmen quickly destroyed its Somalia aircraft in the air and in-ground different main airbases and strategic target areas in every corner of Somalia and end the war with victory.

Ethiopian Air Force also participating in the peacekeeping missions, in AMISOM and UN missions. After so many ups and down now Ethiopian Air Force reviving with new vibe and generation of Aircraft, Electronic warfare's, and Radars that will help to stay on the required level of readiness ('Niser', 2018).

Currently, Ethiopian Air Force have missions to defend the Nation's air and space at any time and under any circumstance, provide close air support for ground force and destroy high-value targets, air mobility, prompt reaction to any natural and manmade disasters, participate on regional, continental and worldwide peacekeeping mission, and build electronic warfare and cyber resilience capability.

1.2 Problem Statement

Ethiopian National Defense Force prides itself on always being ready to respond to the orders of the commander chief of the Ethiopian Armed Force and at all times obey and respect the Constitution of the country (constitution of FDRE, article 87). The requirements of what goes into "being ready" are determined by the senior leaders of each military service based on global or national commitments and priorities and are authenticated by the Defense policymakers. These requirements ensure that Soldiers, Sailors, Airmen, and Marines receive the necessary training and well-maintained equipment that enables or empowers them to succeed no matter the mission.

Consistent with this, the primary objective of military aviation or Air Force operator is to optimize its readiness to deter and respond to external threats, take part in peace supporting mission and provide humanitarian aid, wherever and whenever the home state or international community calls for it (Verhoeff, et al., 2015). This is embodied in the concept of continuous operational readiness: the competence to perform all assigned present and future flight operations.

To maintain a minimum readiness level, Air Forces need to ensure that sufficient aircraft are mission-capable or operational and continue in this state for an adequate time. Furthermore, a sufficient amount of training flight hours needs to be produced to keep aircrew in mission-capable conditions.

An Aircraft-On-Ground (AOG) situation is the most critical and has a negative effect on the aviation industry (Baye, 2017; Girma, 2018). Performance indices in military aviation are intended for use by managers to address institutional process improvement, minimize downtime (AOG), achieve best flight and maintenances safety record, operational availability of the aircraft, and reduce cost (Raju, et al., 2012). Thus, Operational aircraft availability is one measure of performance in the aviation industry (Cameron, 1988), and maintaining an optimal level of inventory is a key issue to firms' operational performance (Shin, et al., 2015).

The literature on aviation industry indicates the aviation industry failure to have operational aircraft or face AOG situation due to spare shortage and special maintenance requirement, this maintenance requirement raise because of the aviation industry strict safety requirement which causes downtime (Girma, 2018; Verhoeff, et al., 2015,). These indicate that the AOG situation has a high association with inventory management and operational aircraft availability. Therefore, adopting the most efficient spare parts inventory management and support program that will prevent aircraft not to be in an AOG situation is the fundamental and critical issue in aviation industries' operational performance. Consequently, preventing an AOG situation is a priority for airlines, as every minute that an aircraft is not flying it loses money & in the case of defense aircraft it may be a major threat to the country (Rao, et al., 2015).

The main challenge the aviation industry confronts is addressing the AOG situation. Since they are undertaking this situation only at the time and place when it occurs and by resorting a 'reactive' mode of spare parts search, mainly "NO-GO" category part, within the organization or in the ecosystem/network of Parts Distributors and go through a guessing game of parts availability, eventually incurring long delays and excessive fees (Melaku, 2017). From the report disclosed in the annual magazine of Ethiopian Air Force 'Niser', (2018) some aircraft are in the AOG situation, there is a shortage of spare part availability and well-skilled maintenance personnel, however, the condition is noticed to resolve with different organizational measures'. This indicates that the case organization faces the same death spiral situation experiencing other aviation industries. So far, there was no research study made to clear the cause of aircraft being in the AOG situation, shortage of spare part availability, and the cause of a shortage of professional maintenance personnel that may have a significant effect on operational performance.

Furthermore, in the previous study researchers address operational performance in different and divergent ways. Atnafu & Hussen, (2017) study show the only effect of supply chain integration on operational performance, as well as (Atnafu, 2017; John, et al., 2015) studies indicate an effect of inventory management practices on operational performance, and a recent study of Girma, (2018) show the role of supply chain integration and inventory management on flight dispatch reliability. The gap addressing fully or completely the effects of supply chain integration and inventory management practices on operational performance in a single case organization and research study

is under-researched. This contributes to a complete view of operational performance for the researchers in a single case study.

From the above discussion, the general intention of this study is to describe and explain the effects of supply chain integration and inventory management practices on operational performance and assess the level of addressing 'proactively' the AOG situation as well as studying the cause of aircraft being in the AOG situation that may have a significant effect on operational aircraft availability.

1.3 Research Questions

1. What is the effect of supply chain integration on operational performance?
2. What is the effect of inventory management practices on operational performance?
3. What are the inventory management practices followed by the case organization for proper asset utilization?
4. What are the major causes of aircraft being in the AOG situation or decline of operational aircraft availability?
5. How proactive is the case organization to address the AOG situation or improve operational performance?

1.4 Research Objective

1.4.1 General Objective

The general objective of this research study is to assess the effects of supply chain integration and inventory management practice on Ethiopian Air Force operational performance.

1.4.2 Specific Objectives

To satisfy the research questions, the specific objective includes:

1. To study the effect of supply chain integration on operational performance.
2. To study the effect of inventory management practices on operational performance.
3. To study the inventory management practices followed by the case organization for proper asset utilization.
4. To examine the major causes of aircraft being in the AOG situation or decline of operational aircraft availability.
5. To examine the level of proactiveness' in addressing the AOG situation or improve operational performance of the case organization.

1.5 Significance of The Study

1.5.1 For Researchers, Academicians and Practitioners

This study is beneficial to researchers and academicians because it adds to the body of knowledge. It will also provide reference material for further research. For practitioners, it enables them to make informed decisions to minimize stock holding cost and ordering cost by optimizing inventory management and integration with supply chain members, build win-win relationships with key stakeholders, develop solutions to advance strategic SCM practices and increasing return for stakeholders. Furthermore, this study will benefit to those at the end line of the supply chain, in this case, Ethiopian Air Force operational units, such as bases, wings, and squadrons, and those airmen, and maintenance personnel. Finally, add a body of knowledge that will increase the level of the unit's readiness by increasing operational and mission-capable aircraft and trained airmen.

1.6 Scope of The Study

This study delimited, first conceptually or topically on specific variables such as operational performance, supply chain integration, and inventory management practices. Even though, there are so many factors that will affect the operational performance of the organization and each independent variable. Second, geographically scope covers both Ethiopian Air Force headquarters at Bishoftu and the Ministry of National Defense (MOND) Procurement Directory, Addis Ababa. Finally, the time or period scope in this study may cover the period from December 2017 to December 2019. These are two years, nearly the length of operational strategic plans executed for most organizations. Two years is good enough for testing the operational plan of the organization.

1.7 Limitation of The Study

As any research, this study has some limitations. A single respondent in firm was asked to respond to complex supply chain integration and inventory management practices. But, in reality, no respondent is in an organization responsible for the entire SCM process. Research data were collected from Ethiopian Air Force and MOND Procurement Directory, only from those middle and lower level managers since operational performance administered. However, it may not be used to generalize for the whole aviation sectors in the country, thus the study can only make an inference and generalization to the case organization. Furthermore, second tire local and international

supplier and other customer of Air Logistics in other bases of the country were not the focusses of these study.

1.8 Definition of Terms

Supply chain management is the management of the interconnection of organizations that relate to each other through upstream and downstream linkages between the processes that generate value to the ultimate user in the form of products and services (Slack, et al., 2010).

Supply chain: is a network of organizations, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer (Christopher, 2005).

Supply chain integration: is defined as practices and procedures through which firms obtain operational and strategic efficiencies both internally and externally, through collaboration among internal functions and with other firms (Flynn, et al., 2010).

Internal integration: defined as the level of collaboration among functional groups in a firm, and is measured by the degree to which a firm can structure its organizational strategies, practices, procedures, and behaviors into collaborative, synchronized, and manageable processes to fulfill its customers' requirements (Zhao, et al., 2011).

External integration: defined as the degree to which a firm can partner with its key supply chain members (customers and suppliers) to structure their inter-organizational strategies, practices, procedures, and behaviors into collaborative, synchronized, and manageable processes to fulfill their end-users' requirements (Zhao, et al., 2011).

Competitive advantage: Competitive advantage is the ability of firms to reply to conditions in their marketplaces by transforming their competencies (internal capabilities and linkages with suppliers and associates) and how they locate themselves to their competitors (Porter, 1985).

Inventory management: defined as a framework employed in firms in controlling their interest in inventory (Stevenson, 2010).

Operational performance: The firm's performance measured against the standard or prescribed indicators of effectiveness, efficiency, and environmental responsibility such as cycle time, productivity, waste reduction, and regulatory compliance (Inc., 2019).

Operational aircraft availability is the degree to which the aircraft is in an operable and a committable state at the start of the mission when the mission is called for at an unknown (random) time (Raju, et al., 2012).

1.9 Organization of The Study

This research study organized as follows: Chapter one, includes the background of the study, problem statement, research question, research objective, scope, significance, limitation, and operational definition of study where discussed. In chapter two, related theoretical review of supply chain integration, inventory management and practices, and concept and measure of operational performance were addressed; empirical findings of the effect of supply chain integration and inventory management practices on operational performance were discussed; a conceptual framework that illustrates dependent and the independent variable was addressed. In the chapter three, introduction, research approach, research design, population sample, source of data and collection techniques, methods of data analysis, the scale of reliability and validity, and ethical considerations were discussed. In the chapter four, data analysis, result, and discussion were addressed. Finally, in the chapter five summary, conclusion, and recommendation were covered.

CHAPTER TWO: LITERATURE REVIEW

2.1 Theoretical Review

The integration of supply chain management system has been the subject of significant debate and discussion. The arena of competition is moving ‘organization against organization’ to ‘supply chain against supply chain’. The survival of any business today is no longer solely dependent on its own ability to compete but rather on the ability to cooperate within the supply chain. However, the goal of supply chain integration is to achieve an effective and efficient flow of materials, information, money, and decisions, to provide maximum value to the customer at low cost and high speed (Flynn, et al., 2010). Therefore, the seemingly independent relationship between the organizations within the supply chain becomes ever more interdependent.

2.1.1 Supply Chain Integration

Different research on supply chain integration indicates that supply chain integration is perceived as an important interfirm practice, which leads to better performance (Jayaram, et al., 2010; Huo, et al., 2014). Furthermore, supply chain process integration is the most significant predictor of a firm’s competitive position (Mellat-Parast & Spillan, 2014). However, Horn, et al., (2014) study indicates internal integration is a precondition for external integration.

Different conceptualization of supply chain integration has emerged, Jayaram, et al., (2010) study defines supply chain integration scope as a construct of ‘arc of integration’ that extends from ‘narrower arcs’ to ‘wide arcs’ of integration. That is, immediate supply chain integration scope involves firms with narrower arcs of integration focusing on immediate supply chain member, whereas extended supply chain integration involves firms with wide arcs that involve extended supply chain members such as second tier suppliers, second tier customers, retailers, wholesalers, and third-party logistics providers in their firm’s supply chain management efforts.

Based on a previous study on supply chain integration (Shen, 2005; Flynn, et al., 2010; Horn, et al., 2014; Pakurár, et al., 2019) supply chain integration defined in two ways such as internal integration and external integration with supplier integration and customer integration. For this particular study only take internal supply chain integration and external supply chain integration with supplier integration and customer integration.

2.1.1.1 Internal Supply Chain Integration

Internal integration involves the aspect of the supply chain that is directly under the control of the company. According to Kim, (2013) internal integration can be defined as all the practices of merging and developing the internal resources and information to generate a shared knowledge that goes beyond the boundaries of individual functions or sections, and through doing so help external integration and achieve goals. Since, internal integration aims to smooth the movement of resources, money, product, and information to satisfy customers quickly and at low cost (Flynn, et al., 2010).

Internal integration is the synchronized and strategic alignment of corporate processes and functions within an organization that is organized to ensure that the firm achieves maximum performance. According to (Basnet, 2013) supply chain integration starts firms with internal integration between the different departments and functions within an organization before external integration is pursued. In their study, (Ralston, et al., 2015) also found out that internal integration improves the firms' performance by reducing costs and limiting the ability of departments within the organization from taking steps that would alter the overall goals of the other organization.

Internal integration involves cross-functional teams of specialists to work together and share supply chain information (Otchere, et al., 2013). Consequently, Joint planning, functional collaboration, information sharing, and teamwork boost the performance of organizations and their internal integration to ensure customers' expectations can be met and deliveries are on time (Pakurár, et al., 2019).

2.1.1.2 External Supply Chain Integration

In an external supply chain integration scope of integration extends to outside the company to embrace supplier and customer. These two elements are very important areas of the supply chain integration; information sharing, for instance, is the interchange of information between these partners. External integration measures the level of how closely an organization works with its partners such as suppliers and customers (Pakurár, et al., 2019). According to Mose (2015), as the competitive environment is becoming ever more challenging, firms are undertaking efforts to strive along multiple fronts. However, various firms find it difficult to compete in the market by relying on their internal resources and competencies alone. They have turned to cooperate with their customers and suppliers to obtain information and complementary resources, which they can deploy to build a competitive advantage.

2.1.1.2.1 Customer Integration

Customer integration is one of the mechanisms or framework firms used to generate customer value through proactively seeking information on customer preferences and needs. This information should allow firms the opportunity to align their actions to best meet customer demand because strategically integrating with customers requires more than process level or operational task integration (Ralston, et al., 2015).

The study of Danese & Romano, (2011) indicates that customer integration can endorse cooperation, the openness of communication and a problem-sharing attitude. Also, it indicates that supplier integration has a positive impact on company performance. However, efficient performance optimization requires leveraging simultaneously on customer and supplier integration to foster their interaction, rather than investing and acting on customer integration only. Furthermore, asserts that before deciding whether to invest in customer integration, managers should determine the level of supplier integration, since it acts as a prerequisite for the successful implementation of customer integration

2.1.1.2.2 Supplier Integration

According to Kim, (2013) supplier integration is an organizational process of buying firms and suppliers sharing and applying operational, financial, and strategic knowledge to create mutual benefits. Flynn, et al., (2010) note that strategic supplier integration simplifies the supplier's understanding and anticipation of the focal firm's needs. This, in turn, can lead to an improvement in the focal firm's customer service. Even though, the main purpose of supplier integration is to surpass a single organization's limits to coordinate processes easily (Pakurár, et al., 2019). Furthermore, Supplier integration pursues to achieve a smooth, efficient flow of materials within the supplier network, and avert potential obstacles in the process of procurement and production. Strategically integrating with suppliers also lets firms to focus on their core competencies (Ralston, et al., 2015). However, there is no particular form that supplier partnerships must take; they can be flexible and could be adapted according to the objective of the partnership.

2.1.2 Inventory Management and Practices

Inventory management has evolved into a highly studied and practiced concept in the business world that combines optimizing inventory movement, information-sharing between buyer and seller, lean strategies, and supply chain management concepts.

