The Effect of Supply Chain Integration on Operational Performance: The case of Ethiopian Airlines - Maintenance, Repair and Overhaul (MRO)

By: Asnake Atnafie

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Advisor: Fesseha Afework (Ass. Prof.)

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By: Asnake Atnafie, ID No. GSD/4594/08

Approved by a Board of Examiners and Advisor:

Fesseha Afework (Ass. Prof.)	_____	_____
Advisor	**Signature**	**Date**
Busha Temesgen (PhD)	_____	_____
Examiner	**Signature**	**Date**
Tadiwos Menta (PhD)	_____	_____
Examiner	**Signature**	**Date**

DECLARATION

I, the undersigned, declare that the thesis entitled "**The Effect of Supply Chain Integration on Operational Performance: The case of Ethiopian Airlines - Maintenance, Repair and Overhaul (MRO)**" is my original work and has not been presented for a degree in any university or institution for the fulfillment of the requirement for any course of study, and that all source of materials used for the study have been duly acknowledged.

Declared by, Name: Asnake Atnafie

ID No.: GSD//4594/08

Sign: _____

Date: _____

Addis Ababa, Ethiopian

CERTIFICATION

This is to certify that this thesis is prepared by Asnake Atnafie, a Masters of Art in Logistics and Supply Chain Management had been working under my supervision and guidance for his project titled "**The Effect of Supply Chain Integration on Operational Performance: The case of Ethiopian Airlines - Maintenance, Repair and Overhaul (MRO)**". He is submitting his genuine and original work and complies with the regulations of Addis Ababa University School of Commerce and meets the accepted standards with respect to originality and quality.

Advisor Name: Fesseha Afework (Ass. Prof.)

Sign: _____

Date: _____

Addis Ababa, Ethiopia

ABSTRACT

In today's competitive business environment, most of the organizations considered that supply chain management is one of the most important management tool so as to secure competitive advantage. It's obvious that sustainable improvement in operational performance of an organization enable to take competitive advantage over rivals. The objective of the study is to investigate the effect of supply chain integration on the operational performance of Ethiopian Maintenance, Repair and Overhaul. The methodology of the research in which mixed quantitative and qualitative approach have been employed to gather and analyze data. The study applied questionnaire survey and semi-structured interview enquiries, which are adapted from the previous study and then developed by using pilot study conducted with a selected team before distribution of the questionnaires. The study used to survey employees and management members working in Ethiopian Maintenance, Repair and Overhaul. The study applied purposive sampling and respondents who have direct exposure towards the study have been selected. The quantitative data collected from 157 respondents out of 191 sample selected; and the qualitative data gathered from four top management member. In reference to the reviewed literature, a model includes the most commonly used categories of supply chain integration that are supplier, internal and customer integrations as independent variables; and the operational performance as a dependent variable in which the well-known dimensions that are cost, quality and time have been evaluated. The study used descriptive and explanatory research design; data has been analyzed, interpreted and discussed by using applicable statistical techniques for which analytical software tool STATA has been used, and also the findings from the interview have been analyzed, discussed and summarized as well. Descriptive statistics such as frequency, percentage distribution, mean and standard deviation, and also multiple-linear regression has been applied to analyze the findings. The result of the findings indicated that positive and significant relationship between variables of supply chain integration and the operational performance. The independent variables; supplier, internal and customer integrations are correlated and positively related each other, and the same is true for the dimensions of operational performance. Supplier integration has the highest effect on operational performance, then internal integration followed by customer integration. The result shows supplier integration, internal integration and customer integration are individually useful in predicting the operational performance of Ethiopian Maintenance, Repair and Overhaul. Therefore, supply chain integration has a positive effect on the operational performance of Ethiopian Maintenance, Repair and Overhaul.

***Keywords**: Supply Chain Management (SCM), Supply Chain Integration (SCI), Supplier Integration (SI), Internal Integration (II), Customer Integration (CI) and Operational Performance (OP).*

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Thank you all, God bless you!!

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LIST OF ACRONYMS AND ABBREVIATIONS

SCM: Supply Chain Management

SCI: Supply Chain Integration

SI: Supplier Integration

II: Internal Integration

CI: Customer Integration

AMT: Aircraft Maintenance

ET/Ethiopian: Ethiopian Airlines

MRO: Maintenance Repair and Overhaul

ET-MRO: Ethiopian MRO

OEM: Original Equipment Manufacturer

OTP: On Time Performance

PSCM: Procurement and Supply Chain Management

TAT: Turnaround time

ACE: Achieving Competitive Excellence

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Since the down of the industrial age, companies have participated in supply chain network buying raw materials, manufacturing products, and selling through market to end customers. In recent years, the relationship among those different organizations have been overlooked except, when isolations occur in the chain. In today's business most of the time, organizations develop their own strategies, they do not consider how capabilities of other members used to create a core competency, which can be found difficult to duplicate. In other hand, organizations do not take into account how the strategy of the one affects the other as player in the supply network. Supply Chain Management (SCM) changes the given traditional and self-centered approach in which organizations encouraged to develop a common strategies and implementation mechanisms. Thinking of supply chain requires managers to look the world in a different way in consideration with the new way of doing things. When they do differently, they can realize opportunities, which enable the organizations to build exceptional supply chain business model (Fawcett, Ogden and Ellram, 2007).

It's known that a number of researchers and academics provided a definition to supply chain management. According to Fawcett, Ogden and Ellram (2007), supply chain management enables to meet the real need of customers; they have stated that SCM is the design and management of processes which found as a seamless and value added beyond the organizational boundaries. Collaboration of all members in the intended network has been considered as the new dream of supply chain management; activities and processes in conversion of raw material to finished goods, and then bringing those goods to the market at the right place, at the right price in a timely manner (Stank, Keller and Closs, 2001). Larson and Rogers (1998) defined that the intention of serving the market/customers in consideration with profit through collaboration with vertical integrated firms called supply chain management.

Bowersox, Closs and Stank (1999) defined that supply chain management is collaborative strategy enable to integrate cross functional business operations, which intended to achieve joint market opportunities. According to Kahn and Mentzer (1998), integration is a framework of process, which anticipated to bring major activities and processes of the functional units together, which considered as commonly accepted definition about integration. Cagliano, Caniato and Spina (2006) projected that supply chain integration is concerned with comprehensive collaboration among different business processes of respective functional units within the organization and beyond the organizational boundaries. Therefore, supply chain integration facilitate departments, sections, units and other players of the network interacting each other so as to secure efficient and effective decision making role.

The three mainly acceptable drivers of supply chain integration are demand for information, enlarged global competition which generates a more challenging customer and markets that are demand driven, and the development of relationship among functional units and organizations (Handfield and Nichols, 1999). Fundamental elements required to be integrated are information systems to manage information flows, inventory management to manage inventory/material flows, and relationship management to manage relationship in the supply chain network (Power, 2005). Supply chain as an integration is a process of activities, which bring entire core activities together across the network, design, manage and unify with the intention of making better decisions. Purposefully, integration allows all constructs together in the network in a more efficient and effective manner so as to provide timely, value added, cost effective goods and services into the market so as to address demand driven customer.

Supply chain mainly has two types of integrations, which are internal and external integration. Internal integration is about interaction, relationship and collaboration among the functional units within the organization; and external integration in another way dealt with relationship and collaboration among different business entities and organizations (Paulraj and Chen, 2007). Stank, Keller and Closs, (2001) discussed from the production perspective, supply chain integration framework essential to have smooth and accurate information flows. In order to deal with logistical supply chain, their study include six vital areas in the framework of integrations, these are integration of customer, internal, supplier, planning, technology, measurement/dimensions, and integration of relationship. Writers have commonly classified supply chain integration into collaboration and coordination (Stank, Keller and Closs, 2001). Most of the concepts that differentiate supply chain integration are the presence of flow of material/information/data/knowledge, among the principal firm to its customers and suppliers.

Therefore, researchers obtained about the categorization of supply chain integration, which is internal integration regarding cooperation within the organization, customer integration, which regarded as downstream integration, and finally supplier integration regarded as upstream integration (Flynn, Huo and Zhao, 2010). Based on the given categorization, supply chain integration related activities and processes are managed in two directions, backwards and forward, in other words from the customer and supplier inwards the focal firm.

Addressing supply chain related problems is essential given that all business organization required to have further improvement on its operational performance, which implies that resolving the entire issues warrant the improvement of the performance of the organization. For instance, external resolutions like outsourcing and vendor managed stock commenced to rise. To this effect, organizations understand that collaboration at different levels with its own suppliers and customers could improve the overall performance. A better collaboration with suppliers are highly required so as to reduce cost and improve efficiency and effectiveness, in other hand collaboration with customers enable to have valuable information flow and inward response as a result forecasting, logistics and replenishment can be improved so as to secure shorter lead time and minimum inventories. Certainly, integration is necessary for a successful management of supply chain network.

UKEssays (2018) stated supply chain integration and its importance towards the following results: integration can create monetary values and process optimization; it can amplify information flow and knowledge sharing, secure lowest total processing cost because of integrity and transparency. In addition to the above; integration empower people to manage different organizations both internally and externally; halt functional obstacles and encourages cross functional collaboration, promotes fast inventory flow within the network of the supply chain, improves internal process and quality outcomes. The highest level of cooperation and coordination among the players of the supply chain obtained by the existence of unified collaboration, material management, technology, finance and information flow.

Because of the continuous pressure in the market for innovative solutions in consideration with cost reduction, an integrated supply chain becomes vital to the MRO business, which empower organizations to take competitive advantage over rivals. The MRO business in the aeronautical industry is a complicated procedure that has a firm requirements and safety concerns defined by regulatory bodies and airworthiness authorities to protect the safety of the industry. The MRO defined that procedures and

processes that aimed to keep and reinstate an items or systems at an acceptable standard level intended to perform the defined function (Darli and Paula, 2016).

ERP Solutions Oodles (2019) supply chain in aviation business is mainly required for cost effective operations in which strategies of the supply chain can determine the success of the organization. The supply chain of low performing airline operators are affected by cost leadership strategies, therefore, outsourcing in the MRO business is the major reason that contributes a lion share towards the reduction the profit margins. In the MRO business, major vendors/MROs those have been providing aircraft maintenance programs to the airlines are aggressively challenging lower tier vendors and service providers. In other hand, because of the sensitivity of the industry and the demanding market, MRO businesses expected to grow in the near future.

Supply chain management as one of the management tool identified as the most predominant business strategies in the Airline MRO industry. In today's business environment which faces global competition and technological advancement demands high level of attention towards the MRO business organizations to protect their competitive position in which to maximize profit margins whilst improving internal procedures and processes of business activities. As a result, Aviation MRO be able to consider how to minimize total costs of ownership, shorten turn-around times and assure quality and safety concern.

1.2. Background of the Organization

Ethiopian Airlines referred as Ethiopian or ET is Ethiopia's flag carrier. ET is fully owned by the government of Ethiopia. ET was established on 21 December 1945 and started its operation on 8 April 1946, extended to international flights in 1951. During the past seventy plus years, ET becomes one of the leading operators in Africa. For efficiency and operational success in Africa, ET turning profits for almost all the years of its existence (Ethiopian Fact Sheet, 2018). The business units of Ethiopian Airlines Group are currently seven excluding Ethiopian Airport Enterprise. Ethiopian MRO is one the most valuable business units, and recognized as the most profitable unit. The seven functional divisions in Ethiopian MRO are 1) Engineering & Maintenance Planning, 2) Engine Maintenance, 3) Line Maintenance, 4) Component Maintenance, 5) Base Maintenance, 6) MRO Marketing & Sales, 7) Group

Procurement and Supply Chain Management/PSCM. Most importantly, Group PSCM is a principal department of the Ethiopian Airlines Group which embraces different sections including those dealing with aircraft and non-aircraft related material requirements. Which means the PSCM is a central that has been rendering service across the group, in addition the department structured in a matrix reporting system in which under Chief Financial Officer administratively accountable for non-aircraft related requirements and under Managing Director of Ethiopian MRO functionally accountable for aircraft related requirements.

Specifically, PSCM is responsible for activities involved in Supply Chain Management and from procurement perspective that can be categorized into two: Strategic and Operational/Tactical Procurement. PSCM involved in main activities such as planning, sourcing, quotation or proposal review, supplier selection, acquiring, logistics management, storing/warehousing, maintaining, distributing, contract management and invoice handling.

Ethiopian Airline Group has a fully integrated MRO as one of the business units in which major MRO activities are performed internally. In addition to its mother Airline, the MRO supports other airlines/operators to be competent enough in the global market. The ultimate objective of Ethiopian MRO is about to deliver airframe maintenance services to the entire aircraft types owned by the mother airline (Ethiopian Airlines) and other operators/third part customers with the aim of providing the reliable quality maintenance, cost effective with a short turnaround time. Ethiopian establishes procedure and control methods necessary for timeliness of maintenance activities to keep the turnaround time duration of Ethiopian MRO better than the industry standards. Most importantly, establishes safety and quality as a core value in ET-MRO by giving due attention and immediate action to conditions that may affect the intended safety and quality.

1.3. Statement of the Problem

As a business organization, the most important players that every MRO business must consider are suppliers and customers. Strategic collaborate with suppliers and customers leads the organization to think of supply chain integration so as to take competitive advantage over rivals. On the other side,

lack of supply chain integration has a harmful impact on the operational performance of the organization as well as the effectiveness of the supply chain. The concept regarding supply chain that may generally be accepted is the entire process of the supply chain network is designed, administered and unified as a single organization. In this case, trust is the most important followed by information and technology sharing along with cooperation, partnership and a valuable transformation to manage a collaborative processes has become the groundwork of the integration. Currently, demand for MRO services is increasing and the future seems brighter for a potential growth of the business. At the same time, MRO service providers required to give attention on the undefined business environment, for which organizations needed to develop supply chain integration to fit with volatile business environment in the present day.

In aviation industry, MROs as maintenance organization concerned with operational performance in terms of quality and efficiency of internal process, which can be improved through internal integration; operating costs, which can be minimized through supplier integration; and customer satisfaction, which can be improved through customer integration. MRO cost is 13% of the total operating cost in aviation industry that can be minimized through supply chain activities, such as forecasting, scheduling and material management committed to serve maintenance planning and implementation (Jingyao, 2015). Recently, Ethiopian Airlines Group has been transformed from regional player to the leading operator in the continent by using the strategic plan developed back in 2010. Chris (2016) strategies required to be disseminated internally and understood by everyone at functional level, moreover stated about overarching strategy of the business required to be aligned with functional objectives. In this case, supply chain integration as an ideal management tool used to address the weaknesses and support to reach at strategic objectives of the organizations. Supply chain empowers and creates synergy among functional units of Ethiopian MRO through internal integration, which considered as a foundation of external integrations (supplier and customer integration). As a business unit in Ethiopian Airlines Group, ET-MRO committed to sustain the projected expansion and cost leadership strategies, however a number of long-lasting drawbacks from a different dimension potentially affect the aggregated performance of the MRO. According to monthly activity reports of ET-MRO, the following challenges and operational disruptions have been identified as major problems given those has been reported frequently as a pending issues (Activity report, 2019). These challenges are extended maintenance turnaround time (TAT), irregularity of maintenance schedules, maintenance task deferrals, non-standard maintenance work and rework, inconsistent quality of work, high removal

rate due to premature failure, spare part cost increment, delay in procurement/sourcing process, long lead time and shipment delivery delay at point of consumption, excess inventory at surplus stores, in contrary shortage or missing of materials and tools, late return fee of exchanged components, inaccurate information flow, manual process and incorrect data entries, delay in payables and receivables process, past due payment penalties, lower level of inter-functional relationship and losing potential and cost effective suppliers.

Even if a number of researchers studied in a similar area of supply chain management in Ethiopian Airlines MRO, the problems still existed and believed that it's worthy to make further investigation. The research intended to assess the effect of supply chain integration on operational performance of Ethiopian MRO, therefore, the following research questions forwarded to address the given problems.