Inventory management is defined as a framework employed in firms in controlling its interest in inventory (Stevenson, 2010). Commonly, in the aviation industry spare parts are classified into four groups: Rotables, Repairable, Expendables and Consumables. Rotables categories are complex components, normally unlimited number of repairs and no scrap is expected, controlled by individual serial number (even though, almost all aircraft components have different identification numbers and symbols), and exchanged during maintenance. Repairable components are which can be technically and economically repaired under normal conditions, a follow up of each serial number is not necessary also have a limited number of repairs with a possibility of scrap. Expendables components cannot be repaired and will be scrapped after removal and inspection result is unserviceable, which are 100 percent replacement items. They are standard parts, which cannot be repaired (not economical to be repaired). Finally, consumables items are any materials used only once, for example, raw materials such as steel and lumber, chemical materials and items which merge on production with new product and cannot be removed.

For different categories of aircraft components, different replenishment policies are used (Gu, et al., 2015). Rotables and Repairable are mainly based on predicted failures estimated by original equipment manufacturers (OEMs), and the planning parameters are finished as a management decision. As to Expendables and Consumables, the reorder point system (ROP) is used and input comes from historical demand with estimated changes. Therefore, as different scholar study indicates the use of scientific inventory management models (Economic Order Quantity (EOQ), ABC analysis, Vendor Managed Inventory (VMI), Just In Time (JIT), Simulation Inventory Control System, and other) is a hot issue to effectively handle spare part shortage, stock out and component pile up with subsequent penalties and this model uses minimum expense to archive maximum productivity (John, et al., 2015; Kamau & Kagiri., 2015; Gu, et al., 2015; Atnafu, 2017). On the other hand, information technology becomes an integrated solution to the component in all organizations. As Muyumba & Phiri, (2017) present argument to emphasize using Barcode, Radio Frequency Identification (RFID), and Near Field Communication (NFC) has a positive impact on inventory management. Additionally, their study shows Barcode scanner 95 percent more efficient and over three times faster than the current manual inventory method used to manage the inventory in Zambia Air Force.

Advancement of inventory management practice in ICT continued to the new paradigm of Blockchain which is an incorruptible digital ledger of economic transactions that can be programmed to record not just transactions but virtually everything of that value. Even though, traditional models and approaches are useful when the amount of data to be processed is relatively small and the complexity of the problem is low. This new era of technology process big data and push supply chain to the industrial internet of things (IIOT) called applications that will help to achieve a transparent network of the supply chain for aircraft's parts and reduce the risk of availability of aircraft's part in any market (Madhwal & Panfilov, 2017).

2.1.2.1 Theory of Inventory Administration

There are theories employed in carrying clarity to the investigation of the effect of inventory management practices on operational performance. This study share concept from the theory of constraints, contingency theory and lean theory to build the critical concern on the effect of inventory management practices on operational performance in aviation industries which can support to administer inventory accuracy, stockout, and inventory planning and control.

2.1.2.1.1 Theory of Constraint

The study of Sillanpää, (2010) States that the theory of constraints is a system based assumption that assumes every organization or production line has at least one constraint. Whereas, a theory of constraints aims to maximize profit by making use of the factor which is limiting the process more and more efficiently. The theory of constraints is maximizing throughput while minimizing operating expenses for labor, sales, and administration. However, the first step to start utilizing the theory of constraints is to find out the constraining factor. For this reason, the concept of the Theory of Constraints (ToC) methodology proposes that organizational productivity is dependent on the software of inventory management practices. For instance, the aviation industry makes sure that the bottlenecks on their operations run smoothly they must embrace the usage of inventory control practices that could facilitate operational performance. This may bring about the acquisition of additional ability or a new generation of stock management practices that raise or ruin the limitations. Refining the performance of the constraint leads to development within the organizational productiveness.

As (Atnafu & Hussen, 2017) study shows the theory of constraints is an administration reasoning that looks to expand firms throughput proficiency evaluated on the bases of

recognizable proof of those procedures that are helping the industrial system. Further asserts that there are numerous challenges experienced in the application of the theory of constraints. For instance, there is a long lead time, a significant number of unsatisfied requests, irregular state of meaningless inventories or nonexistence of appropriate inventories, wrong materials request, an expansive number of crisis request and endeavor levels, absent of clients engagement, nonattendance of control identified with need orders which suggest on timetable clashes of the assets. Moreover, this theory of constraints focuses on effectively dealing with the limit and ability of these limitations to enhance efficiency and to apply on the firm inventory control policy.

2.1.2.1.2 Contingency Theory

The contingency theory views a firm as an open system, where its performance is affected by the environment. According to contingency theory, the effect of organizational practices on firm performance is conditioned by the organization's strategic postulates (Huo, et al., 2014). Furthermore, John, (2013) study of strategic management points out that contingency theory represents a middle ground perspective that views organizational performance as the joint outcome of environmental forces and the firm's strategic actions. Therefore, the main and central idea in contingency theory is that the fit of organizational appearances to the contingency factor leads to higher organizational performance (Donaldson, 2013). For this reason, the inventory management system in these different organizational environments requires different combinations of approaches and techniques and organization strategies to achieve higher performance.

2.1.2.1.3 Lean Theory

Lean methodology is an inventory strategy that provides for the delivery of material or product at the exact time and place where the material or product will be used (Christensen, et al., 2013). This finding supported by Slack, et al., (2010) lean is both a philosophy and a method of operations planning and control, which aims to meet demand instantaneously, with perfect quality and no waste. This involves supplying products and services in perfect synchronization with the demand for them. Since, synchronization means that the flow of products and services always delivers exactly what customers want (perfect quality), in exact quantities (neither too much nor too little), exactly when needed (not too early or too late), and exactly where required (not to the wrong location). Lean synchronization is to do all this at the lowest possible cost. It results in items flowing rapidly and smoothly through processes, operations and

supply networks. Furthermore, the lean system solves the problem of inventory buffer between supply chain stages using just in time concept.

As business organizations strive to maintain competitiveness in an ever-changing global economy, they are increasingly exploring new and better ways of operating. For some, this means shifting from the traditional ways of operating to what is now referred to as lean operation. A lean operation is a resilient system of operation that uses considerably fewer resources (i.e., activities, people, inventory, and floor space) than a traditional system (Stevenson, 2012). Moreover, lean systems tend to achieve greater productivity, lower costs, shorter cycle times, and higher quality than non-lean systems.

2.1.2.2 Inventory Management Practices

Robust inventory management is vital in today's computing environment to ensure timely delivery and desired quality standards. As Kamau & Kagiri, (2015) noted that the reason for carrying inventory management practices is to guarantee a regular supply of materials as and when required. As different study indicates:

2.1.2.2.1 Economic Order Quantity

According to Hiller & Lieberman (1995), Economic Order Quantity (EOQ) is a well-known deterministic model, which concerned with inventory problems where the actual demand in the future is assumed to be known. On this bases, different scholar study shows that the logical way of an organization how to know when to order and how much to order is determined by in this model (Dave, 2001). According to Russell & Taylor, (2011), the function of this EOQ model is to determine the optimal order size that minimizes total inventory. Even though, John, et al., (2015) notes that the economic order quantity model focuses on minimizing the inventory costs rather than on minimizing the inventory, their argument extends to comparing Just in Time to EOQ. Depending on the assumptions made about the inventory system there are several variations of the EOQ model, some of them are basic EOQ model and the production quantity model. The basic EOQ model is a formula for determining the optimal order size that minimizes the sum of carrying costs and ordering costs. The model formula is derived under a set of simplified and restrictive assumptions. Which states demand is known with certainty and is constant over time, no shortages are allowed, lead time for the receipt of order is constant, and the order quantity is received all at once. The optimal order quantity, in general, is an approximate value, since it is based on estimates of carrying and ordering costs as well as uncertain demand (although all of these

parameters are treated as known, certain values in the EOQ model). According to Russell & Taylor, (2011) in practice, it is desirable to round the EOQ values off to some nearby pragmatic value. Further asserts that the precision of a decimal place is generally not necessary. Besides, the optimal order quantity is computed from a square root, errors or variations in the cost parameters and demand tend to be dampened. As a result, the EOQ model is relatively resilient to errors in the cost estimates and demand or is robust, which has tended to enhance its popularity.

2.1.2.2.2 Just in Time

Just in Time (JIT) was developed in Japan and is also known as the Toyota Production System. A contrasting approach to JIT is called Just in Case associated with holding inventory for safety issues. JIT rationality associated with assembling which comprises having the right things in the right quality and amount in the correct place and at the opportune time. This increases efficiency, reduces waste, and ultimately minimizes inventory management costs and lead time costs (Kamau & Kagiri, 2015). According to Shin, et al., (2015) to implement a JIT inventory system, a sound, long-term relationship with suppliers is critical because suppliers have to fill the inventory as soon as it reaches a minimum level. Therefore, sharing information about the production schedule with part suppliers and delivery companies is essential. This information sharing is now available through a modern IT infrastructure utilizing the Internet and Enterprise Resource Planning (ERP). Since the main goal of ERP is to share data by all functional departments and to access the data immediately to increase prompt decision making (Russell & Taylor, 2011). Together, the Internet and ERP systems dramatically improve the JIT inventory system, allowing real-time information tracking and sharing of both production and accounting information. JIT inventory management and the utilization of the Internet and ERP systems provide for a “lean production” opportunity.

2.1.2.2.3 ABC Analysis

According to Russell & Taylor, (2011) ABC system of analysis is a method for classifying inventory according to several criteria, including its dollar value to the firm. Typically, thousands of independent demand items are held in inventory by a company, especially in the aviation industry (Atnafu, 2017), but a small percentage is of such a high dollar value to warrant close inventory control. ABC examination is an essential action method that follows the Pareto principle concerning an organization’s arrangement of stock (Atnafu & Hussien, 2017). In general, about 5 to 15 percent of all inventory items account for 70 to 80 percent of the total dollar value of inventory. These

are classified as *A*, or *Class A*, items. *B* items represent approximately 30 percent of total inventory units but only about 15% of the total inventory dollar value. *C* items generally account for 50 to 60 percent of all inventory units but represent only 5 to 10 percent of total dollar value.

2.1.2.2.3 Vendor Managed Inventory

Vendor-managed inventory (VMI) is one of the most widely discussed partnering initiatives for improving multi-firm supply chain efficiency. VMI is a streamlined way to deal with inventory management and request satisfaction whereby the merchant is completely in charge of the recharging of stock in light of the opportune point of all data to the purchasers (Atnafu & Hussien, 2017). This argument supported by Smaeros, et al., (2003) the vendor has the authority and the obligation to replenish the purchaser's inventory according to collectively agreed inventory control concepts and targets. Management of inventory determines the way an organization will thrust itself to excessive overall performance. The study of VMI in the retail supply chain by Walle, et al., (1991) indicate that success in supply chain management usually derives from understanding and managing the relationship between inventory cost and customer service level. Further asserted that VMI reduces cost and improves service of the supply chain. Additionally note that successful implementation of VMI dependent on computer platforms, communications technology, and product identification and tracking system. Software systems are the most likely area of deficiency and are important because they facilitate such discussions as replenishment quantity and timing; safety stock level, transportation routing, and inter-facility transshipments. According to Gitau, (2016) a few agencies have resulted in VMI structures that aid the provider to reveal consumer's inventory usage. Via this VMI system, customers will avoid stock-outs due to the fact the suppliers may have already replenished their inventory.

2.1.2.2.4 Collaborative Planning, Forecasting, And Replenishment (CPFR)

Lack of common goal, error inventory reporting, reluctant to share supply chain information and an implementation plan affect the performance of the supply chain. For this reason, different supply chain initiative is developed such as vendor managed inventory, customer response, and CPFR. Crum & Palmatier, (2004) study shows that the CPFR initiative could reduce inventory by 30-50 percent and cut supply chain costs, while at the same time improving customer service. Furthermore, (Hill, et al., 2017) systematically study the relationship between CPFR adoption and the firm's operations and financial performance in a more rigorous manner. The results also provide several

managerial insight which serves as a benchmark for firms preparing for the CPFR implementation, CPFR provides consistent and positive results.

CPFR is one of widely accepted supply chain collaboration that promotes inter-organizational cooperation, joint work, openness, intercompany decision making, information, and knowledge sharing and customer-supplier intimacy (Hollmann, et al., 2015). Trust and ICT is the main enabler of CPFR, however, lack of this and other hosts of contextual factors such as demand elasticity and uncertainty, goals of the process, number of products, SC spatial complexity and the levels and scope of collaboration are the main barriers for implementation of CPFR. Therefore, the quality of information sharing, trust and ICT appeared as powerful CPFR levers (Hollmann, et al., 2015).

Hill, et al., (2017) notes that CPFR initiative is an increasingly popular paradigm that helps the supply chain well coordinate activities to serve customers with improved demand forecasting and production scheduling. Further assert that CPFR provides a framework that covers a broad range of issues including demand forecasting, inventory management, production and replenishment planning, and order fulfillment.

2.1.2.2.5 Software Application and Tracking System

Research results indicate that the implementation of inventory management software applications has become a valuable tool for organizations looking to upgrade the stock control system (Muyumba & Phiri, 2017; Madhwal & Panfilov, 2017). The number of inventory management applications give organizations a structured method of accounting for all incoming and outgoing flow of inventory within their facilities. The study was done by Aro-gordon & Gupte, (2016) on contemporary inventory management techniques indicate that organizations save a significant amount in costs associated with manual inventory counts, administrative errors and reductions in inventory stock-outs. Inventory management software can also be customized to fit your individual needs. Additionally, many facilities develop a tracking system, ranging from spread-sheets to computer programs, to manage inventory and monitor turnaround times. They provide complete inventory control allowing inventory managers to do proper inventory record-keeping. Some of the software applications that control inventory management are using the following application tools: Barcode, Radio Frequency Identification (RFID) and Enterprise Resource Planning (ERP).

2.1.2.2.5.1 Barcode

Barcode reader is the equipment of bar code data application systems that can collect the data sources quickly and accurately and transfer to the computer. A study of

different research on Barcode indicates it has a significant contribution to warehouse operation management. Warehouse have commonly three operations that handling inbound logistics, recording and storing management and handling outbound logistics by distributing the stored inventory. In the situation of no using barcode technology, product information about entering, stocktaking and outing warehouse is often filled in paper-based documents by hand or input manually to the computer, bring lots of error data and reduce the reliability of the system. As a result, companies have to arrange additional inspection personnel to avoid the errors, consequently, labor cost will increase, the directive processing speed will slow, eventually, enterprises benefit will drop (Hong-ying, 2009). Empirical Study on barcode by (Aro-gordon & Gupte, 2016) shows that the barcode scanner was 95% more efficient and over three times faster than the current manual method of warehouse management used to manage the inventory in Zambian Air Force. So, the advantages of using a barcode information system are obvious for warehousing operation, especially in a busy warehouse storage system, benefits become more promising.

2.1.2.2.5.2 RFID Technology

RFID is an identification method used to transmit information from a tag to a reader device within a given radio frequency range through radio waves without human intervention or data entry. The technology uses tags that are programmable containing information regarding destination, weight, and a timestamp (Leaven, et al., 2017). The tags facilitate automation throughout the supply chain system. Additionally, Leaven, et al., (2017) study indicate RFID enables warehouse space optimization and efficient goods tracking that reduce the cost and enhance customer service. RFID tags also enable real-time communication and offer accurate information. A study on A hierarchical model of the impact of RFID practices on retail supply chain performance by Vlachos, (2014) show that RFID practices have a positive impact on stock availability (45.4%), waste reduction (42.2%), sales increase (40.1%), and overall supply performance (36.3%). Additionally, by eliminating inventory inaccuracies and reducing human resource effort to perform non-value-added activities RFID adoption can provide a source of sustainable competitive advantage, which will attract more companies shortly soon. RFID overcomes the shortfalls of individual manual tracking systems in storing, tracking, wirelessly identifying and communicating information without the need for the object to be within the line-of-sight.

2.1.2.2.5.3 ERP

According to (Ince, et al., 2013) the major purpose of ERP is to integrate a wide range of information regarding organizational resources to create synergies with business partners, meet customer requirements, and enhance operational performance. ERP system is standard adaptable software. It is an information system that manages production planning, supplies, production, sales, distribution, accounting, and customer service by integrating them all. The purpose of implementing an ERP system varies among the companies and with this reason the perceived advantages of ERP are different and difficult to be defined. It can be tangible or intangible. An ERP system has several advantages. These are normalization of firm procedures, integration of facilities and data, computerization of trading processes, increasing the flexibility, reduction of the number of the employees, strengthening the globalization system and solving the problems.

2.1.3 Concepts and Measures of Operational Performance

Burns, et al., (2010) advocate that the primary objective of the military supply chain (SC) is to attain a specific state of readiness at the lowest possible overall cost. They claim that the metric for military SC success is readiness for war and not the presumed profitability of the SC. A military supply chain is a complex network of linked activities associated with procurement, production, packaging, warehousing, repair, maintenance and transportation of army supplies. The lack of coordination among the different components that form the supply chain can impair the effectiveness and responsiveness of military forces. To advance the general supply chain performance and to track the supply chain operations (see table summary), firms share supply chain information between the partners to reduce the lack of demand visibility as it goes from downstream end customer to upstream partners in the chain, work closely with customers and suppliers to improve information and product flows, and diminish wonders from demand variations, improve internal processes integration, work with suppliers to decrease lead times, reduce the risk of supply disturbance, alleviate the bullwhip effect, diminish supply chain cost of all members through collaboration and trust (Krajewski, et al., 2010).

To increase a firm's supply chain performance the drivers of supply chain management play insensible roles. These drivers comprise facilities, logistic management, transportation, inventory management, information distribution, pricing, and sourcing.

The excellent management of all these events leads to improved performance of firms (Soni & Kodali, 2010). However, there is a growing body of evidence indicating that supply chain integration has a positive effect on operational performance (OP), which includes cost, quality, flexibility, and delivery outcomes (Yuen & Thai, 2016).

The company also needs to rigorously execute against critical operational performance metrics, such as customer service, responsiveness, supply chain cost, asset utilization, product quality, and operational flexibility, to achieve overall business success (Shen, 2005). According to Tsadikovich, et al., (2010) the two military supply chain performance measure is the time of response (that defines the system's ability to react speedily to military requirements) and the military effectiveness (that defines the ability of the military supply chain to deliver the right product at the right time). Performance indices in military aviation are intended for use by managers to address institutional process improvement, minimize downtime, achieve best flight and maintenances safety record, operational availability of the aircraft, and reduce cost (Raju, et al., 2012). Besides, the urge to measure the efficiency and effectiveness of supply chain integration and inventory management practices in the Air Force to be well implemented and to stay operational readiness level of the Air Force.

Authors	Focus area of the research:	Operational performance measures used in the study:
(Shen, 2005)	Linking supply chain practices to operational and financial performance	customer service, responsiveness, supply chain cost, asset utilization, product quality, and operational flexibility
(John, et al., 2015)	Inventory management practices and operational performance...	Reduce production cost, enhance continuous production, prevents shortages and stockout costs, minimize scrap and rejects, reduced delivery lead time, minimize machine downtime, reduced resource wastages, boost employee work morale.

(Atnafu & Hussen, 2017)	The effect of supply chain integration on operational performance...	Cost, quality, delivery, flexibility, innovation, process efficiency, time-based performance, and logistics services provider.
(Yuen & Thai, 2016)	The relation between supply chain integration and operation performance	cost, quality, flexibility, and delivery outcomes.

Table 2.1 summary of operational performance measures

2.2 Empirical Review

2.2.1 Effect of Supply Chain Integration and Inventory Management Practices on Operational Performance

Many types of research have analyzed different inventory management practices, supply chain integration of both internal and external, and operational performance. These studies have combined enormous knowledge related to inventory management, supply chain management, and organizational performance.

Atnafu & Hussen, (2017) findings confirm that effective supply chain integration (internal, customer, and supplier integration) leads directly to higher operational performance. Their findings indicate there is a significant relationship between the independent variable (internal integration) and dependent variable operational performance, since all variable score statistically significant value of less than five percent ($p < 0.05$) and the magnitude of the correlation coefficient indicates that there is the good positive relationship between supply chain integration and operational performance. Further point out that there is no significant evidence on the relationship between internal and external integration (supplier and customer), these infer that internal integration may not always grant firms external integration which opposes the finding of (Basnet, 2013) that states supply chain integration starts firms with internal integration among the different department and functions within an organization before external integration is pursued.

The study of Quayle (2006) confirms expenditure on purchasing goods and services in a company may account for between 30 to 75 percent of total costs. Additionally, emphasize that expenditure on storing and distributing materials may absorb a further 10 to 20% of total costs. This finding supported by Ballon, (2000) inventory carrying cost typically ranges from 20 to 40 percent of inventor value. From the above discussion

selection of the right inventory management practice may have serious implications on the efficiency of inventory management and can minimize the inventory cost.

John, et al., (2015) findings show that under the summary of Pearson correlation between inventory management practice and operational performance, it observed that inventory management practices- Scientific Model, ABC Model, Thumb Rule, EOQ, EBQ, Vendor Managed Model, Automatic Replenishment, and Just- In- Time (JIT) are independently and positively correlated with Operational performance and most of the variables that measure inventory management practices in this study made a significant contribution towards operational efficiency and by extension competitive excellence. For instance, with a beta coefficient of 0.313, Just-In-Time Inventory contributes 31.3% towards predicting operational performance. This is closely followed by beta coefficients of 0.219 or 21.9% and 0.141 or 14.1% for a computerized inventory management system and Economic Order Quantity (EOQ), respectively. From the above, it is necessary to infer that efficient choice or a mix of the scientific inventory management tools guarantees the optimal production processes as well as enhance the competitiveness of the firm. Further, assert that the correlation inventory management practices indicate a positive relationship exists between and operational performance. The correlation coefficient of 0.721 at 0.05 level of significance implies that the type of inventory management approaches adopted by manufacturing companies plays a significant positive role in enhancing the performance of their production operations. The empirical study of (Atnafu & Hussen, 2017; Atnafu & Balda, 2018) indicates that inventory management practice has a direct impact on operational performance. The findings show that the standardized coefficient is 0.438 which is statistically significant at $p < .01(0.001)$. This implies that various inventory management practices, such as ABC analysis, EOQ decision, customer relationship building, vendor managed inventory, and JIT techniques, may provide the organization to enhance performance in maintaining profitability, output level, and cost-efficiency.

2.3 Conceptual Framework of The Study

Many chains of events affect operational performance of aviation industry. Since, a military supply chain is a complex network of linked activities associated with procurement, production, packaging, warehousing, repair, maintenance, and transportation of army supplies. The lack of coordination among the different components that form the supply chain can impair the effectiveness and responsiveness

of military forces. Especially in the aviation industry of the military, supply chain integration of internal and external (customer and supplier) and inventory management practices affect operational aircraft availability.

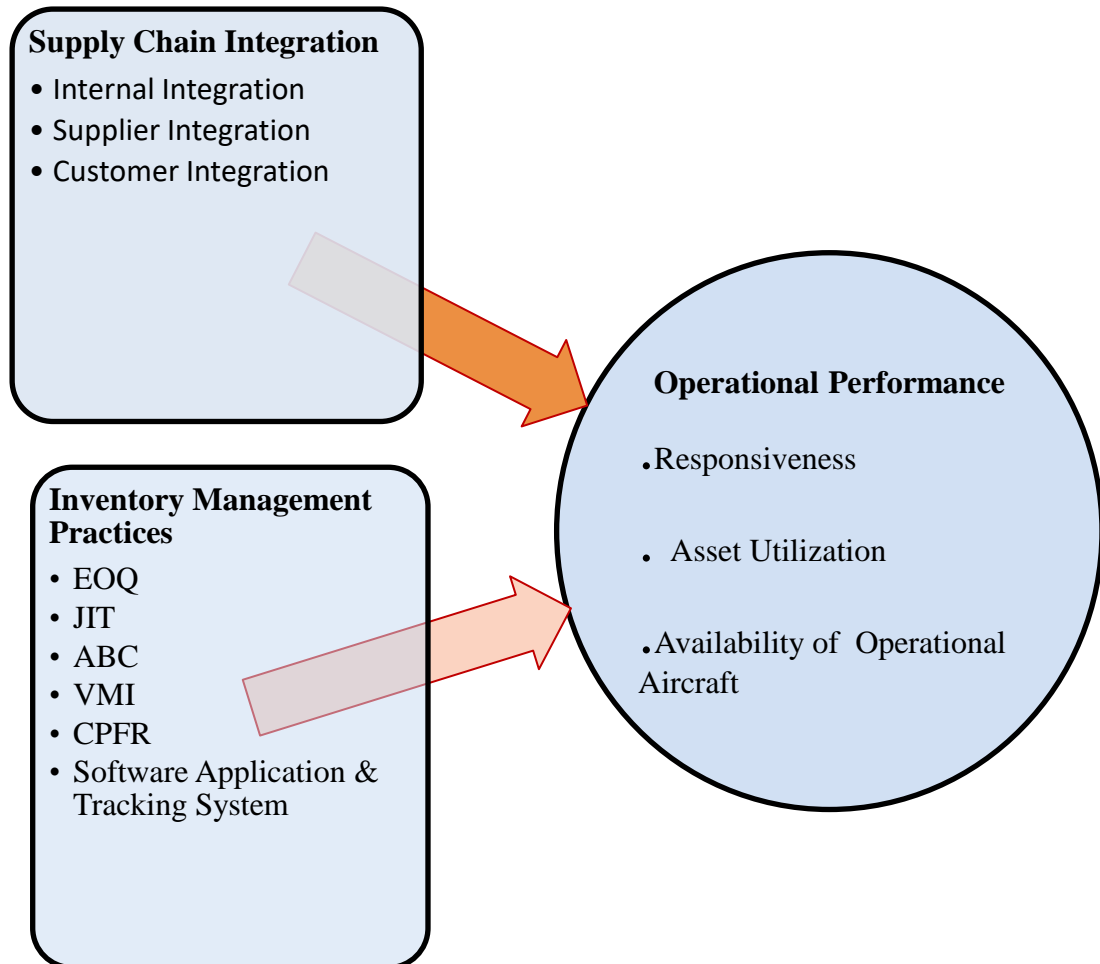


Figure 2.1 Conceptual framework of the study modified from (Atnafu & Balda, 2018; Atnafu & Hussien, 2017).

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

Defining proper research methodology is considered as an important part in this research study. Creating the research methodology involves an approach to the whole process of a research study, beginning from the theoretical foundations and up to data collection and analysis, and extends to developing the recommendation for the research problems being studied.

Research methodology, in essence, is focused around the problems to be studied in a research study and therefore varies according to the problems studied. It is important to have consistency among research questions, the research methodology, and theoretical approaches. A research strategy is one of the parts of research methodology. Research strategy offers the overall course of the study including the process by which the study is conducted (Churchill & Sanders, 2007). The different parts of the research methodology used in this study are discussed below.

3.2 Research Approach

The quantitative approach encompasses the generation of data in a quantitative form which can be subjected to tremendous quantitative analysis via statistical tools and the qualitative approach is concerned with subjective assessment of attitudes, perceptions, opinions, and behavior.

The third approach according to Creswell, (2009) mixed research design, is an approach to an inquiry involving collecting both quantitative and qualitative data, integrating the two forms of data, and using discrete designs that may comprise philosophical assumptions and theoretical frameworks. The main assumption of this form of inquiry is that the blend of qualitative and quantitative approaches offers a more comprehensive understanding of a research problem than either approach alone.

The appropriate research approach for this study is a mixed research approach. Among the three design of mixed research approach (concurrent, sequential, and transformative), researcher employ a concurrent type of mixed research approach. Thus, both qualitative and quantitative researches have equal value over data collection and interpretation to provide a full picture by triangulating both the result concurrently. The researcher was collected quantitative data using self-administered questionnaires with five points Likert scale, which distributed personally by the researcher to the

subjects to measure the effect of supply chain integration and inventory management practices on operational performance in the case of Ethiopian Air Force Air Logistics.

3.3 Research Design

The study adopts an explanatory research design since it intended to gather mixed (both quantitative and qualitative) data to describe and explain the effect of supply chain integration and inventory management practices on the operational performance of the Ethiopian Air Force. The study considered this design appropriate since it would facilitate the gathering of “what” and “how” research questions. Moreover, the gathering of reliable and accurate data that clearly describes and explains the effect of a research study on organization operational performance.

3.4 Population and Sampling Techniques

The total population size of this study covers MOND Procurement Directory and four Air Force bases at the homeland, which are operational at the moment in Ethiopia. Namely, Central Air Base (Bishoftu/Deberzeit at Harer Meda), West Air Base (Bahirdar), North Air Base (Mekele), and East Air Base (Dire Dawa and Gode). However, they are structurally under headquarter of the Air Force. In this research both time and cost are the limiting factor to collect data from all corner of Ethiopian Air Force bases and also similar data expected to be gathered for the research study due to similar organizational structure. Thus, purposively select Ethiopian Air Force Air Logistics under the headquarter since it is the main hub of Air Logistics and Central Air Base representatively for other airbases (operational units).

Furthermore, a simple random sampling technique was employed to determine which subject of the population to be included in the research study. This random sample of data collected by being in person and distributed randomly to every functional unit of both Air Logistics and the MOND Procurement Directory.

The target population was middle level managers, supervisors, whose responsibility from any of directly related to aviation logistics, cross-functional team, distribution channel management, warehouse and inventory management, and finance, which are Air Logistics personnel. To ensure the reliability of the findings additional respondent are selected randomly from the first tire local customers (operational units) and supplier (MOND procurement directory).

The researcher targeted Ethiopian Air Force Air Logistics units as main units of analysis for this study purpose. To select a representative sample size from the total population,

the researcher used Green, (1991) formula. As a right-hand rule, it is used when total population size is unknown and a representative sample size required for multiple regression that will help to understand which predictor is statistically significant contributors to the multiple regression equation.

Green, (1991) recommend for medium effect ($R^2=0.07$; $\beta=0.20$) the following:

- ❖ If the test is interested only in the multiple R^2 values:
 - Sample size (N) $\geq 50 + 8(K)$, where K is the number of independent variables
- ❖ If the test is interested in the beta (significant contributors) weights:
 - Sample size (N) $\geq 104 + K$

This calculation and their plot can be supported by the software called G*Power Version 3.1.9.4. so, using 10 number of predictors with a 95 percent confidence level for medium-size effect and with recommended power of beta value, we can get 118 total sample size from the G*Power software.