1.4. Research Questions

The purpose of the study is to attain the best and valuable answers to the following questions:

1. What is the effect of supplier integration on operational performance at Ethiopian Maintenance, Repair and Overhaul?

2. What is the effect of internal integration on operational performance at Ethiopian Maintenance, Repair and Overhaul?

3. What is the effect of customer integration on operational performance at Ethiopian Maintenance, Repair and Overhaul?

1.5. Research Objectives

The main objective of the study is to examine the effect of supply chain integration on operational performance of Ethiopian Maintenance, Repair and Overhaul. The specific objectives as follows:

1. To examine the effect of supplier integration on operational performance at Ethiopian Maintenance, Repair and Overhaul.
2. To examine the effect of internal integration on operational performance at Ethiopian Maintenance, Repair and Overhaul.
3. To examine the effect of customer integration on operational performance at Ethiopian Maintenance, Repair and Overhaul.

1.6. Significance of the Study

Today, supply chain integration related topics and its effect on organizational performance become the most important issue because of its positive impact on sustainable competitive advantage. The finding of the study can provide constructive information mainly for Ethiopian MRO, functional departments, other business units, stakeholders and decision makers, which enable them to recognize the effect of supply chain integration. In addition, it will be considered as initiative which explores the effect of supply chain integration of Ethiopian MRO towards the intended operational performance. The outcome of the study, most importantly vital for Aviation MRO business. Mainly, the study can be included in current literatures and used as a pathway to future researches through its groundwork of a solid reference of information and applicable publication in the academy.

1.7. Scope of the Study

The scope of the study is limited and carried out in Ethiopian MRO located in Addis Ababa, Ethiopia. The effect of supplier integration, internal integration and customer integration on operational performance of ET-MRO has been assessed and examined. The study is limited and focused on three categories of supply chain integration, which are supplier, internal and customer integration; and not extended beyond the first tiers to analyze the effect. And also the study limits and applied the three dimensions of operational performance only, which are cost, quality and time. The study used the data collected from employees of Ethiopian MRO, not included data from any other sources. The study is not considered other business units in Ethiopian Airlines Group. The research not considered operational interruptions caused by natural and potential man-made disasters, like pandemic, war, civil unrest, strike and other factors, which are not related to supply chain integration under a normal circumstance.

1.8. Limitation of the Study

This study has some potential limitations, among these, the scarce of researches on supply chain integration in Aviation MRO industry, and the limited accessibility of a very recent literatures and research findings that are published in consideration with contemporary business environment. The study has been carried out on Ethiopian MRO in Ethiopian context, so generalizing the results of this organization to other industry and in other countries are questionable. The study used the data gathered from employees working in Ethiopian MRO, the scheduled shift work and current situation COVID19 pandemic affected timely collection of data. Given that data collected from employees of Ethiopian MRO, including other stakeholder in a sample group could end up with different interpretation, in addition generalizing results that has been attained based on employees' perception might be arguable. The study considered three categories of supply chain integration and three dimensions of operational performance only, therefore applying other categories and dimensions along with environmental factors might affect the outcome. The study used the first tier of suppliers and customers in a supply chain network, which means that is not extended beyond the first tiers.

1.9. Definition of Terms

In this study, the following key words and terms has been used:

1. **Supply Chain Management**: Supply Chain Management enable to meet the real need of customers, they stated SCM as the design and management of processes which are seamless and value added beyond the organizational boundaries (Fawcett, Ogden and Ellram, 2007).

2. **Supply Chain Integration**: Chopra and Meindl (2007) stated that supply chain includes the entire players and functional processes that have been participated in receiving and committed in fulfilling customer demand. The activities and processes focus on the interaction among the functional units of the organizations as well as the organization and its suppliers and customers. And they specified that supply chain divided into well accepted categories to create better understanding, which are supplier, internal and customer integrations. According to different scholars, it is generally acknowledged that supply chain integration is one of the most valuable tool to achieve the anticipated performance and competitive advantage.

3. **Supplier Integration (upstream integration)**: Flynn, Huo and Zhao (2010) the process of cooperation and collaboration among the organization and its valuable suppliers, which enable to facilitate resources sharing such as technology, finance, information, knowledge, materials and experiences.

4. **Internal Integration (inside the organization)**: Flynn, Huo and Zhao (2010) explained about internal integration is the level where organizations commitment to arrange its processes, structures and activities towards its objectives and strategic planning with the intention to meet customers' requirements through efficiently and effective cooperation with its suppliers. Authors stressed that internal integration is the baseline of external integration through dedicated relationship with customers and suppliers.

5. **Customer Integration (downstream integration)**: Customer integration is the source of demand related information that enable to forecast the requirement, planning and scheduling activities, which are needed for manufacturing process (Flynn, Huo and Zhao, 2010). They have further explained that customer integration took collaboration with key customers as a core competency to achieve the intended objectives of the organizations.

6. **Operational Performance**: According to Birech (2011), operational performance is a group of procedures and standards used by the organizations to achieve competitive advantage and profitability through customer satisfaction. Operational performance is evaluated by using several parameters and measurements including those related with cost, quality, time/speed, inventory, utilization and productivity.

7. **Cost**: Total cost of ownership or whole life cost and expenses that has been incurred while processing and completing the entire or specific activities of the operation within the network of a certain supply chain intended to meet customer requirements. In general, cost related with MRO, manufacturing, price, value addition and services considered as the measurement of operational performance in terms of cost (Neely and Platts, 2005).

8. **Quality**: According to Juran and Godfery (1998), quality defined as the feature of products which projected to meet customer needs. Quality is simply referred to as fitness for use, customer satisfaction, or conformance to the requirements.

9. **Time**: delivery time is required by the organization so as to provide the required materials or services to the customer within the anticipated period of time. The perceived reliability of the organization and the reliability against competitors regarding the relative on-time delivery, commitment to meet the due dates, progressively improve the delivery performance (White, 1996).

10. **Maintenance Repair and Overhaul (MRO)**: According to Darli and Paula (2016), MRO business in the given aeronautical industry is a complex procedure that has a firm requirements defined by regulatory bodies and airworthiness authorities to assure the safety of the industry. The authors include in their literature that MRO defined as the procedures, which has the objective of keeping

and reinstating an item to the original standard level of requirements. In General, MRO is an organization or business unit in the aviation industry that performs servicing, testing, inspection, repairing, modifying, overhauling of aircraft, engines components, parts and airframe.

1.10. Organization of the Study

This thesis contains five chapters and the first chapter covers the introduction, which includes the background part of the study as well as the organization in which the study took place. Moreover, it includes statement of the problem followed by research questions, research objectives, and finally, the scope, significance and limitations of the study along with definition of key terms are included in the chapter. Chapter two dealt mainly with review of literature and concepts about the subject matters. It has included and discussed conceptual and theoretical issues about supply chain integrations and organizational performance. Empirical studies along with identified literature gaps and conceptual framework of dependent and independent variables are also included in this section. In the third chapter methodology of the research has been discussed, which mainly described the techniques related with sampling, data collection and analysis. Data description, presentation, analysis and interpretation has been included in chapter four, in which statistical techniques such as descriptive statistics and regression analysis has been used. The last chapter includes summary and conclusion along with recommendations of practices and future study.

CHAPTER TWO

LITERATURE REVIEW

2.1. Overview

Even if many authors explained about supply chain integration and organizational performance in a diversified approach, every definition has been linked in line with the features and objective of the study and the industry practice along with the geographical location of the organization. Supply chain integration is a collaboration among the members, which potentially improve the performance of the individual organization. In addition to the theoretical part, this chapter includes literature review of the existing research with regards the effect of supply chain integration on operational performance.

2.2. Theoretical Literature Review

As a thought of business and management, supply chain management specified and defined by different scholars and researchers. According to Fawcett, Ogden & Ellram (2007), Supply Chain Management enable to meet the real need of customers, they stated SCM as the design and management of processes, which found to be a seamless and value added beyond the organizational boundaries. Stank, Keller and Closs (2001) stressed that collaboration of all members in the intended network is considered as the new dream of supply chain management, and activities and processes in conversion of raw material to finished goods, and then bringing those goods to the market at the right place, at the right price in a timely manner. Larson and Rogers (1998) defined supply chain management with the intention of serving the market/customers in consideration with profit through collaboration with vertical integrated firms. According to Bowersox, Closs and Stank (1999), supply chain management is

collaborative strategy enable to integrate cross functional business operations that intended to achieve a joint market opportunity.