For interview purposes, the researcher applied a non-probable purposive sampling method to select the target population by the judgment of the researcher. Researchers often believe that a non-probable purposive sampling method can acquire a representative sample by using a sound judgment, which will result in saving time and money. The target population was middle level manager and senior supervisor working under Air logistics and MOND Procurement Directory. Collection of interview data were continued until saturated.

3.5 Sources of Data and Collection Techniques

Both primary and secondary sources of data were employed in the study. The primary sources of data were a structured questionnaire and semi-structured interviews. The secondary data was obtained from organization reports, newsletters, annual magazines, and documents.

The structured questionnaire was collected by the self-administered way and pretested (with a pilot questionnaire) to check its appropriateness/reliability for gathering all the required information. Furthermore, to questioners, semi-structured interviews were used as a primary data. Since interviews are particularly valuable for getting the story behind a participant's experiences and pursue in-depth information around the topics.

3.6 Method of Data Analysis

In this study, the quantitative data analysis was done using IBM statistical package for social studies (SPSS) version 26 to get the required analysis results for study and the researcher was present the results using descriptive statistics such as mean, standard deviation, percentile, and frequency. For inferential statistical data analysis, Correlation and Multiple Linear Regression analysis were also employed.

The qualitative data collected from the case Ethiopian Air Force Air Logistics different functional units, local first tire suppliers (MOND Procurement Directory) and customer (operational units), distributors and internal cross-functional team and higher manager of warehouse and inventory managers were used to further explain and get an in-depth insight into the findings of the qualitative data. Moreover, the findings of the qualitative data were summarized and presented complementary with descriptive study.

3.7 Scale of Reliability and Validity

Reliability and validity are terms that denote to the quality of the measures used in a research study. Reliability denotes the internal consistency and validity denotes the precision of the measure.

3.7.1 Validity

Validity is concerned with two main issues: whether the tools used for measurement are precise and whether they are determining what they want to measure. There are two extents of validity, internal and external validity (Burns & Burns, 2008). Internal validity is the degree to which the measurements of the questionnaire provide the data required to meet the purpose of the study or validity refers to the degree to which the questionnaire measures what the researcher plans to measure to confirm internal validity. External validity is concerned with the degree to which the research discoveries can be generalized to the wider population.

In this study, a structured questionnaire was developed based on rigorous related literature review. Therefore, the researcher trusts that the data collection instrument measure what it is projected to measure. Generalizability is determined by the error Green (1991) formula. So, from a previous research study, it is believed that the tool magnifies what is intended to measure.

3.7.2 Reliability

According to Creswell, (2009) reliability are a measure of internal consistency (are the items' responses consistent across constructs?) and test-retest correlations (score stable

overtime when the instrument is administered a second time?). Also, determine whether there was consistency in test administration or scoring (were errors caused by carelessness in admiration or scoring). This means the measure (data collection instrument) should deliver the same answer on another occasion or similar results should be obtained by another researcher using the similar measuring instrument.

There are four treats for reliability including participant error, participant bias (may not tell the reality for fear of top management), interviewer error (when different people organize the interview), and researcher’s bias during interpretation (Robson, 2002). In this study, the researcher was collected data by proper support letter written from Addis Ababa University School of Commerce to the organization and gave and collect questionnaires directly being in person and gave fair chance for the research units to be selected in the area of work. Therefore, the researcher believed that the respondents’ error and bias are minimal to affect the reliability of the findings.

The researcher’s error and bias do not affect the reliability of the study. Hence, the researcher data collection tool is a well-structured and self-administrated questionnaire and the data were analyzed objectively using statistical tools (SPSS version 26). Besides, the researcher was conducting a pilot test by collecting data from a sample of small (four) respondents from the case Ethiopian Air Force and reliability test were completed using SPSS.

Commonly, Cronbach's alpha coefficient is a measure of internal consistency. According to Bonett & Wright, (2014) the sample value of Cronbach’s alpha for a response variable or a predictor variable in a statistical analysis might be unacceptably small because the sample value of Cronbach’s alpha was below 0.7. However, there is no universal minimally acceptable reliability value. Further, assert that besides that confidence interval or reliability value of 0.95 and higher is desirable. Even though, all Cronbach alpha values exceeded 0.70, indicating an acceptable reliability level (Kotzab, et al., 2005). In this study four key and experianced respondent Cronbach's alpha was analyzed and tested, its reliability value is greater than 0.70:

Supply chain operational performance variable	Cronbach’s alpha with 95% confidence value
Supply Chain Integration	0.949
Inventory Management Practices	0.809
Effect on Operational Performance	0.903

Causes of Aircraft being in the AOG Situation	0.753
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Table 3.1 Cronbach's alpha test

3.8 Ethical Considerations

Ethics is becoming an increasingly prominent issue for all researchers. Researchers are recommended to employ knowledge of research ethics in practice. Ethical issues were prominent in this research process, during the data collection, throughout the analysis and writing up of the final report. The researcher was appreciated the rights to anonymity, confidentiality, and the will to inform the consent of the respondents. The purpose of the research was communicated to the respondents, interviewees, and the organization's data owners so that they can provide accurate information.

CHAPTER FOUR: ANALYSIS, RESULTS, AND DISCUSSIONS

4.1 Introduction

For this research study, the questionnaire is distributed to analyze and measure its level of agreement or disagreement over their experience in their organization. The rating is from 1=strongly disagree (low measure) to 5=strongly agree (high measure) of the Likert variable. Since, outlier can have considerable influence on the regression solution and should be identified and removed as they affect the accuracy of prediction (Burns & Burns, 2008). These outliers can be checked by inspecting the Mahalanobis distances, and for two independent variables the critical value should not be greater than 13.82 (Pallant, 2016). Regarding that 145 questionnaires were distributed and 7 questionnaires have missing items that need to filled by the respondent, furthermore 7 outliers voided. Finally, after voiding missing, outliers and uncollected data, 119 (78.621%) questionnaires were used for this study. To analyze the collected data statistical package for social science (SPSS) Version, 26 is used.

Similarly, the researcher gathered qualitative data through semi structured interview from different functional units of Air Logistics, MOND procurement directory, and operational units until the data saturated. Regarding that 9 senior respondents were interviewed.

4.2 Demographic Information

Table 4.1 Respondent Demographic Information

Demographic Information					
		Frequency	Percent	Valid Percent	Cumulative Percent
Gender	MALE	112	94.1	94.1	94.1
	FEMALE	7	5.9	5.9	100.0
	Total	119	100.0	100.0	
Age	18-25	7	5.9	5.9	5.9
	26-35	43	36.1	36.1	42.0
	35-45	42	35.3	35.3	77.3
	More than 45	27	22.7	22.7	100.0
	Total	119	100.0	100.0	
Current Position in The Organization	Middle-Level Manager	9	7.6	7.6	7.6

	Low-Level Manager	110	92.4	92.4	100.0
	Total	119	100.0	100.0	
Experience	Less than 1 year	1	.8	.8	.8
	1-5	12	10.1	10.1	10.9
	6-10	29	24.4	24.4	35.3
	11-15	20	16.8	16.8	52.1
	16-20	30	25.2	25.2	77.3
	More than 20 years	27	22.7	22.7	100.0
	Total	119	100.0	100.0	
Qualification Level	College Diploma	61	51.3	51.3	51.3
	B. A/B.SC	57	47.9	47.9	99.2
	MA/MSC & Above	1	.8	.8	100.0
	Total	119	100.0	100.0	

Source: own survey,2020

Table 4.1 indicates the respondents Gender, Age, Managerial Position, Experience, and Qualification level distribution respectively in the MOND Procurement Directories and Air Logistics supply chain. Each parts of discussion are presented respectively as follow:

Respondent Gender variation and proportion, that is, the high portion (94.1%) of males and 5.9% percent of females. Which shows there was unproportionable gender participation in the area of work over the random selection of participant.

The productive groups of age in this study are between 18-25 (5.88%), 26-35 (36.13%), 35-45 (35.29%), and more than 45 (22.69%) years respectively. From these, we can say that the most productive group of age was young that have a future to learn and excel the performance of the operation.

The managerial position of the respondent that participated in this research study, as it indicated in the above table, 7.6% are Middle-level Managers and 92.4% Low-level Managers. As it shows they have the experience to observe and lead the operation of the Air Logistics supply chain.

Over 25.21% respondent have the working experience of 16-20 years, 24.37% (6-10), 16.81% (11-15), 10.08% (1-5), 22.69% more than 20 years, and 0.84% less than 1-year experience over the up and down stream supply chain of Air Logistics. Most

respondents in this research are well skilled and experienced and know how the supply chain works.

As the table indicate 51.3% of respondents' have College Diploma, 47.9% have BA/B.SC, the rest 0.8% indicate MA/MSC or above education level. The result specifies most of the respondent of these research study are qualified personnel and understand how the supply chain works.

4.3 Descriptive Statistics

When the quantitative questionnaire designed a series of questions that combined measure particular traits, it might be created a Likert scale, to correctly analyze these Likert scale data the appropriate statistical to use is mean and standard deviation to describe the scale (Norman, 2010; Boone & Boone, 2012). So that, both individual and aggregated descriptive statistics were used to analyze the research by SPSS, based on the information that was collected using Likert scale questionnaire.

Both qualitative and quantitative study was parallely gathered and analyzed one after the other. For quantitative analysis mean score '3' taken as a cutoff or middle value to define a low and high measure of the representing Likert variable.

The mean score values 3 and below indicates the area that needs attention and consideration. Similarly, the mean score values 4 and above indicate the high measure of Likert variable.

4.3.1 Descriptive Analysis of Independent Variables

Supply Chain Integration

Under the supply chain integration, there is internal, operational, and supplier integration. There quantitative and qualitative analysis is discussed in the following manner:

Internal Integration

Table 4.2 Internal Integration (INT)

Statistics				
DESCRIPTION	N		Mean	Std. Deviation
	Valid	Missing		
In the Air Force, there is coordinated and strategically aligned data integration among intra-functional Air Logistics and operational units to improve operational aircraft availability and avoid AOG situation	119	0	3.50	.982

Air Logistics aims to smooth the movement of resources, money, product, and information to satisfy operational units quickly and at low cost by integrating its Air Logistics functional units	119	0	3.58	.907
Air Logistics utilize periodic interdepartmental meeting among internal functional units	119	0	2.65	1.161
Air Logistics involve cross-functional teams of specialists to work together and share information for the improvement of operational units' performance	119	0	2.63	1.126
Air Logistics departments & different operational units in my organization collaboratively develop & share service plan for better organizational performance	119	0	2.39	1.237
Different Air Logistics departments in my organization share technical information to ensure operational units' expectations can be met and deliveries are on time.	119	0	3.29	.896

Source: own field survey, 2020

According to the response of 119 respondents, 50% of the mean score value indicates a moderate level of internal integration in Air Logistics. However, the rest 50% indicate low-level internal integration in the Air Logistics supply chain. Also, the mean response of the distribution ranges between 2.39-3.58, while the standard deviation lies between (0.896-1.237). This implies that the variables are normally distributed and concentrated around the mean.

From the above result, limited efforts exhibited in Air Logistics to utilize periodic interdepartmental meetings among internal functional units, that involve cross-functional teams of specialists to work together and share information and service plan for the improvement of operational units' performance. Therefore, the Air Logistics division need to consider some important internal integration variables to excel in its interdepartmental level of integration.

The qualitative semi-structured interview further elaborates, there are some main departments in the Air Logistics that are responsible for spare part availability, such as,

inventory management and warehouse. Under inventory management, there is requirement allocation and material accounting. Within the warehouse section, there are receiving and store management units. However, those different units aren't quite integrated. There is overstock due to requirement allocation section doesn't revise and assess the level of inventory on hand in the warehouse management control before sending operational unit requirements to the MOND Procurement Directory. Also, they send one type of spares which can be used by different aircraft without checking the annual consumption rate of that spares, these kinds of practice create overstock of one type of spare in the store.

Operational Unit Integration

Table 4.3 Operational Unit Integration (CRM)

Statistics				
DESCRIPTION	N		Mean	Std. Deviation
	Valid	Missing		
Ethiopian Air Logistics unit frequently interacts with end lines operational units such as bases, wings, and squadrons to set its reliability, responsiveness, and other standards to improve operational aircraft availability and avoid AOG situation	119	0	2.39	1.136
My organization frequently follow-up inventory with its key operational units for demand forecasting & quality/service feedback to avoid AOG situation	119	0	2.36	1.118
Ethiopian Air Logistics units frequently measure and evaluates operational units' satisfaction	119	0	2.35	1.078
My organization frequently evaluates the formal and informal complaints of its operational units	119	0	2.42	1.004
My organization periodically evaluates the importance of its relationship with its operational units & Sharing real-time inventory information for automatic replenishment.	119	0	2.40	1.003

Source: own field survey, 2020

Table 4.3 shows the experience of 119 respondents over the integration of Air Logistics with an operational unit. The above result indicates that 100 percent of the mean score value below-average level of these integrations. Also, the mean response of the distribution ranges between 2.35-2.42, while the standard deviation lies between (1.003-1.136). This implies that the variables are normally distributed and data exhibit relatively low values in most of dimensions measured. This a low level of Air Logistics integration to an operational unit results, Air Logistics unit to be limited on frequent interacts for Sharing real-time inventory information for automatic replenishment, demand forecasting, and quality of service feedback. Similarly, Air Logistics inadequate to evaluate the formal and informal complaints, the satisfaction of operational units such as bases, wings, and squadrons to set its reliability, responsiveness, and other standards required by operational units'. Therefore, Air Logistics needs critical consideration and evaluation of the point under the operational unit integration to promote system integration.

Similarly, a semi-structured interview elaborates the results of the above quantitative observation. Operational units usually complain about spare availability, responsiveness, and reliability in Air Logistics. This complaint raises mainly due to manual usage of inventory management that leads misallocation of inventory, limited capability seeing the level of inventory in the operational unit, shops, and on-Air Logistics store. There is no automated way of item accounting can measure consumption rate that helps to forecast and provide the minimum, reorder, and maximum level of spares to do economical order quantity model. There is also limited managerial engagement and commitment to solve formal and informal complaints and measure the satisfaction of the operational unit. The above condition and circumstances reduce the reliability of Air Logistics providing any requirement of the operational unit and less responsive providing immediate genuine answer and solution over the complaint and requirement of an operational unit.

The overall reason of these problem is that operational units only see their inventory requirement when they inspect with a store manager, there is no automated real-time inventory level indicator software that helps for demand forecasting mechanism, showing the location of inventory with a full description of the spars. The only software that they got helped to perform only to add the inventory which cannot reduce when that stock is taken away form store for operational use. Even though this software is not operating in this time and Air Logistics turn fully to use the manual system, which

is not economical, it can decrease the level of spares visibility, lead to a time-consuming process, which can degrade the morals of employees. Generally, Air Logistics limited to provide operational units requirement and replenish accordingly without asking their consent and waiting until requirement filled by the operational unit.