In today's business, concepts related with supply chain management transformed all of a sudden in different dimensions. Chopra and Meindal (2007) stated that supply chain includes the entire players and functional processes that have been participated in receiving and committed in fulfilling customer demand. The given functional activities involved in raw material suppliers, manufacturers, inventory and warehouses, logistics, retailer stores and the final customers. The ultimate goal of the supply chain is about to enhance the entire value generated in the network. Supply chain management is considered as a connection used for sourcing of raw materials, scheduling, and manufacturing, generating services, warehousing, distributing and delivering finished goods to the end customers (Wheelen and Hunger, 2012). Krajewski, Ritzman and Malhorta (2013) supply chain is the interconnected activities of processes within an organization from the corner to corner of different firms that manufacture a products or service intended to meet customer satisfaction.

2.2.1. Supply Chain Integration

Due to today's dynamic competition, relationship among the members of the supply chain becomes essential to deal with the competitive market in a contemporary business environment. Krajewski, Ritzman and Malhorta (2013) stated that supply chain integration with regards the actual coordination of supply chain activities and processes through the flow of information within the supply network. Supply chain integration defined as the activities in which members of the network working in a cooperation manner to achieve the common goal intended to provide value added product or services with a possible minimum cost.

In this study, supply chain integration defined in consideration with collaboration with whole players in the supply chain network participated to design and manage activities enable to secure efficient flow of materials, finance, technology and information so as to provide value added products and services to the end customer with the right quality, at the right time in a cost effective manner. As discussed above, supply chain integration majorly constructed in having supplier and internal

integration along with customer integration. According to Chopra and Meindl (2007), supply chain management divided into the following well accepted categories to create better understanding:

1. **Supplier Integration**: activities and processes focus on the interaction among the organization and its suppliers called supplier integration.
2. **Internal Integration**: activities and process focus on the interaction among functional units of internal operations within the organizations called internal integration.
3. **Customer Integration**: activities and processes focus on the interaction among the organizations and its customers called customer integration.

In order to secure competitive advantage over rivals in today's business environment, strategic thinking is mandatory due to the dynamic nature of the actual market. The performance of the supply chain network directed to the performance of the organization. Therefore, the organizations whatever they are profitable started to implement the idea of supply chain, and the range enable to manage the relationship in the supply chain network. Unlike the previous concept about organizations were focusing lonely and managing their internal processes and activities towards their individual goals which were exemplified by its profitability and customer satisfaction.

Many study and academic papers have been written about supply chain management and the benefit of its categorical elements. According to Vaidya and Hudnurkar (2012), multiple criteria for supply chain performance has been explored in their international journal. These criteria include quality, innovative activities, cost, supplier management, customer service, time, asset management and flexibility along with the degree of collaboration. Zhao, Huo and Zhao (2013) examined based on their international journal that the effect of the integration and related risk within the supply chain network along with company performance in sustaining competitive advantage.

2.2.1.1. Supplier Integration (Upstream Integration)

Suppliers considered as the source of inputs such as raw materials, components, parts, tools, information and other services required for the operation of the organization, they have vital role in the transformation process which aimed to provide value added products/services to the end customer.

Currently, organizations likely to collaborate with their suppliers so as to manage dynamic customer expectation in having cost effective quality products/services in a timely manner. Mostly, suppliers involved in the designing stage of products and operations to facilitate the manufacturing and maintenance process to secure strong supply chain network in which intended to provide value added products/services to the end customer. Stank, Keller and Closs, (2001) examined about supplier integration through the examination that deals with relationship among the focal firms and its suppliers. Supplier integration enable to secure coordination with critical suppliers considered as core competencies. Accordingly, supplier integration is the process of cooperation between supplier and the organization that facilitates sharing of information, knowledge, finance, materials, technology and experiences (Flynn, Huo and Zhao, 2010).

2.2.1.2. Internal Integration (Within the Organization)

Internal integration is the center where external supply chain players (suppliers and customers) attracted to develop a relationship. It has been considered as the way that can maintain stability and continuity of all parties in the supply chain network. Thus, the organization could collaborate neither with supplier nor customer without appropriate internal integration. Journal of Operations Management highlighted about internal integration, and determined that customer and supplier integrations depends on the dedication of internal integration. The structure, procedures, processes and activities of the organization streamlined and integrated with the intention to meet customer requirements (Zhao et al., 2011).

The intended goals derived from vision, mission and objectives of all functional units and departments of the organization correlated to build the proper supply chain strategy. In the presence of such consent, each functional unit considers to have both internal and external customers. The external customers are the major customer determine the existence of the organization, and the internal customers are operational units the one depend on the other so as to achieve the intended objectives of the organization. Internal integration is the level where organizations commitment to arrange its processes, structures and activities towards its strategic plan and objectives with the intention to meet

customers' requirements through efficiently and effective cooperation with its suppliers (Flynn, Huo and Zhao, 2010).

2.2.1.3. Customer Integration (Downstream Integration)

Customers considered as the most valuable that can assure existence and success of the organizations projected to provide whether products or services. Any organization intended to grow or survive in such volatile market with the presence of strong competitions, required to strength relationship with customers. In the meantime, the organizations must take macro-environmental forces in to consideration and control proactively so as to take competitive advantage over rival through customer satisfaction. To this effect, relationship management is vital element in supply chain. A lot of researchers defined and discussed about customer integration. Customer integration took collaboration with key customers as a core competency to achieve the intended objectives of the organizations (Flynn, Huo and Zhao, 2010). The international journal stated that both supplier and customer integration can be classified as external integration. Customer integration activities include sharing of suggestions and feedback; sharing of knowledge and experiences; and sharing of products and services with customers (Huo, 2012).

2.2.2. Operational Performance

The concept of supply chain and operational performance has been developed from the long term objectives of the supply chain according to the ultimate business strategies of the organizations. Companies, which are enthusiasm towards success required to fit with the anticipated competitive tactic derived from strategies of the supply network. From a different perspective, researchers and academicians examined the performance of supply chain. Gimenez, Vaart, and Donk (2011) examined in their international journal profits, speed/delivery and transportation costs considered as the measurement of the performance. Operational performance examined in different international journals.

Vanichchinchai (2014) investigated company's supply performance that is a composition of flexibility, cost, relationship, quality and efficiency. According to Wheelen and Hunger (2012), organizational performance highly affected by resources involved in a supply network.

According to international journal, the parameters of performance evaluation are cost, human capital, customer service, productivity, quality, innovation, time, adaptability, capability of collaboration, supplier management, and marketing methods (Vaidya and Hudnurkar, 2012). The research considers the operational performance as group of procedures and standards used by the organizations to achieve competitive advantage and profitability as a result of customer satisfaction. Operational performance is evaluated by using several parameters and measurements including those related with cost, quality, time/speed, inventory, utilization and productivity (Birech, 2011). This is therefore, Time, Quality and Cost are appropriate performance measurements for MRO, which have been considered as the most commonly used dimensions of operational performance (Aitken, Christopher and Towill, 2002).

2.2.2.1. Cost

Total cost of ownership or whole life cost and expenses that has been incurred while processing and completing the entire or specific activities of the operation within the network of a certain supply chain intended to meet customer requirements. According to Neely and Platts (2005), performance measured by costs related with manufacturing, value adding, selling, running and services. Well-structured and coordinated resources can benefit the organizations as well as the supply chain in consideration with the way how to minimize wastage and/or costs.

2.2.2.2. Quality

Juran and Godfery (1998) explained about quality that is the feature of the products anticipated to ensure customer satisfaction. Quality is simply referred to as fitness for use, customer satisfaction, or conformance to the requirements. The study stressed that quality is about the degree to which supply chain integration meets customer requirements. Quality begin with the life of the commodity, the degree to which intended to meet the requirement (ISO 9000). Well-structured and coordinated resources can determine the quality of products or services of the organization/supply chain.

2.2.2.3. Time (Speed)

Every business organization require efficient delivery time, which enhance its performance that enable to provide the right product or services to the customer within the intended period of time. White (1996) stated that the perceived reliability of the organization and the reliability against competitors regarding the relative on-time delivery, commitment to meet the due dates, progressively improve the delivery performance. Gimenez, Vaart, and Donk (2011) well-defined in their international journal that lead time, as the time needed by the customer or organization so as to deliver the required products or services. Well-structured and coordinated resources of the organization/supply chain can provide required products or services in a timely manner.

2.3. Review of Empirical Studies

Most of the empirical studies investigated supply chain integration towards operational performances, while others were discussed intermediating elements that impact the supply chain integration of an organizations in a different industry.