Supplier Integration

Table 4.4 Supplier Integration (SSP)

Statistics				
DESCRIPTION	N		Mean	Std. Deviation
	Valid	Missing		
To improve Ethiopian Air Force operational responsiveness Strategic long-term relationship were developed to its suppliers	119	0	2.52	1.301
Developing a better relationship with original aircraft parts suppliers help Ethiopian Air Logistics units to properly utilize asset and avoid AOG situations	119	0	2.44	1.154
MOND Procurement Directory consider Quality as the number one criterion in selecting suppliers of overhaul and new spare part to ensure operational aircraft availability & avoid AOG situation	119	0	2.37	1.141
MOND Procurement Directory rely & dependable on few high-quality original equipment manufacturers (OEMs) and legal part suppliers to insure operational aircraft availability	119	0	2.33	1.113
MOND Procurement Directory and Air Logistics work jointly to solve problems with its suppliers	119	0	2.37	1.111
Air Logistics work with MOND Procurement Directory and operational units by aiming there will be responsive, agile supply chain integration to improve operational aircraft availability and avoid AOG situation	119	0	2.45	1.118

Source: own field survey, 2020

Table 4.4 shows the experience of 119 respondents about the integration of Air Logistics and the MOND Procurement Directory with genuine suppliers. 100 percent of the mean score value indicates below-average score 3. The mean response of the distribution ranges between 2.33-2.52, while the standard deviation lies between (1.111-1.301). This implies that the variables are normally distributed and data exhibit relatively low values in most of dimensions measured. Which shows there is limited experience of Air Logistics and the MOND Procurement Directory with genuine suppliers.

Air Logistics and MOND Procurement Directory, have limited responsiveness and weak cooperation with legal original equipment manufacturers (OEMs) that can improve operational aircraft availability. They do not practice long term relationships with OEMs and suppliers to improve responsiveness, proper assets utilization, to excel operational aircraft availability, and to solve any raised problem. They are limited to use quality as the number one criterion for selecting a few high-quality new OEMs and overhauled legal suppliers.

The qualitative semi-structure interview more elaborates result of the above quantitative result. By representing Ethiopian Air Force, the MOND Procurement Directory open bid every time Air Force needs a spare part and participates all suppliers' agents that have an office in Addis Ababa, Ethiopia. These units procure spares according to international restricted bid and send a proposal to agents that can provide a full description of items found in their abroad store. Hence, they provide different quality and prices for spare parts.

The sourcing unit limited to participate a few high-quality OEMs and suppliers directly from the international market other than who has an office in the capital city. Hence, the MOND Procurement Directory does not have an authenticated international web address, that enables them to contact and procure directly from legal OEMs and suppliers, other than, local and international brokers which can exposed them to unnecessary national hard currency losses. In the current practice agents in Addis doesn't provide quick response over the complaint of Air Logistics and still participating and providing spares even though they have more than three-year spare part that needs to be returned and changed because of they are wrong parts and low quality that doesn't have a legal certificate. Also, they replenish Air Logistics requisition after repeated yearly requisition of same spars.

Since that the value of any logistics procurement organization depends upon its ability to provide high-quality products and services, at the lowest price commensurate with the quality, and in a timely manner. So that, both Air Logistics and MOND Procurement Directory have inability provisioning as per a complement of operational functional spares or minimum equipment list to support each aircraft. Even with the basic provisioning for the ETAF aircraft recommended by minimum equipment list that required for the readiness, and they are limited making long term agreement with genuine OEMs and suppliers that can provide certified, traceable, and approved material that maintains a high level of operational readiness by reducing downtime related to assembly repair and to have access consignment spare augmented with purchased spares.

Furthermore, the limited effort and agreement with OEMs made not to have the part required for the AOG received in a short period of requisition from all similar aircraft operator that has a direct communication link with OEMs and ETAF will benefit from these. Besides, MOND Procurement Directory and Air Logistics division limited integration solving problems of suppliers, such as, by updating their aircraft spare catalog and logbook that have the opportunity to find the alternative spare and quick response for each requisition.

From the above result, we can say that the level of integration of Air Logistics division and MOND Procurement Directory with a genuine supplier is under-considered and these have a significant effect on operational aircraft availability and avoid the AOG situation.

Inventory Management Practices (IMP)

Table 4.5 Inventory Management Practices (IMP)

Statistics				
DESCRIPTION	N		Mean	Std. Deviation
	Valid	Missing		
My organization Air Logistics management is aware of existing scientific models of managing inventory	119	0	2.45	1.031
All inventories of my organization items in our stores are classified according to their economic value and importance	119	0	3.19	1.257

Inventory management decisions in my organization are based on guesstimates	119	0	3.10	1.298
My organization use model to determine the optimal order size that minimizes the sum of carrying costs and ordering costs	119	0	2.40	.905
My organization implement a sound, long-term relationship with suppliers to fill the inventory as soon as it reaches a minimum level	119	0	2.23	1.004
My organization implement a Collaborative Planning, Forecasting and Replenishment (CPFR) approach with its partners	119	0	2.71	1.152
In Air Logistics supplier has the authority and the obligation to replenish my inventory according to their collective inventory agreement	119	0	2.46	1.064
Air Logistics implement software applications that save a significant amount in costs associated with manual inventory counts, administrative errors, and reductions in inventory stockouts	119	0	2.03	1.153
Most inventory decisions in Air Logistics are made based on computerized data output.	119	0	2.01	1.124

Source: own field survey, 2020

Table 4.5 shows the experience of 119 respondents about inventory management practices in Air Logistics. The mean response of the distribution ranges between 2.01-2.71, while the standard deviation lies between (0.905-1.298). This implies that the variables are normally distributed and data exhibit relatively low values in most of dimensions measured. The above-average mean score, 22.22% of respondent observation indicates that there is a moderate level of inventory management practices, such as items are classified according to their economic value and importance (practicing ABC inventory management model) and their inventory management decisions made based on guesstimates.

The rest 77.78% of evaluation of Air Logistics inventory management practices score below average mean value, these indicate there is a limited model to determine and implement the optimal order size (EOQ), CPFR, long term relationship with suppliers

to fill the inventory as soon as it reaches a minimum level (JIT), supplier authority and obligation to replenish according to the collective agreement (VMI), and software application and tracking system that help better inventory management decisions and save a significant amount in cost associated with manual inventory counts, administrative errors, and reductions in inventory stockouts.

Similarly, a semi-structured interview elaborates inventory practices of Air Logistics. In Air Logistics spare parts are used to classify according to their economic value and importance, classification of spares type, weight, size and category of aircrafts spars. But they don't have any mechanism knowing operational units individual item forecasted consumption rate and their minimum, reorder, and the maximum level of each item to fulfill before asked by operational units. So that, their inventory management decision is based on guesstimates and limited to use optimal the annual budget. As illustrated above there is no way to find optimal order size in their practice, for this reason, they are under considering holding safety stocks that required to maintain complement to a minimum equipment list of each aircraft. The main reason behind all these is Air Logistics supply chain system is designed manually and exposed to administrative errors and reductions in inventory or stockouts.

In Air Logistics, supplier don't have any authority and obligation to replenish inventory. Hence, there is no collective inventory agreement to replenish spars as soon as it reaches a minimum level. Furthermore, VMI system dependent on computer platforms, communications technology, and product identification and tracking system. Since any of these facilities were not available and proficiently exercised in the Air Logistics supply chain, it is difficult to replenish promptly.

Furthermore, their agreement to work directly with few high-quality OEM suppliers is limited, instead, they are participating indirectly through brokers/agents. Most importantly, there is lack of common goal, error inventory reporting, reluctant to share supply chain information and an implementation plan that will affect the performance of the supply chain, in this case it is difficult to say those agents participating throughout years of bidding processes working according to CPFR.

Air Logistics requirement allocation section balance, the demand of operational unit and Air Force higher officers consistent with the following year's planned aircraft usage for training and mission purposes. Even though, the budget is a critical issue here. Consequently, operational units that are not considered and gave high priority are asked to reduce their requirement according to an allowed budget of each aircraft, in this case,

violation of fulfilling minimum equipment list occurs and left aircraft to the AOG situation.

Generally, awareness and continuous learning and development to excel inventory management practices are under-considered.

4.3.2 Descriptive Analysis of Dependent Variable

Operational Performance (OP)

Table 4.6 Operational Performance (OP)

Statistics				
DESCRIPTION	N		Mean	Std. Deviation
	Valid	Missing		
In Air Logistics, spare parts are procured before aircraft are on AOG situation, additional ordering & expedite costs	119	0	2.11	1.141
Air Logistics supply chain integration & inventory management approach reduces delivery time & wastage to improve operational aircraft availability and avoid AOG situation	119	0	2.24	.972
Air Logistics inventory management system prevents stockout and AOG situation that interrupted operational units' performance	119	0	2.67	.958
My organization employee morale is boosted & Maintenance shops (engine shop, components shops and repair shops) productivity increased by efficient management of inventory in the Air Logistics	119	0	2.12	.967
Air Logistics inventory management practices are helping to have maximum operational aircraft availability and avoid the AOG situation.	119	0	2.28	1.024

Source: own field survey, 2020

In table 4.6, respondents evaluate the level of operational performance over their experience working under the supply chain of the Air Logistics, generally, their evaluation shows a 100 percent mean score value below 3. The mean response of the distribution ranges between 2.11-2.67, while the standard deviation lies between (0.958-1.141). This implies that the variables are normally distributed and data exhibit

relatively low values in most of dimensions measured. Respondent observation indicates Air Logistics is limited to consider critically - its spare parts procurement process starts after aircraft is in the AOG situation and in a condition additional ordering and expedite cost incurring; Its approach reducing delivery time and wastage improvement; it's system capability to prevent stockout; its capacity to increase productivity and boost employee morale, and finally helping to have maximum operational aircraft availability and avoiding AOG situation.

Semi-structured interview results also indicate Air Logistics is not proactive to forecast the inventory requirement of operational units since that requirement always starts from an operational unit and there is a limited Air Logistics inventory accounting unit that is responsible to balance the inventory level of Air Logistics that will help them to be proactive. Furthermore, its inventories management approaches can't reduce delivery time, exposed to wastage (overstock) and stockout case, and eventually, productivity and readiness of operational units such as bases, wings, and squadrons lead to deteriorated, their employee morale undermined. Finally, maximum operational aircraft availability and avoiding the AOG situation are left open.

Generally, Air Logistics operational performance is compromised, need critical consideration, and support to overcome the above situation.

4.3.3 Aggregated Descriptive Statistics

Table 4.7 Aggregate Statistics of Both Independent and Dependent Variable

Statistics				
DESCRIPTION	N		Mean	Std. Deviation
	Valid	Missing		
Supply Chain Integration	119	0	2.6144	.49398
Inventory Management Practices	119	0	2.5089	.63028
Operational Performance	119	0	2.2824	.69692

Source: own field survey, 2020

Table 4.7 shows the grouped responses result for each variable, namely, supply chain integration (Mean =2.6144, SD = 0.49398), inventory management practices (Mean =2.5089, SD = 0.63028), and operational performance (Mean =2.2824, SD = 0.69692). The aggregated result of the mean value of independent and dependent data is below average. Furthermore, the table indicates there was a limited practice of both supply chain integration and inventory management practice, also low quality on operational

performance. However, at this level, we cannot say that there is an effect of independent variables over the operational performance.

4.4 Cause of AOG

Table 4.8 Cause of Aircraft Being in the AOG Situation

Statistics				
DESCRIPTION	N		Mean	Std. Deviation
	Valid	Missing		
Aircraft are in the AOG due to physical & system balance discrepancy	119	0	3.63	1.206
Aircraft are in the AOG due to Inventory misallocation	119	0	3.11	1.177
Aircraft are in the AOG due to Complexity and delay in the approval of procurement processes	119	0	3.72	1.104
Aircraft are in the AOG due to suppliers takes a long time to deliver spare part as per the agreement of contract	119	0	3.67	1.283
Aircraft are in the AOG due to poor inventory model to determine the optimal order size that minimizes the sum of carrying costs and ordering costs	119	0	3.70	1.109
Aircraft are in the AOG due to poor implementation of Collaborative Planning, Forecasting and Replenishment (CPFR) approach with its partners	119	0	3.68	1.065
Aircraft are in the AOG due to MOND Procurement Directory is not working with high-quality original equipment manufacturers (OEMs) and suppliers	119	0	3.84	1.150
Aircraft are in the AOG due to long turnaround time of foreign repaired components	119	0	4.01	.943
Aircraft are in the AOG due to lack of automated inventory management	119	0	3.77	.915

Source: own field survey, 2020

Table 4.8 indicate the experience of 119 respondent about what factor cause the aircraft to be ground in the case of the Ethiopian Air Force. The mean response of the distribution ranges between 3.11-4.01, while the standard deviation lies between

(0.915-1.283). This implies that the variables are normally distributed and data exhibit relatively high values in most of dimensions measured. Their mean score value for the cause of AOG indicates above the average value of 3 shows Aircraft are in the AOG due to - physical & system balance discrepancy; Inventory misallocation; Complexity and delay in the approval of procurement processes; Suppliers take a long time to deliver spare part as compared to the agreed period of contract time; Poor inventory model to determine the optimal order size that minimizes the sum of carrying costs and ordering costs; Poor implementation of Collaborative Planning, Forecasting and Replenishment (CPFR) approach with its partners; MOND Procurement Directory is not working directly with high-quality original equipment manufacturers (OEMs) and suppliers; A long turnaround time of foreign repaired components, and lack of automated inventory management.

Semi-structured interview result indicates Air Logistics requirement for spare raises from the operational unit. Mostly, these requirement filling process start manually when the aircraft is in the AOG situation. Hence, Air Logistics does not automate and update inventory level in one database that increases visibility to all supply chain stakeholder. Furthermore, Air Logistics has limited capability conduct those warehouses, item accounting, and requirement allocation functional units to raise and fill their minimum equipment list required for each aircraft without consent of operational units in automate way before three aircrafts getting into the AOG situation.

In Air Logistics, there is limited effort dealing with unskilled personnel to have proper continuous training and development that help them to improve and excel their skill. Those unskilled warehouses and item accounting personnel exposed to inventory misallocation and physical and system discrepancies. Hence, the software used for item accounting performs only adding inbound items and don't minus outbound spares.

Centralized National Defense Procurement process mix and involve those value-adding and nonvalue adding supply chain stakeholders for important spare management decision and these leave the Air Logistics procurement to complex and long approval process. The Other result of this study indicates, there is a long turnaround time of foreign repaired components that retard air logistic operational performance and operational aircraft availability. Furthermore, those procuring parts are from unreliable and unpredictable sources in terms of lead time & product quality, for this reason, difficult to make the CPFR approach. These inconsistencies incapacitate to have proper spare according to the agreement made to deliver with suppliers.

Generally, this study indicates that Air Logistics has to improve the gaps under the description of what caused the aircraft to be in the AOG situation, in the meantime need to increase their operational aircraft availability.

4.5 Inferential Statistics

To make inferential analysis both employees of the Ethiopian Air Force and MOND Procurement Directory were used. Furthermore, to test the relationship between independent and dependent variable the researcher uses both correlation and multiple linear regression analysis methods. Multiple linear regression was used to emphasize how much the independent variable explains the dependent variable.

4.5.1 Assumption of Multiple Linear Regression

The researcher checked the major assumptions to have excellent result of multiple regression, such as: reliability, sample size, multicollinearity, normality of residuals, and Homoscedasticity were tested respectively in the following manner.