2.3.1. Supply Chain Integration on Operational Performance

Frohlich and Westbrook (2001) studied the arc of supplier and customer integration, focused on operational performance, which shall be affected by order variance reduction, fast material flow and eliminating waste and non-value adding processes. Rosenzweig, Roth and Jr (2002) investigated the degree of supply chain integration measured by its competitiveness and the intended business performance of the organization. The study stressed, supply chain integration is the process of cooperation, which enables all members of the supply chain working together in an integrated way to achieve a common result.

Devaraj, Wei and Krajewski (2007) investigated the impact of technological (e-Business) on operational performance, which mainly focused on information integration related with production in the supply network. The study is about the role of technology on operational performance and found that the efficiency and effectiveness of information technology towards supply chain integration: supplier integration and customer integration. Fawcett, Magnan and Brau (2007) stated the role of willingness and relationship examined by the performance of supply chain through information sharing. The study intended to consider that enhance supply chain performance through information technology. The study reviewed and found that organizational performance affected by information sharing in a supply network.

Zedekia (2008) titled supply chain performance measurement in aviation industry, carried out in Kenya Airways LTD, aimed to develop measurements of supply chain performance used to identify related challenges. The study recognized measurements of effective supply chain performance, which are internal and external factors can be addressed through improved communication and consultation. Zelbst, Jr and Sower (2009) investigated the effect of supply chain bondage on supply chain performance, and also assessed the linkage and its relationship with supply chain performance. The study found that operational performance affected by supply chain integration, these are internal integration, strategic integration and external integration.

According to Huo (2012), the influence of supply chain integration towards the performance of the organizations. Based on the capability of the organization, drive to investigate the impact of the three categories of supply chain integration, which are internal, supplier, and customer integration towards the three constructs of organizational performance. The study found that external integration improved

by internal integration, consequently, the organization's performance boosted by internal and external integration. Zhang and Huo (2012) examined the impact of trust and reliance on supply chain integration, which intended to inspect the mutual influence of trust and reliance on relationships across the supply chain. The study found that supply chain integration influenced by trust with customers/suppliers. And financial performance of the organization improved by both supplier integration and customer integration.

According to Hamad (2013), the effect of supply chain integration on the organizational performance, and the role of environmental instability has been investigated. The study intended to analyze the impact of supply chain integration on organizational performance. Zhao, Huo and Zhao (2013) examined the effect of the integration and related risk within the supply network along with company performance in sustaining competitive advantage. The study identified risks in the supply chain, which are negatively related with supply chain integration. In other hand, supplier, internal and customer integration affects the ultimate goal of the organization, which are customer satisfaction and competitiveness. Andinet (2018) investigated about reliability of the flight dispatch affected by MRO, supply chain integration and inventory management. The study found that cross functional integration within Ethiopian MRO and external integration beyond organizational boundary with suppliers have been found critical so as to achieve the overall performance of Ethiopian MRO.

2.3.2. Supplier Integration on Operational Performance

Peterson, Handfield and Ragatz (2005) studied about supplier integration towards product development, which is about early coordination with suppliers for product related activities and process design. The study is about suppliers' involvement in a product development stage. The study deals with early stage of supplier involvement has a positive impact on new product development, which improves return on investment/operational performance. Based on Forslund and Jonson (2009), difficulties of supply chain integration towards the activities of performance management in buyer-to-supplier has been examined. The study aimed that to what extent supply chain integration of the performance management activities affected, difficulties in supplier relationship and other operational tool. Moreover, the study addressed that integration of performance management process highly hindered by challenges of supplier relationship management.

Gimenez, Vaart, and Donk (2011) studied supply chain integration and managing performance, which is about the adaptable effect of supply complications, committed to examine the effectiveness and efficiency of supply chain integration in a diverse perspective. It has been found that supply chain integration lead to increase performance even if supply complexity became high and the vise-versa. Zhang and Huo (2012) examined the impact of trust and reliance on supply chain integration, which intended to inspect the mutual influence of trust and reliance on relationships across the supply chain. The study found that supply chain integration influenced by trust with customers/suppliers. And, financial performance of the organization improved by both supplier integration and customer integration.

Alam et al. (2014) titled that the arbitrating impact of logistical integration on the performance of the supply chain. And finally determined that integration in logistics has a vital influence on the performance of the supply chain. The study found that logistics integration had a significant effect on operational performance as well significant effect on supplier integration, which is about the extent of supplier relationship and automated technology on operational performance. Asrat (2017) investigated the role of strategic sourcing towards the organizational performance of Ethiopian Airlines MRO. The study determined that the coherent of supply base highly affects the operational performance, and followed by contract and supplier relationship management.

2.3.3. Internal Integration on Operational Performance

Kim (2006) examined the effect of supply chain integration towards the alignment between the capabilities of the supply chain performance and corporate competitiveness. The study investigated to identify the relationship between the ability of corporate competitiveness and operational supply chain. Moreover, the study examined the effect of supply chain integration on performance improvements, which is incomparable with the effect of the interface between operational capability and corporate competitiveness. Devaraj, Wei and Krajewski (2007) study about operational performance which might be affected by e-Business/e-commerce technologies. The study stressed that the role of feedback in having production information in the supply network. The study investigated the role of technology on operational performance, consequently find out the efficiency and effectiveness of information technology towards supply chain integration: supplier integration and customer integration.

Vanichchinchai (2014) titled that supply chain management and total quality management intended to measure the level of supply chain management practices in a given organization. In order to achieve higher level of supply chain performance, organization need to adopt activities related with supply chain management and total quality management. Zhao et al. (2011) highlighted about internal integration, and determined that customer and supplier integrations depends on the dedication of internal integration. The study focus on structure, procedures, processes and activities of the organization streamlined and integrated with the intention to meet customer requirements.

Charenet (2018) examined the role of implementation of achieving competitive excellence/ACE as an operating system on the Airline internal supply chain integration. The study implied that a better understanding towards the roles of achieving competitive excellence/ACE as the operating tool on the internal supply chain integration of Ethiopian Airlines.

2.3.4. Customer Integration on Operational Performance

Jr, Whitten and Inman (2008) examined the development of supply chain marketing as a primary concept and organizational performance secured by alignment of marketing strategies throughout the supply chain enable to extend towards the organizational performance. The study found that aligning marketing strategies of all players in a supply chain improves operational performance, and improve organizational performance of individual organization in a supply chain.

Cirtita and Segura (2012) titled measuring downstream operational performance, which intended to determine the performance metric systems will improve inter-firm performance. The study concluded that downstream supply chain integration positively affects operational performance of the firm. Zhang and Huo (2012) examined the impact of trust and reliance on supply chain integration, which intended to inspect the mutual influence of trust and reliance on relationships across the supply network. The study found that supply chain integration influenced by trust with customers/suppliers. And, financial performance of the organization improved by both customers and key suppliers' integration.

Even though different researchers examined the relationship between supply chain integration and operational performance from the different point of view in different organizations, the scarce of similar study in Aviation MRO industry has been observed.

2.4. Summary of the Literature Review and Research Gaps

The researcher has reviewed several studies, among these Frohlich and Westbrook (2001) studied the arc of supplier and customer integration, focused on operational performance, which shall be affected by order variance reduction, fast material flow and eliminating waste and non-value adding processes, but the study not discussed in detail about the effect of inter-functional integration on operational performance. Rosenzweig, Roth and Jr (2002) investigated the degree of supply chain integration measured by its competitiveness and the intended business performance of the organization. The study stressed, supply chain integration is the process of cooperation, which demands all members of the supply chain working together in an integrated way to achieve a common result. But the study is not discussed about the three categories of supply chain integration rather examined supply chain integration as an individual variable.

Peterson, Handfield and Ragatz (2005) studied about supplier integration towards product development, which is about early coordination with suppliers for product related activities and process design. The study focus on suppliers' involvement in product development stage but not included the role of internal and customer integration on operational performance. Kim (2006) examined the effect of supply chain integration towards the alignment between the capabilities of the supply chain performance and corporate competitive, the study identified the relationship between the competency of corporate competitiveness and operational supply chain.