Reliability

Table 4.9 Reliability of Questionnaire

Main Variables	N of Item	Reliability
Supply Chain Integration	17	0.754
Inventory Management Practices	9	0.733
Effect on Operational Performance	5	0.720
Cause of Aircraft being in the AOG Situation	9	0.876

Source: own field survey, 2020

Ideally, analyzing the Cronbach's alpha test the reliability value greater than 0.7 is good to go for further analysis. However, there are some issues to reliability. According to Turk, et al., (2017) and Pallant, (2016) one of the issues is the notion of internal consistency. As they argue that the alpha value is sensitive to the number of items in the scale and for scales with a small number of items (e.g. less than 10), it is sometimes difficult to get a decent Cronbach alpha value. Furthermore, for an exploratory study, an alpha value of 0.60 is also acceptable. But you need to make a case for it in a context. However, for explanatory factor analysis, the researcher may also report a reliability alpha between 0.55 and 0.60. For this study researcher found Cronbach's alpha value greater than 0.7 and its ready for further analysis.

Sample Size

To select a representative sample size from the total population, the researcher used the famous Green, (1991) formula, based on the recommended medium effect ($R^2 = 0.07$;

$\beta=0.20$). This calculation can be supported for excellent output by the software called G*Power Version 3.1.9.4. so, using 10 number of predictors with a 95 percent confidence level for medium-size effect and with recommended power of beta value, we can get 118 total sample size from the G*Power software. Which is less than the sample size (N=119) collected for this research study.

Multicollinearity

The major assumption applies in multiple regression is that very high correlations between independent variables (supply chain integration and inventory management practices) should be avoided. This is Multicollinearity. By inspecting the correlation matrix for a high correlation of 0.90 and above as this implies the two variables are measuring the same variance and will over-inflate R., therefore, one of the two is needed (Burns & Burns, 2008).

The Variance Inflation Factor (VIF) measures the impact of collinearity among the independent variables in a multiple regression model on the precision of estimation. It expresses the degree to which collinearity among the predictor degrades the precision of an estimate. Typically, a VIF value greater than 10.0 is of concern (Pallant, 2016).

Correlations			
		Supply Chain Integration	Inventory Management Practices
Supply Chain Integration	Pearson Correlation	1	.580**
	Sig. (2-tailed)		.000
	N	119	119
Inventory Management Practices	Pearson Correlation	.580**	1
	Sig. (2-tailed)	.000	
	N	119	119
**. Correlation is significant at the 0.01 level (2-tailed).			

Table 4.10 Correlation Analysis

Source: own field survey, 2020

To assess multicollinearity by inspecting a correlation matrix of the independent variable (Supply Chain Integration and Inventory Management Practices) the presence of a high correlation (0.90 and above) between the independent variable. None of the intercorrelations are sufficiently high to cause concern.

Normality of residuals

An outlier can have considerable influence on the regression solution and should be identified and removed as they affect the accuracy of prediction (Burns & Burns, 2008). Outliers can be checked by inspecting the Mahalanobis distances, and for two independent variables the critical value should not be greater than 13.82 (Pallant, 2016). One extremely low or high value well away from the run of other values distorts the prediction by changing the angle of slope of the regression line. This is parallel to the effect on a mean by a single outlier pulling it away from the general run of scores. (Mahalanobis distance measure)

Residuals Statistics^a					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1.4143	3.6265	2.2824	.46775	119
Std. Predicted Value	-1.856	2.874	.000	1.000	119
Standard Error of Predicted Value	.049	.165	.079	.023	119
Adjusted Predicted Value	1.4053	3.5437	2.2825	.46736	119
Residual	-1.87242	1.12984	.00000	.51663	119
Std. Residual	-3.593	2.168	.000	.991	119
Stud. Residual	-3.749	2.286	.000	1.010	119
Deleted Residual	-2.03842	1.25570	- .00018	.53676	119
Stud. Deleted Residual	-3.982	2.329	-.002	1.024	119
Mahal. Distance	.034	10.835	1.983	1.907	119
Cook's Distance	.000	.415	.013	.043	119
Centered Leverage Value	.000	.092	.017	.016	119

a. Dependent Variable: Operational Performance

Table 4.11 Residuals Statistics

Source: own field survey, 2020

The maximum Mahalanobis distance is 10.835, which is less than the critical value of 13.82, in this case, residuals are limited to distorts the prediction of regression.

Homoscedasticity

Difference between obtained and predicted dependent variable (operational performance) value should normally be distributed and variance of residuals the same for all predicted scores (homoscedasticity). These assumptions can be tested by inspecting residual scatter graphs and histograms (Pallant, 2016). The histograms and

standardized residual scatter graphs are essential and address the issue of whether the assumptions for linear multiple regression were met.

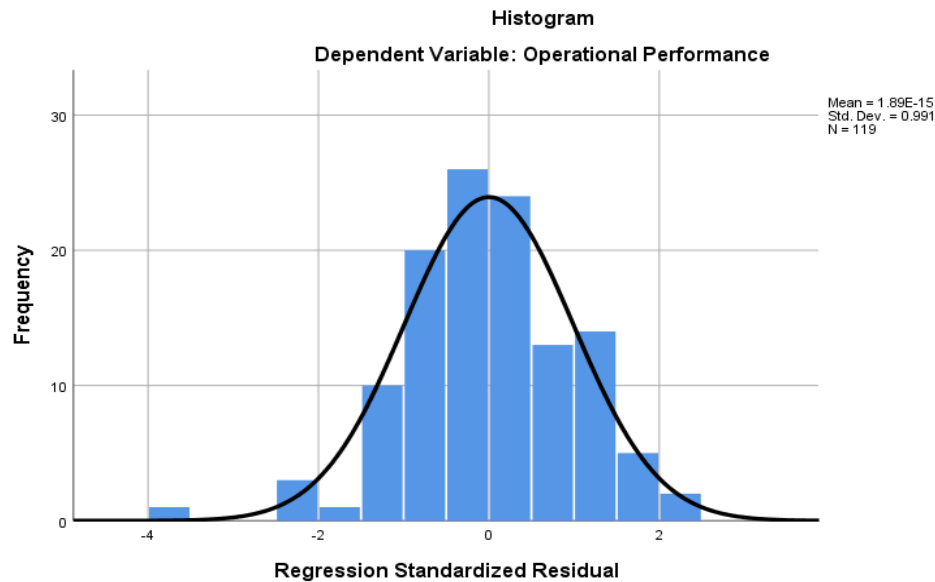


Figure 4.1 Histogram

Source: own field survey, 2020

The histogram assesses normality and reveals no definite skewness between (-2 and +2) or extreme outliers.

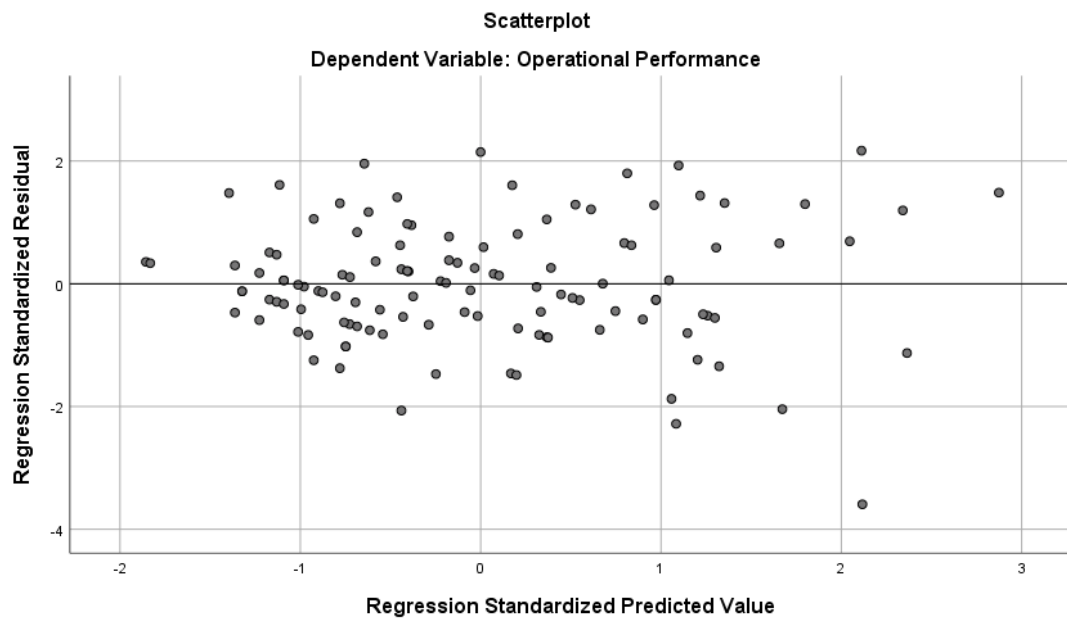


Figure 4.2 Residual by Predicted Scatterplot

Source: own field survey, 2020

The scatterplot is a near-perfect plot and very acceptable with data spread reasonably equally around the line with no apparent pattern, i.e. it is homoscedasticity.

4.5.2 Interpret the Output of Main Multiple Regression Tables

Model Summary ^b				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.671 ^a	.450	.441	.52107

a. Predictors: (Constant), Inventory Management Practices, Supply Chain Integration

b. Dependent Variable: Operational Performance

Table 4.12 Model Summary

Source: own field survey, 2020

Multiple correlation R of +0.671 represents the combined correlation of all the independent variables (Supply Chain Integration and Inventory Management Practices). Adjusting R² tells us that 44.1% of the variation in operational performance can be explained by variation in the Supply Chain Integration and Inventory Management Practices have taken together. This leaves 55.9% unexplained.

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25.817	2	12.909	47.543	.000 ^b
	Residual	31.496	116	.272		
	Total	57.313	118			

a. Dependent Variable: Operational Performance

b. Predictors: (Constant), Inventory Management Practices, Supply Chain Integration

Table 4.13 ANOVA

Source: own field survey, 2020

In the ANOVA table, we have an F value of 47.543 which is significant with $p > 0.001$. This informs us that Supply Chain Integration and Inventory Management Practices have taken together as a set are significantly related to the Operational Performance. The chance of obtaining these results assuming the two independent variables have taken together as a set are not significantly related to the dependent variable is less than 1 in 1000. The multiple correlations are therefore highly significant.

Multicollinearity Test

Coefficients ^a						
Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	Collinearity Statistics

	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF	
1	(Constant)	.025	.264		.095	.924	-.497	.548		
	Supply Chain Integration	.316	.119	.224	2.649	.009	.080	.552	.663	1.508
	Inventory Management Practices	.571	.093	.516	6.105	.000	.385	.756	.663	1.508

a. Dependent Variable: Operational Performance

Table 4.14 Coefficients

Source: own field survey, 2020

The coefficients table reveals the significant regression coefficients, namely, rating of Supply Chain Integration at $P = 0.009$ and Inventory Management Practices $P = 0.000$ was significant ($p < 0.05$). These significant levels tell us that three variables uniquely contribute to the regression equation, thereby making a significant contribution to the prediction.

The magnitude of the unique contribution is given by the relevant part correlation squared in unstandardized coefficient value of B. we can interpret the B values as indicating that for one percent increase in the rating of Supply Chain Integration, Operational Performance will increase by 31.6 percent. Similarly, one percent increase in the rating of Inventory Management Practices, Operational Performance will increase by 57.1 percent. The VIF data suggests that collinearity is no problem as the figures are well below 10.0 for each variable.

The standard beta weight can also be used to compare the relative contributions of each predictor (Burns & Burns, 2008). They display the same rank order in size as do the part correlations squares. The value of the constant is 0.025. From this information, we can now produce the regression equation.

$$\text{Operational Performance} = 0.025 + 0.316 (\text{Supply Chain Integration}) + 0.571 (\text{Inventory Management Practices})$$

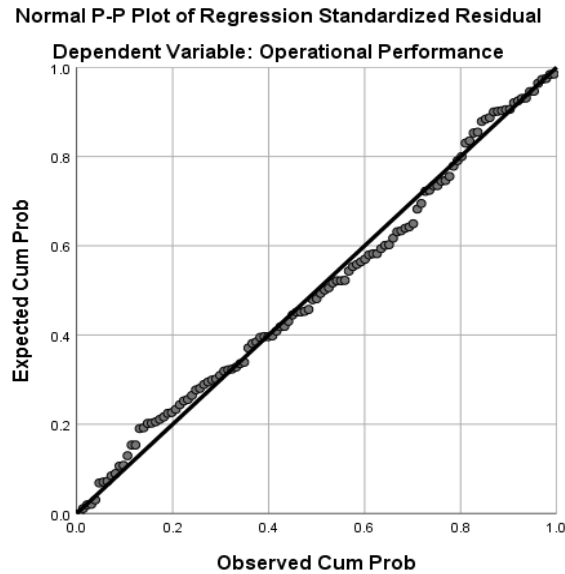


Figure 4.3 Normal P-P Plot

Source: own field survey, 2020

Figure 4.3 by visual inspection of the normal probability plot (P-P) tells us that there is an excellent possibility that the data normally distributed and which provides that the residuals (error terms) are indeed normally distributed. The closer the points are to the diagonal line, the greater the probability of normality (Burns & Burns, 2008).

Result/ findings of multiple regression based on research questions

A standard multiple regression was performed between operational performance as the dependent variable and rating of supply chain integration and inventory management practices as independent variables. The adjusted squared multiple correlations were significantly different from zero ($F = 47.543$, $p > 0.001$) and 44.1% of the variation in the operational performance explained by the set of supply chain integration and inventory management practices. All the independent variables were found to uniquely and significantly contribute to the prediction of operational performance, Thus, the magnitude of the unique contribution is given by the B value, that is, for one percent increase in the rate of Supply Chain Integration, Operational Performance will increase by 31.6 percent. Similarly, one percent increase in the rate of Inventory Management Practices, Operational Performance will increase by 57.1 percent. Besides, 0.025 value of constant.

CHAPTER FIVE: SUMMARY, CONCLUSION, AND RECOMMENDATION

5.1 Summary

The researcher is interested to assess the effects of supply chain integration and inventory management practice on Ethiopian Air Force operational performance. To address the research objectives, researcher used the findings of both quantitative and qualitative study to triangulate and ensure the reliability of this research. The quantitative study used a structured questionnaire and collect data from senior middle and lower-level managers that are working in the Air Logistics different functional units and operational units of a central base of the Ethiopian Air Force, furthermore collect data from MOND Procurement Directory. For the qualitative study, the researcher was collected data using semi-structured interviews from Air Logistics different functional units, operational units, and MOND Procurement Directory.

The researcher used SPSS version 26 to analyze the quantitative data. Both mean and standard deviation were used to further understand individual independent and dependent variables and also aggregated descriptive study. Furthermore, there is other variable that describes the cause of AOG situation or decreased operational aircraft availability. Based on both descriptive and inferential research analysis the researcher discovers some important findings as summarized below.

A standard multiple regression was performed between operational performance as the dependent variable and rating of supply chain integration and inventory management practices as independent variables.

All the independent variables were found to uniquely and significantly contribute to the prediction of operational performance. The magnitude of the unique contribution is given by the B value, that is, for one percent increase in the rate of Supply Chain Integration, Operational Performance will increase by 31.6 percent. Similarly, one percent increase in the rate of Inventory Management Practices, Operational Performance will increase by 57.1 percent. Besides, 0.025 value of constant. The adjusted squared multiple correlations were significantly different from zero ($F = 47.543, p > 0.001$) and 44.1% of the variation in the operational performance explained by the set of supply chain integration and inventory management practices.

Also, the descriptive study result show that Aircraft are in the AOG or operational aircraft availability declined when there are - physical & system balance discrepancy; Inventory misallocation; Complexity and delay in the approval of procurement

processes; suppliers take a long time to deliver spare part as compared to the agreed period of contract time; poor inventory model to determine the optimal order size that minimizes the sum of carrying costs and ordering costs; poor implementation of Collaborative Planning, Forecasting and Replenishment (CPFR) approach with its partners; MOND Procurement Directory is not working directly with high-quality original equipment manufacturers (OEMs) and suppliers; a long turnaround time of foreign repaired components, and lack of automated inventory management.

Similarly, the descriptive study of operational performance shows that the Air Logistics supply chain is limited being proactive and responsive to deliver spars before aircraft are on the AOG situation, which incurs additional ordering and expedites cost.

5.2 Conclusion

Based on the finding of inferential statistics, that is, multiple linear regression shows that there is a significant and positive effect of supply chain integration and inventory management practices on the operational performance of the case organization. Specifically:

- Supply Chain Integration and Operational Performance have a significant and positive relationship. Also, supply chain integration is one of the predictors of Air Logistics operational performances. A strong bond of integration is required between each supply chain stakeholder in the aviation industry, air logistic built internal, supplier, and customer integration. However, this aggregated supply chain integration has limitation involving all stakeholders to smooth the flow of aircraft spares.
- Inventory Management Practices and Operational Performance has a significant and positive relationship. Also, inventory management practices are one of the predictor operational performance of Air Logistics. Air Logistics have a practice classifying items according to their economic value and importance. However, they are limited practicing to determine optimal order size (EOQ), CPFR, developing long term relationship with suppliers to fill the inventory as soon as it reaches a minimum level (JIT), VMI, and using the latest software application and tracking system that helps better inventory management decision and save a significant amount in cost associated with manual inventory counts, administrative errors, and reductions in inventory or stockout.

Based on the finding of descriptive statistics in the Air Logistics, aircraft are in the AOG situation or operational aircraft availability declined due to long turnaround time of a foreign repaired component, MOND Procurement Directory is not working directly with high-quality original equipment manufacturers (OEMs) and suppliers, contrary, they used to have agreement with local and international brokers that damage hard currency of nations, also there is lack of automated inventory management system, and there are complexity and delay in the approval of procurement process.

Similarly, the descriptive study of operational performance shows that the Air Logistics supply chain is limited being proactive and responsive to deliver spars before aircraft are on the AOG situation, which incurs additional ordering and expedites cost. Also, Air Logistics management system limited preventing stockout and AOG situation that interrupted operational units' performance.

5.3 Recommendation

Supply Chain Integration of Air Logistics will improve when they automate and build a strong bond between each supply chain stakeholder to smooth the flow of aircraft spares. Specifically:

- when they improve provisioning as per minimum equipment list to support each aircraft by making long term agreement with genuine OEMs and suppliers that can provide certified, traceable, and approved material that maintains a high level of operational readiness by reducing downtime.
- Furthermore, by continuously updating their aircraft spare catalog and logbook with OEMs and suppliers, they will have the opportunity to find the alternative spare and quick response for each requisition.

Inventory management practices of Air Logistics will be improved:

- If they are committed to determine optimal order size by applying the approach of EOQ simultaneously with minimum equipment list of each aircraft;
- If they developing long term relationship with suppliers to fill the inventory as soon as it reaches a minimum level (JIT) by using the latest software application and tracking system.
- Finally, when they grow common goal, reduce error of inventory reporting, committed to share supply chain information and an implementation plan by developing CPFR approach.

Operational Aircraft Availability will be improved mainly:

- when Air Logistics decreased turnaround time of new and a foreign repaired component by working directly with high-quality original equipment manufacturers (OEMs) and suppliers.
- When they outsource or develop automated inventory management and tracking system, and restructure and start its own procurement process as any aviation industry perform to reduce and improve turnaround time of new and foreign repaired components, complexity, unnecessary long chain, and delay in the approval procurement process and avoid AOG situation.

Air Logistics operational performance will be improved:

- If in thire current supply chain and inventory management adopt proactive strategies to deliver spars before aircraft are on the AOG situation, incurring additional ordering and expedites cost, rather than completely trusting reactive measures that depend on fluctuations in market and inventory supply situation. Consequently, operational units' performance and stockout condition will be resolved.

5.4 Suggestion for Future Research

For this research study data were collected from Ethiopian Air Force and MOND Procurement Directory. Therefore, it may not be used to generalize for the whole aviation sectors in the country, thus the study can only make an inference and generalization to the case organization. Second tire local and international supplier and other customer of Air Logistics in other bases of the country were not the focusses of these study. Hence, it is highly recommended in the future research to consider it and have a full picture to increase generalizability. The researcher had study effect on operational performance yet failed to consider its effect on financial performance. Furthermore, researchers need to assess the reason why Air Logistics procurement needs is processed under MOND Procurement Directory in contrary to operational responsiveness, unit readiness, and other logistics standards.

References

- Aro-Gordon, T. & Gupte, J., 2016. Contemporary Inventory Management Techniques: *A Conceptual Investigation*. Mysuru, India, Icomar, pp. 1-20.
- Atnafu, D. & Balda, A., 2018. The impact of inventory management practice on firms' competitiveness and organizational performance: *Empirical evidence from micro and small enterprises in Ethiopia*. *Congent Business & Management*, pp. 1-16.
- Atnafu, D. & Hussein, S. O., 2017. The Effect of Supply Chain Integration on Operational Performance: A Study on Chemical And Chemical Product Manufacturing Firms In Ethiopia. *European Journal of Logistics, Purchasing, and Supply Chain Management*, Volume 2, pp. 10-18.
- Ayelegn, A., 2015. *History of Ethiopian Air Force*. Addis Ababa: Eclipse.
- Ballou, R. H., 2000. Business logistics/ supply chain management. planning, organizing and controlling the supply chain.. *5th ed. USA: Pearsons-Prentice Hall*.
- Basnet, C., 2013. The measurement of internal supply chain integration. *Management Research Review*, 2(36), pp. 153-172.
- Baye, D., 2017. Effects Of Inventory Management Practices On Organizations Operational Performances: *The Case Of Ethiopian Airlines*. *Thesis*.
- Bode, W. P. & E., 2011. Understanding Responses To Supply Chain. *Academy of Management Journal*, Volume 54(4), pp. 833-856.
- Bonett, D. G. & Wright, T. A., 2014. Cronbach's alpha reliability: Interval estimation, hypothesis testing, and sample size planning. *Journal of Organizational Behavior*, Issue DOI: 10.1002/job.1960.
- Boone, J. H. N. & Boone, D. A., 2012. Analyzing Likert Data. *Journal of Extension*, 50(2), pp. 1077-5315.
- Burns, L., Tseng, F. & Berkowitz, D., 2010. Global network analysis in a military supply chain: using a systems based approach to develop a next-generation end-to-end supply chain performance measurement and prediction system.s.l., In Proceedings of the 2010 Cambridge International Manufacturing Symposium.
- Cameron, W. E., 1988. Case Studies Of Supply Inventory Models. *Thesis*, pp. 1-18.
- Childhouse, P., 2003. simplified material flow holds the key to supply chain integration. Volume 31, pp. 17-27.
- Christensen, C., Betz, K. M. & Stein, M. S., 2013. *The certified quality process analyst handbook*. 2nd ed. s.l.: ASQ Quality Press.

- Christopher, M., 2005. *Logistics & Supply Chain Management*. 3rd ed. ed. London: Prentice Hall/Financial Times.
- Churchill, H. & Sanders, T., 2007. *Getting your Ph.D.: a practical insider's guide*. London: Sage Publications Ltd.
- Creswell, J. w., 2009. *Research design; qualitative, quantitative, and mixed methods approaches*. 3rd ed. ed. Los Angeles: SAGE Publications. Inc.
- Crum, C. & Palmatier, G. E., 2004. Demand collaboration: what's holding us back?. *Supply Chain Management Review*, 1(8), pp. 54-61.
- Danese, P. & Romano, P., 2011. Supply chain integration and efficiency performance: a study on the interactions between customer and supplier integration. *Supply Chain Management: An International Journal*, 16 (4), pp. 220 - 230.
- Dave, P. L., 2001. Relationship between inventory, sales, and services in a retail chain store operation. *International Journal of Physical Distribution and Logistics Management*, 2(31), pp. 124-140.
- Donaldson, L., 2013. *The contingency theory of organizations*. s.l. Lightning Source UK Ltd., Sage Publications.
- FDRE Air Force Yearly, M., 2018. NISER. *Niser*, pp. 1-62.
- Flynn, B. B., Huo, B. & Zhao, X., 2010. The impact of supply chain integration on performance: A contingency and configuration approach. *Journal of Operations Management*, 28(1), pp. 58-71.
- Girma, A., 2018. *The Role Of Maintenance, Repair And Overhaul Supply Chain Integration And Inventory Management In Flight Dispatch Reliability; The Case Of Ethiopian Airlines*. Addis Ababa, Ethiopia: THESIS.
- Gitau, R. W., 2016. Inventory Management Practices And Organizational Productivity In Parastatals In Kenya. *Thesis*.
- Green, S., 1991. *How many subjects does it take to do a regression analysis? Multivariate Behavioral Research*. s.l.:s.n.
- Gu, J., Zhang, G. & Li, K., 2015. Efficient aircraft spare parts inventory management under demand uncertainty. *Journal of Air Transport Management*, Volume 42, pp. 101-109.
- Hill, C. A., Zhang, G. P. & Miller, K. E., 2017. Collaborative planning, forecasting, and replenishment & firm performance: An empirical evaluation. *International Journal of Production Economics*, Issue DOI: 10.1016/j.ijpe.2017.11.012.

- Hiller, F. s. & Lieberman, G. J., 1995. *Introduction to Operations Research*. 6th ed. New York: McGraw-Hill, Inc.
- Hollmann, R. L., Scavarda, L. F. & Tavares Thomé, A. M., 2015. Collaborative Planning, Forecasting and Replenishment: a literature review. *International Journal of Productivity and Performance Management*, 64(7), pp. 971-993.
- Hong-Ying, S., 2009. *The Application of Barcode Technology in Logistics and Warehouse Management*. Shenyang, China, IEEE Computer Society.
- Horn, P., Scheffler, P. & Schiele, H., 2014. Internal Integration As A Pre-Condition For External Integration In Global Sourcing: A Social Capital Perspective. *Int. J. Production Economics*, Issue 153, p. 54–65.
- Huo, B., Qi, Y., Wang, Z. & Zhao, X., 2014. The impact of supply chain integration on firm performance. *Supply Chain Management: An International Journal*, 19(4), p. 369–384.
- Inc., W., 2019. *businessdictionary*. [Online] Available at: <http://www.businessdictionary.com/definition/operational-performance.html> [Accessed 27 11 2019].
- Ince, H. et al., 2013. *The Impact of ERP Systems and Supply Chain Management Practices on Firm Performance: Case of Turkish Companies*. Istanbul, Turkey, Elsevier Ltd. Open access under CC BY-NC-ND license.
- Jayaram, J., Tan, K.-C. & Nachiappan, S. P., 2010. Examining the interrelationships between supply chain integration scope and supply chain management efforts. *International Journal of Production Research*, 48(22), p. 6837–6857.
- John, A. P., 2013. *Strategic Management. Theory and Practice*. 4th ed. s.l.: Sage Publications.
- John, N. E., Etim, J. J. & Ime, T. U., 2015. Inventory management practices and operational performance of flour milling firms in Lagos, Nigeria. *International Journal of Supply and Operations Management*, 1(4), pp. 392-406.
- Kamau, L. W. & Kagiri, A. W., 2015. Influence of inventory management practices on organizational competitiveness: A case of Safaricom Kenya Ltd. *International Academic Journal of Procurement and Supply Chain Management*, 5(1), pp. 72-98.
- Kim, D. Y., 2013. Relationship between supply chain integration and performance. *Oper. Manag. Res.*, Volume 6, p. 74–90.
- Kotzab, H., Seuring, S., Müller, M. & Reiner, G., 2005. *Research Methodologies in Supply Chain Management*. s.l.: Physica-Verlag Heidelberg.

- Krajewski, L. J., Ritzman, L. P. & Malhotra, M. K., 2010. *Operations Management Process and Supply Chains*. New Jersey: Pearson Education Inc.
- Lambert, D. M. & Cooper, M. c., 2000. Issues in Supply Chain Management. *Industrial Marketing Management*, Volume 29, pp. 65-83.
- Leaven, L., Ahmmad, K. & Peebles, D., 2017. Inventory Management Applications for Healthcare Supply Chains. *Int. J Sup. Chain. Mgt*, 6(3), pp. 1-7.
- Madhwal , Y. & Panfilov, B. P., 2017. *Blockchain And Supply Chain Management: Aircrafts' Parts' Business Case*. Vienna, Austria, DAAAM International.
- Melaku, M., 2017. Impact Of Supply Chain Management In Ethiopian Airlines Maintenance, Repair And Overhaul (MRO) Services Performance. *Thesis*, pp. 1-59.
- Mellat-Parast, M. & E. Spillan, J., 2014. Logistics and supply chain process integration as a source of competitive advantage An empirical analysis. *The International Journal of Logistics Management*, 25(2), pp. 289-314.
- Mose, M. E., 2015. Impact Of Supply Chain Integration Impact Of Supply Chain Integration Processing Industry In Rwanda (Case Of German Butchery In Kigali). *European Centre for Research Training and Development UK* (www.eajournals.org), Issue Thesis.
- Muyumba, T. & Phiri, J., 2017. A Web based Inventory Control System using Cloud Architecture and Barcode Technology for Zambia Air Force. *International Journal of Advanced Computer Science and Applications*, 11(8), pp. 132-142.
- Naliaka, V. W. & Namusonge, G. S., 2015. Role of Inventory Management on Competitive Advantage among Manufacturing Firms in Kenya: a Case Study of Unga Group Limited. *International Journal of Academic Research in Business and Social Sciences*, Vol. 5(No. 5), pp. 87-104.
- Norman, G., 2010. Likert scales, levels of measurement and the "laws" of statistics. *Adv in Health Sci Educ*, 15(5), pp. 625-632.
- Otchere, A. F., Annan, J. & Anin, E. K., 2013. Achieving competitive Advantage through Supply Chain Integration in the Coca Industry: A Case Study of Olam Ghana Limited and Produce Buying Company Limited. *International Journal of Business and Social Research*, 2(3), pp. 131-145.
- Pakurár, M. et al., 2019. The Impact of Supply Chain Integration and Internal Control on Financial Performance in the Jordanian Banking Sector. *MDPI Journal of sustainability*, 11(1248), pp. 1-20.