Devaraj, Wei and Krajewski (2007) investigated the impact of technological (e-Business) on operational performance, which mainly focused on integration of information related with production in the supply network. The study examined the role of information and technology towards operational performance, identified that the efficiency and effectiveness of information technology towards supply chain integration: supplier integration and customer integration towards production information in place of internal integration.

Fawcett, Magnan and Brau (2007) studied the role of willingness and relationship examined by the performance of supply chain through information sharing. The study intended to consider that enhance supply chain performance through information technology. The study reviewed and found that

organizational performance affected by information sharing in a supply network, but failed to include resources other than information involved in supply chain performance. Zedekia (2008) examined supply chain performance measurement in the aviation industry. The study focus on the Airline as an operator, which is not about MRO, in addition it's not include operational performance rather focus on challenges encountered in supply chain performance measurement.

Jr, Whitten and Inman (2008) examined the development of supply chain marketing as a primary concept and organizational performance secured by alignment of marketing strategies throughout the supply chain enable to extend towards the organizational performance. The study found that aligning marketing strategies of all players in a supply chain improves operational performance, and improve organizational performance of individual organization in a supply chain., but the study not include the elements of supply chain integration toward operational performance.

According to Forslund and Jonson (2009), obstacles related with supply chain integration towards the activities of performance management in buyer-to-supplier has been examined. The study focus on difficulties of supply chain integration, communication and supplier relationship but not include the effect of major categories of supply chain integrations on operational performance.

Zelbst, Jr and Sower (2009) examined the effect of supply chain bondage on supply chain performance, and also assessed the linkage and its relationship with supply chain performance. The study found that operational performance affected by supply chain integration, these are internal integration, strategic integration and external integration. The intention of the research aimed at discovering the effect of supply chain integration on organization operational performance but not studied in Aviation industry. Gimenez, Vaart, and Donk (2011) examined supply chain integration and managing performance, which is about the adaptable effect of supply complications, committed to examine the effectiveness and efficiency of supply chain integration in a diverse perspective. The study found that supply chain integration lead to increase performance even if supply complexity became high and the vise-versa, but the study not focus on internal and customer integration.

Cirtita and Segura (2012) titled measuring downstream operational performance, which intended to determine the performance metric systems will improve inter-firm performance. The study concluded that downstream supply chain integration positively affects operational performance of the firm, but not focus on upstream and internal integration for operational performance.

Huo (2012) examined supply chain integration towards the performance of the organizations. Based on the capability of the organization, drive to investigate the impact of the three categories of supply chain integration, which are internal, supplier, and customer integration towards the three constructs of organizational performance. The study found that external integration improved by internal integration, in other hand the organization's performance boosted by internal and external integration. But, the study only focus on operational performance in terms of financial dimension and not studied in Aviation industry.

Zhang and Huo (2012) examined the impact of trust and reliance on supply chain integration, which intended to inspect the mutual influence of trust and reliance on relationships across the supply network but not focus on internal integration and the major dimensions of operational performance. According to Hamad (2013), the impact of supply chain integration towards organizational performance, and the role of environmental instability has been investigated. The study intended to analyze the impact of supply chain integration on organizational performance but not studied in aviation industry.

Zhao, Huo and Zhao (2013) examined the effect of the integration and related risk within the supply network along with company performance in sustaining competitive advantage. However not studied in aviation industry, the study identified risks in the supply chain, which are negatively related with supply chain integration. In other hand, supplier, internal and customer integration affects the ultimate goal of the organization, which are customer satisfaction and competitiveness. According to

Alam et al. (2014), the arbitrating impact of logistical integration on the performance of the supply chain. And finally determined that integration in logistics has a vital influence on the performance of the supply chain, but the study not included categories and dimensions of supply chain integrations and operational performance. Vanichchinchai, (2014) examined supply chain management and total quality management intended to measure the level of supply chain management practices in a given organization. In order to achieve higher level of supply chain performance, organization need to adopt activities related with supply chain management and total quality management, but the study not include the overall dimensions of operational performance.

Asrat (2017) examined the role of strategic sourcing towards the organizational performance of Ethiopian Airlines MRO. The study determined that the coherent of supply base heavily affects the

operational performance, and followed by contract and supplier relationship management, but the study did not include categories of supply chain integrations towards operational performance. Andinet (2018) examined about reliability of the flight dispatch affected by MRO, supply chain integration and inventory management. The study found that internal cross functional integration within Ethiopian MRO and the external beyond organizational boundary integration with suppliers is critical so as to achieve the overall performance of Ethiopian MRO. The study focus on operational performance of the airline as an operator but not focus on the MRO business, in addition the study failed to indicate category of supply chain integrations.

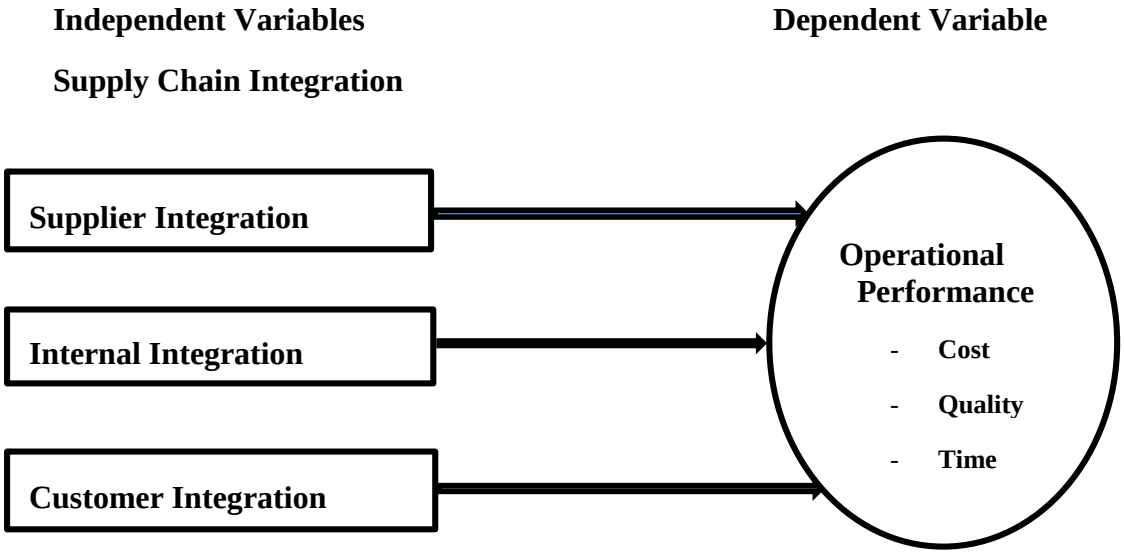
Charenet (2018) examined the role of implementation of achieving competitive excellence/ACE as an operating system on the Airline internal supply chain integration. The study found that implied that a better understanding towards the roles of achieving competitive excellence/ACE as the operating tool on the internal supply chain integration of Ethiopian Airlines. The study focus on the roles of the operating tool on the company's internal supply chain integration, but not focus on other dimensions of inter-functional integration.

Furthermore, studies those were done in the case of Ethiopian Airlines operational performance were not included major categories of supply chain integration towards the performance of Ethiopian MRO; instead focused on strategic sourcing, SCM integration on Airline performance, material planning and others. To this effect, it has to be well-intentioned to study the connection between supply chain integration and operational performance of Ethiopian MRO. Therefore, this research has been committed to discover the effect of supply chain integration in Ethiopian MRO towards its operational performance.

2.5. Conceptual Framework of the Study

According to Chopra and Meindl (2007), Supplier Integration, Internal Integration & Customer Integration as an independent variable. The three important dimension of operational performance are Time, Cost and Quality used as dependent variable (Aitken, Christopher and Towill, 2002).

Figure 1: Conceptual Framework of the Study



Source: adapted from Daniel A. and Shambachew O. (2015).

CHAPTER THREE

RESEARCH METHODOLOGY

The study made an effort to investigate the effect of supply chain integration on operational performance in Ethiopian MRO. This chapter has presented the research methodology to achieve the given research objective. In this section, research approach and design, population of the study, sampling techniques, sampling design, sample size, data collection method, validity and reliability test are discussed. And finally, ethical considerations and data analysis and presentation method are presented.