- Pallant, J., 2016. *SPSS Survival Manual*. 6th ed. New York, NY 10121-2289, USA: McGraw-Hill Education.
- Porter, M. E., 1985. *Competitive Advantage: Creating and Sustaining Superior Performance*. New York: Free Press.
- Quayle, M., 2006. *Purchasing and Supply*. 1st ed. ed. London: IRM Press.
- Turk, E. S., Uysal, M., Hammitt, W. E. & Vaske, J. J., 2017. *Research Methods for Leisure, Recreation and Tourism*. 2nd ed. s.l.:CABI.
- Raju, V. S., Gandhi, O. P. & Deshmukh, S. G., 2012. Maintenance, Repair, and overhaul Performance Indicators for Military Aircraft. *Defense Science Journal*, 62(2), pp. 83-89.
- Ralston, P. M., Blackhurst, J., Cantor, D. E. & Crum, M. R., 2015. A Structure Conduct Performance Perspective of How Strategic Supply Chain Integration Affect Firm Performance. *Journal of Supply Chain Management*, 2(51), pp. 47-64.
- Rao, M. V., P, V. K., Rao, K. A. & Chaitanya, M., 2015. Inventory Management Best Practices for Aircraft Servicing Industry In India. *International Journal of Marketing & Technology (IJMT)*, 5(07).
- Robson, C., 2002. *Real World Research: A Resource for Social Scientists and Practitioner-Researchers*. 2nd ed. Oxford: Blackwell Publishers.
- Russell, R. S. & Taylor, B. W., 2011. *Operations Management Creating Value Along the Supply Chain*. 7 TH ed. N.Y: John Wiley & Sons, Inc.
- Shen, T., 2005. linking supply chain practices to operational and financial performance. *supply chain 2020 project work paper*, August, pp. 3-4.
- Shepherd, C. & Gunter, H., 2006. Measuring Supply Chain performance: current research and future directions. *Int. Journal of Productivity and Performance Management*, Volume 55, 3/4, pp. 242-258.
- Shin, S., Ennis, L. K. & Spurlin, W. P., 2015. Effect Of Inventory Management Efficiency On Profitability: Current Evidence From The U.S. Manufacturing Industry. *Journal of Economics and Economic Education Research*, 16(1), pp. 98-106.
- Sillanpää, I., 2010. *Supply Chain Performance Measurement In The Manufacturing Industry*. Finland, Linnanmaa., Acta Univ. Oul. C 374, 2010.
- Slack, N., Chambers, S. & Johnston, R., 2010. *operations management*. 6th ed. England: Pitman Publishing.

- Smaêros, J., Lehtonen, J.-M., Appelqvist, P. & Holmström, J., 2003. The impact of increasing demand visibility on production and inventory control efficiency. *International Journal of Physical Distribution & Logistics Management*, 33(4), pp. 336-354.
- Soni, G. & Kodali, R., 2010. Internal benchmarking for assessment of supply chain performance. *An International Journal*, 17(1), pp. 44-76.
- Stevenson, B. U., 2010. Operations management. *10th edition ed. N.Y:McGraw-Hill Publishing Inc.*
- Stevenson, W. J., 2012. *Operations Management*. 11th ed. New York: McGraw-Hill/Irwin.
- Tsadikovich, D., Levner, E., Tell, H. & Werner, F., 2010. *Integrated demand-responsive scheduling of maintenance and transportation operations in military supply chains*. Mexican, International Conference on Artificial Intelligence (Micai-2010).
- Verhoeff, M., Verhagen, W. C. & Curran, R., 2015, Maximizing operational readiness in military aviation by optimizing flight and maintenance planning. *18th Euro Working Group on Transportation, Ewgt 2015*, 14-16 July, p. 941 – 950.
- Vlachos, I., 2014. A hierarchical model of the impact of RFID practices on retail supply chain performance. *chain performance*, 1(41), pp. 5 - 15.
- Walle, M. W., Johnson, M. E. & Davis, T., 1991. Vendor-Managed Inventory In The Retail Supply Chain. *Journal of Business Logistics*.
- Yuen, K. F. & Thai, V. V., 2016. The relationship between supply chain integration and operational performances: A study of priorities and synergies. *Transportation Journal*, Volume 55, pp. 31-50.
- Zhao, X., Huo, B., Selen, W. & Yeung, J., 2011. The impact of internal integration and relationship commitment on external integration. *Journal of Operations Management*, Volume 29, pp. 17-32.

Appendix-A

Addis Ababa University

School of Commerce

Graduate Studies in Logistics & SCM

Supply Chain Operational Performance Assessment Questionnaire

Dear-sir/madam

I am undertaking my master's thesis on the title "Effect of supply chain integration and inventory management practices on operational performance: the case of F.D.R.E Air Force" as a partial fulfillment requirement for M.A degree in Logistics & Supply Chain Management. Considering that your response and participation are essential to contribute to the body of knowledge in the areas of supply chain management and the success of this study, I kindly request you to participate in this data collection process. All responses will be kept confidential and will not be traceable to individual respondents. You will be asked questions concerning the company's current supply chain management. If you are unable to complete the questionnaire yourself, please entrust the task to another who is knowledgeable about supply chain management, supply chain integration, and supply chain performance. There are no right or wrong answers to the following questions. The researcher is only interested in your assessment of your organization's supply chain integration and inventory management practices.

Finishing the questionnaire will take about 20 minutes. Kindly spare a few minutes from your valuable time and busy schedule to complete the questionnaire as your participation is valuable and crucial for the success of this study. Please put the checkmark (X) in the box of your choice and your effort to answer all the questions is highly respected. I confirm that the whole data collection and analysis will be apprehended confidential and ethical. Please be aware that it is not required to mention your name. Once you have finished the questionnaire, I am delighted to physically gather or you can mail it straight to me using my e-mail address shown below. Thank you in advance for your cooperation and in case of an inquiry, please do not hesitate to contact me at my e-mail below. Finally, I respect your concern and compassion while replying to the questionnaire.

Biruk Tilahun

Master's Degree Program student

Addis Ababa University School of Commerce.

Email: buredar@hotmail.com

SECTION-1 RESPONDENT'S PROFILE

The following questions are about the respondent's profile in the organization.
Kindly indicate the appropriate characteristics of yours profile using (X) mark

<p>1.1 Gender</p> <p><input type="checkbox"/> Male</p> <p><input type="checkbox"/> Female</p>	<p>1.2 Your age</p> <p><input type="checkbox"/> 18-25</p> <p><input type="checkbox"/> 26-35</p> <p><input type="checkbox"/> 36-45</p> <p><input type="checkbox"/> More than 45</p>
<p>1.3 Your current position in the organization</p> <p><input type="checkbox"/> Air Logistics Manager</p> <p><input type="checkbox"/> Supply chain Manager</p> <p><input type="checkbox"/> Deputy Production Manager</p> <p><input type="checkbox"/> Distribution Manager</p> <p><input type="checkbox"/> Transport Manager</p> <p><input type="checkbox"/> Warehouse and Inventory Manager</p> <p><input type="checkbox"/> Warehouse and Inventory Officers</p> <p><input type="checkbox"/> Sourcing Manager</p> <p><input type="checkbox"/> Procurement Manager</p> <p><input type="checkbox"/> Category Manager</p> <p><input type="checkbox"/> Import Manager</p> <p><input type="checkbox"/> Freight Forwarder</p> <p><input type="checkbox"/> Inventory Controller</p> <p><input type="checkbox"/> Any other, please write here</p> <p>_____</p>	<p>1.4 Your work experience in this organization:</p> <p><input type="checkbox"/> Less than 1 year</p> <p><input type="checkbox"/> 1-5 years</p> <p><input type="checkbox"/> 5-10 years</p> <p><input type="checkbox"/> 10-15 years</p> <p><input type="checkbox"/> 15-20 years</p> <p><input type="checkbox"/> More than 20 years</p> <p>1.5 Respondent's qualification level:</p> <p><input type="checkbox"/> Certificate</p> <p><input type="checkbox"/> College Diploma</p> <p><input type="checkbox"/> B. A/B.SC</p> <p><input type="checkbox"/> MA/MBA/MSC & Above</p>

SECTION 2: SUPPLY CHAIN INTEGRATION

Please indicate the level of your agreement or disagreement using (X) on the following statements based on your experience in your company on the following statements. The rating is from 1= Strongly Disagree to 5=Strongly Agree as shown below.

2.1 SUPPLY CHAIN INTERNAL INTEGRATION (INT)

CODE	STATEMENT	Strongly	Disagree	Disagree	Neutral	Agree	Strongly	Agree
		1	2	2	3	4	5	
INT1	In the Air Force, there is coordinated and strategically aligned data integration among intra-functional Air logistics and operational units to improve operational aircraft availability and avoid AOG situation							
INT2	Air logistics aims to smooth the movement of resources, money, product, and information to satisfy operational units quickly and at low cost by integrating its Air logistics functional units							
INT3	Air logistics utilize periodic interdepartmental meeting among internal functional units							
INT4	Air logistics involve cross-functional teams of specialists to work together and share information for the improvement of operational units' performance							
INT5	Air logistics departments & different operational units in my organization collaboratively develop & share service plan for better organizational performance							

INT6	Different Air Logistics departments in my organization share technical information to ensure operational units' expectations can be met and deliveries are on time						
2.2 Integration with Customer/ Operational Units (CRM)							
CODE	STATEMENT	Strongly	Disagree	Disagree	Neutral	Agree	Strongly
		1		2	3	4	5
CRM1	Air logistics unit frequently interacts with end lines operational units such as bases, wings, and squadrons to set its reliability, responsiveness, and other standards to improve operational aircraft availability and avoid AOG situation						
CRM2	Air logistics frequently follow-up inventory with its key operational units for demand forecasting & quality of service feedback to avoid AOG situation						
CRM3	Air logistics units frequently measure and evaluates operational units' satisfaction						
CRM4	Air logistics frequently evaluates the formal and informal complaints of its operational units						
CRM5	Air logistics periodically evaluates the importance of its relationship with its operational units & Sharing real-time inventory information for automatic replenishment.						
2.3 Integration with Suppliers (SSP)							
CODE	STATEMENT	Strongly	Disagree	Disagree	Neutral	Agree	Strongly
		1		2	3	4	5

SSP1	To improve Ethiopian Air Force operational responsiveness Strategic long-term relationship were developed to its suppliers						
SSP2	Developing a better relationship with original aircraft parts suppliers help Ethiopian Air logistics units to properly utilize asset and avoid AOG situations						
SSP3	MOND procurement directory consider Quality as the number one criterion in selecting suppliers of overhaul and new spare part to ensure operational aircraft availability & avoid AOG situation						
SSP4	MOND procurement directory rely & dependable on few high-quality original equipment manufacturers (OEMs) and legal part suppliers to insure operational aircraft availability						
SSP5	MOND procurement directory and Air logistics work jointly to solve problems with its suppliers						
SSP6	Air logistics work with MOND procurement directory and operational units by aiming there will be responsive, agile supply chain integration to improve operational aircraft availability and avoid AOG situation						
SECTION-3: Inventory Management Practices (IMP)							
CODE	STATEMENT	Strongly 1	Disagree 2	Disagree 2	Neutral 3	Agree 4	Strongly 5 Agree

IMP1	My organization air logistics management is aware of existing scientific models of managing inventory					
IMP2	All inventories of my organization items in our stores are classified according to their economic value and importance					
IMP3	Inventory management decisions in my organization are based on guesstimates					
IMP4	My organization use model to determine the optimal order size that minimizes the sum of carrying costs and ordering costs					
IMP5	My organization implement a sound, long-term relationship with suppliers to fill the inventory as soon as it reaches a minimum level					
IMP6	My organization implement a Collaborative Planning, Forecasting and Replenishment (CPFR) approach with its partners					
IMP7	In air logistics supplier has the authority and the obligation to replenish my inventory according to their collective inventory agreement					
IMP8	Air logistics implement software applications that save a significant amount in costs associated with manual inventory counts, administrative errors, and reductions in inventory stockouts					
IMP9	Most inventory decisions in air logistics are made based on computerized data output.					
SECTION-4: Effect on Operational performance						

CODE	STATEMENT	Strongly	Disagree	Disagree	Neutral	Agree	Strongly	Agree
		1		2	3	4	5	
OP1	In air logistics, spare parts are procured before aircraft are on AOG situation, additional ordering & expedite costs							
OP2	Air logistics supply chain integration & inventory management approach reduces delivery time & wastage to improve operational aircraft availability and avoid AOG situation							
OP3	Air logistics inventory management system prevents stockout and AOG situation that interrupted operational units' performance							
OP4	My organization employee morale is boosted & Maintenance shops (engine shop, components shops and repair shops) productivity increased by efficient management of inventory in the organization							
OP5	Air logistics inventory management practices are helping to have maximum operational aircraft availability and avoid the AOG situation.							
SECTION-5: Causes for Aircraft Being in The AOG Situation								
CODE	STATEMENT	Strongly	Disagree	Disagree	Neutral	Agree	Strongly	Agree
		1		2	3	4	5	
AOG1	Aircraft are in the AOG due to physical & system balance discrepancy							
AOG2	Aircraft are in the AOG due to Inventory misallocation							

AOG3	Aircraft are in the AOG due to Complexity and delay in the approval of procurement processes					
AOG4	Aircraft are in the AOG due to suppliers takes a long time to deliver spare part as per the agreement of contrate					
AOG5	Aircraft are in the AOG due to poor inventory model to determine the optimal order size that minimizes the sum of carrying costs and ordering costs					
AOG6	Aircraft are in the AOG due to poor implementation of Collaborative Planning, Forecasting and Replenishment (CPFR) approach with its partners					
AOG7	Aircraft are in the AOG due to MOND procurement directory is not working with high-quality original equipment manufacturers (OEMs) and suppliers					
AOG8	Aircraft are in the AOG due to long turnaround time of foreign repaired components					
AOG9	Aircraft are in the AOG due to lack of automated inventory management					

Appendix-B

Interview Questions for Key Informant, such as:

- **Air Logistics Managers**

- In your organization, how do you describe the importance of internal (Air Logistics functional units), supplier, and operational units (base, wings, and squadrons) integration?
- How responsive and proactive is the supply chain of Ethiopian Air Force Air Logistics unit for optimal asset utilization?
- How do you rate the level of integration?
- Is there strong Integration between MOND Procurement Directory and operational unit?
- What type of inventory management technique you are following?
- Do you think inventory management practices have an important contribution to operational aircraft availability?
- What is the major cause of the AOG/critical situation? Does it have an effect on optimal operational aircraft availability?

- **Operational Units Managers**

- Is there strong Integration between MOND Procurement Directory and operational unit?
- How do you rate the level of integration?
- Does operational unit requirement fulfill according to minimum equipment list?
- Does Air Logistics give high priority fulfilling AOG aircraft requirements?
- Do Air Logistics replenish according to the budget each aircraft has at the end of the year?
- How responsive and proactive is the supply chain of Air Logistics unit replenishing requirement of operational units?

- **MOND Procurement Directory Managers**

- Is there strong Integration between MOND Procurement Directory and Air Logistics?
- How do you rate the level of integration?
- How responsive and proactive is the MOND Procurement Directory to replenish Air Logistics requirement?

- Do MOND Procurement Directory have long term agreement with supplier?
- What problem do you face when procuring spare parts?
- Is there any automated way that connect all stakeholders in time manner?
- How MOND Procurement Directory evaluate and select high quality OEMs and suppliers?
- Does it have an effect on optimal operational aircraft availability?