3.1. Research Approach

The research approach handled based on the research questions and objectives. In order to gather and analyze the data, the study used both questionnaires and interview in the form of quantitative and qualitative approach. Therefore, the study applied mixed approach and considered Ethiopian MRO as a case company and intended to investigate the effect of supply chain integration practice in the MRO on its operational performance, and to present the result for the analysis.

3.2. Research Design

Research design is the proposal and structure of investigation intended to find answers to the research questions, which includes procedures and methods employed to collect, discuss and analyze the data, presenting the findings in an acceptable arrangement (Mugenda, OM and Mugenda, AG, 2003). The study used both descriptive and explanatory research design. Descriptive research design applied to describe and discuss the findings by using descriptive statistics, such as mean, standard deviation and percentage distribution. And, the explanatory research design used to address research objectives and

that examined the cause and effect relationship among variables of supply chain integration and operational performance of Ethiopian MRO.

3.3. Research Population and Sampling

3.3.1. Population and Sampling Frame

A population is the whole set of individuals or objects with commonly noticeable characteristics. This study focus on Ethiopian MRO as a business unit; and departments, sections, specifically managers and directors, and also team in the departments like Procurement and Supply Chain Management (PSCM) and MRO Marketing & Sales. In Ethiopian Airlines/MRO, most of the teams have an exposure towards supply chain activities enable them to be the right sources of research information. Regarding MRO Marketing & Sales, they have exposure that directly working with different customers of Ethiopian MRO. As an operational organization, directors and managers of Ethiopian MRO are responsible for the performance of their respective departments and sections. In addition, they have been handling assignments in coordination with PSCM and MRO Marketing & Sales, and monitoring the performance of the MRO. It is obvious that the role of the team under managerial position has been handling transactional tasks. They have less administrative role and might not be involved in the strategic issues of the MRO. That is why 42 Managers and Directors of departments/sections in Ethiopian MRO, 214 employees of PSCM, 15 employees of MRO Marketing & Sales accepted as valid population targeted for the study in order to address research objectives. Therefore, target population in total is 271 employees from PSCM, MRO Marketing & Sales and MRO's Director and Managers (N=271). In this study, target population is the **sampling frame** of the research which is 271 (N=271) obtained from the list of employees working in Ethiopian MRO including PSCM and MRO Marketing & Sales.

3.3.2. Sample Design

Sampling design involves selecting a group from the targeted population in which a researcher draws conclusion about the whole population. Sample might be drawn in different ways, which depends on the character of the population and the information expected from sampling (Schreuder, Gregoire and Wood, 1993). Purposive sampling design, which is an informant selection tool has been used extensively. In other word, judgement sampling is purposive sampling that deals with the deliberate choice of an informant based on its qualities possesses. In this study, the researcher used purposive sampling design that has been selected respondents who have direct exposure and more concerned with PSCM, MRO Marketing & Sales and MRO operation; in general, helped to get supportive data for the study.

3.3.3. Sample Size

In this study, departments such as MRO Marketing & Sales, PSCM, Managers and Directors of the MRO selected as target population. Therefore, sampling has been applied for the study to focus on target population by using Taro Yamane's formula. According to Yemane, (1967), the simplified formula which helps to calculate sample size as follows:

$$\mathbf{n = N / [1+N(e)^2]}$$

Where:

n = Sample size, N = Population size, e = Margin of error

Table 3.1: Sample Size Determination

Departments	Population	Sample
PSCM	214	139
MRO Marketing & Sales	15	14
MRO Managers and Directors	42	38
Total	**271**	**191**

Source: Own Survey Finding, 2020

Based on table 3.1, the researcher approached 191 respondents from the total 271 population size.

3.4. Data Collection Method

The procedure employed to collect data has been impacted by research instruments used to proceed (Kombo and Tromp, 2006). Once research problem and design well-defined, data collection process shall begin (Kothari, 2004).

The research procedure has been started by carrying out a pilot test and some questioners has been directly used from the previous related studies. It's know that pilot test is required to refine the questionnaire survey with the purpose of avoiding difficulties which respondents may face in answering the questions. It has been done on ten respondents from the target population, and helped in ensuring that the information gathered became reliable and valid. In addition, it helps to manage the data collection process with respondents hence reducing ambiguity. The questionnaires have been administered personally to the respondents after explaining the purpose of the research to them and how their sincerity would be important to the study.

In this research, primary data has been used for analysis, and data collected through questionnaire surveys and semi-structured interview. Semi-structured interview employed with a total of four directors from Ethiopian MRO for a total duration ranging between 20 to 40 minutes individually in their facility at their convenience time. Questionnaire surveys distributed to the purposive respondents at their

working offices. In order to give a room for the respondent to dedicate sufficient time to fill the questionnaire as per the allocated time of three days, the drop-and-pick-later method has been adopted.

3.5. Data Analysis Methods

According to Kombo and Tromp (2006), data analysis intended to prepare required data for description and presentation according to statistical inference. In this study, data has been analyzed, interpreted and discussed by using applicable statistical techniques for which analytic tool STATA has been used. Descriptive statistics such as frequency, percentage distribution, mean and standard deviation used to summarize the data into a meaningful form. Moreover, multiple-linear regression has been applied to analyze the cause and effect relationship among dependent and independent variables. Prior to proceeding with multiple regression analysis, tests of assumptions such as normality, multi-collinearity, linearity and heteroscedasticity or homoscedasticity of residuals have been applied in this study. Cooper & Schindler (2006) stated that regression is conducted to analyze the nature and strength of relationship among each of the independent and dependent variables. The study applied multiple linear regression model specified based on dependent variable (operational performance) and independent variables (categories of supply chain integration) so as to address the objective of the study.

Multiple linear regression model of the study: $Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3$

Where: Y: Operational performance, β: coefficients of independent variables, X1: Supplier integration, X2: Internal integration, X3: Customer integration.

3.6. Validity and Reliability Test

The quality of the research has evaluated by using its reliability and validity test. The study used standard survey questionnaire that was developed in a previous related studies and also the questionnaire items designed and identified during the review of the literatures.

Validity of the Research:

In research, issues of validity are the basis up on which the worthiness of the findings of the study can be determined (Creswell, 2003). Tharenou and Lamp (2007) internal validity implies data triangulation through the use of multiple sources and methods provide better result. Therefore, the findings are accurate, valid and conclude to the participant of the study. In other hand, external validity is related to the extent to which the findings from one research can be applied to other similar (Leedy and Ormrod, 2005). In order to assess validity of this research, experts mainly from procurement and supply chain management, operations and MRO marketing have been evaluated the questions. Accordingly, the content was revised based on the feedback from those experts collected through a focus group discussion. Therefore, the researcher believed that the methods employed in this study and sources used for data collection provided sufficient information about the problem; and also the findings obtained in this study can be transferable and tested to other similar situations in the MRO.

Reliability of the research:

Reliability, essentially means consistent or dependable results (Grad, 2011). Reliability meant the extent to which a measurement procedure yields the same result if, when repeated, using the same methods in a similar condition. The researcher checked that this study is reliable since the respondents have been participated based on their consent. In order to assure the reliability and validity of the questionnaires, pilot test was conducted in advance. The reliability of the questionnaire has been analyzed by using Cronbach's alpha statistics. According to George and Mallery (2003), internal consistency can be described by a commonly accepted rule of thumb.

Table 3.2: Reliability Test

Variables	No. of Items	Cronbach's alpha
Supplier Integration	5	0.8568
Internal Integration	5	0.9202
Customer Integration	5	0.7664
Cost	7	0.8273
Quality	5	0.9284
Time	6	0.9044

Source: Own Survey Finding, 2020

In reference to table 3.2 reliability test, the value of Cronbach's Alpha coefficient for independent variables is between for 0.7664 and 0.9202, and for the dependent variables ranging from 0.8273 to 0.9284; which implies that the survey questionnaire is acceptable since Cronbach's Alpha coefficient is greater than 0.70 which stated as the marginal value. As a result of reliability test, Cronbach's Alpha coefficient value is reliable and acceptable.

3.7. Test of Assumptions/Diagnosis Tests

The following test diagnosis tests required to be fulfilled prior to proceeding with multiple regression analysis. These are normality, multi-collinearity, linearity and heteroscedasticity or homoscedasticity of residuals.

1. Normality

Normality/Multivariate normality is one of the assumptions can be confirmed by inspecting the data set to be normally distributed. In this study, Skewness/Kurtosis tests for Normality has been used based on the residual data instead of the raw data (multiple variables). N.B. residual data is derived from the regression model, which has been estimated in order to generate residuals.

Table 3.3: Normality Test (Skewness/Kurtosis tests for Normality)

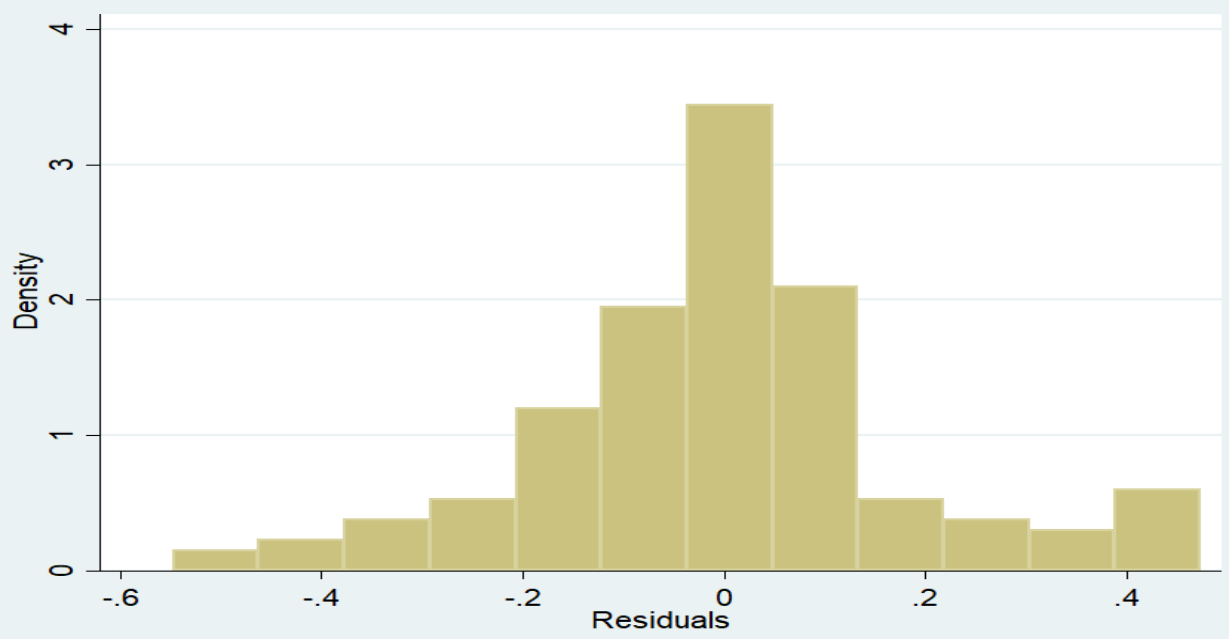
Variable	Observation	Pr(Skewness)	Pr(Kurtosis)	-------- Joint --------	
				Adj chi2(2)	Prob>chi2
Residuals	157	0.3149	0.0549	4.7700	0.0923

Source: Own Survey Result, 2020

In reference to table 4.11, probability of Skewness and Kurtosis are 0.3149 and 0.0549 respectively, that means both of them are greater than 0.05 (p>0.05), in addition chi2 (0.0923) is greater than 0.05 shows its significance. Therefore, residuals of the regression model according to Skewness/Kurtosis tests are normally distribution.

In addition, normality can be illuminated by using histogram as indicated below (fig. 2).

Figure 2: Normality Test (Histogram, Residuals)



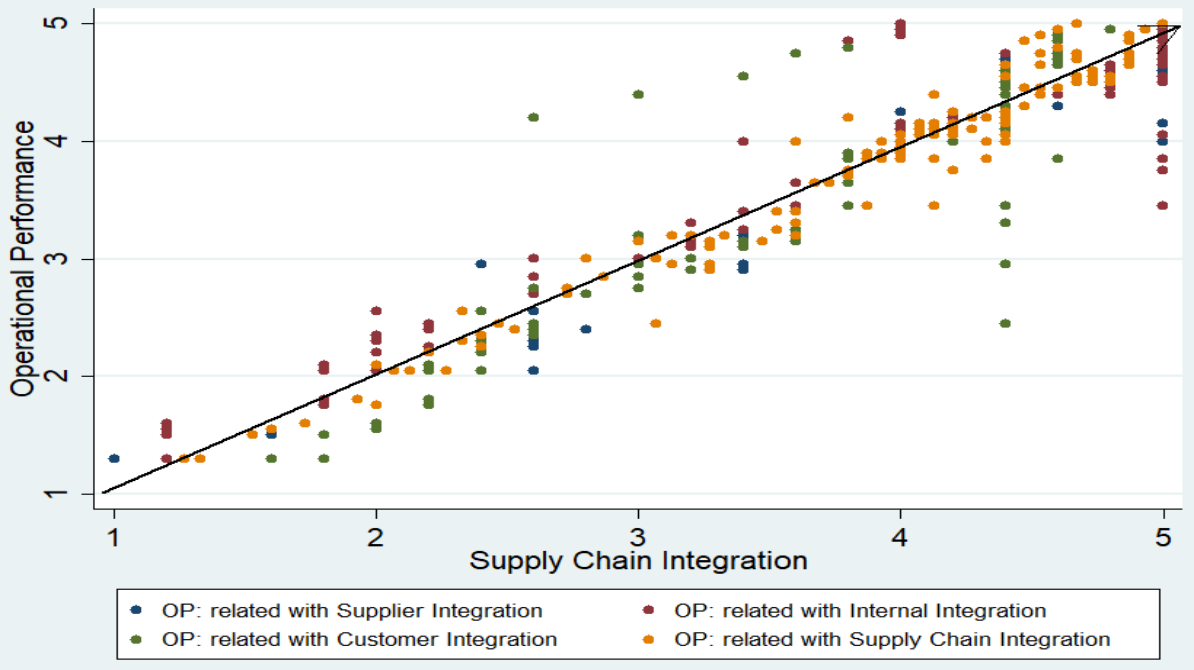
Source: Own Survey Result, 2020

Figure 2 shows normal distribution of the residuals/errors.

2. Linearity

Linearity is one of the assumptions can be confirmed by relationship between dependent and independent variables. The scatterplots are the best way to test the assumption of linearity, which indicated in figure 3.

Figure 3: Linearity Test (Variables of Supply Chain Integration and Operational Performance)



Source: Own Survey Result, 2020

Figure 2 shows almost a linear relationship:

1. Dependent variable (Operational Performance) with each of the independent variables (Supplier Integration, Internal Integration and Customer Integration).
2. Dependent variable (Operational Performance) with aggregated independent variables (Supply Chain Integration).

Table 3.4: Analysis of Variance (ANOVA)

Model	R	R-Square	Adjusted R^2	Sig.
1	0.9774	0.9560	0.9551	0.0000

Dependent Variable: Operational Performance

Source: Own Survey Result, 2020

In reference to table 4.12, the detail shows that significance relationship between operational performance and variables of supply chain integrations since R^2 0.9551, Sig. 0.000. This implies the categories of supply chain integration have a direct effect on operational performance of Ethiopian MRO.

3. Multi-collinearity

Multi-collinearity is the assumption employed to confirm the degree of collinearity when more than two variables in a regression analysis are correlated. In this case, the assumption is to confirm that there is no high level of correlation among independent variables. The linear combination of one another has been defined by using the value of Variance Inflation Factor (VIF).

Table 3.5: Multi-collinearity Test (Variance Inflation Factor, VIF)

Variable	VIF	1/VIF
Supplier Integration	6.42	0.15583
Internal Integration	7.27	0.13762
Customer Integration	4.31	0.23186
Mean VIF	**6.00**	

Source: Own Survey Result, 2020

In reference to table 4.13, the detail shows that VIF value of all independent variables are less than 10, which implies there is no multi-collinearity related problem.

4. Heteroscedasticity

Heteroscedasticity is one of the major assumption applied to test whether the residuals are homogenous or not.

Table 3.6: Heteroscedasticity Test (Breusch-Pagan/Cook-Weisberg test for Heteroscedasticity)

Variables: fitted values of Y		Variables: X1 X2 X3	
Chi-Square	**Prob>chi3**	**F(3, 153)**	**Prob > F**
3.20	0.0737	1.59	0.1948

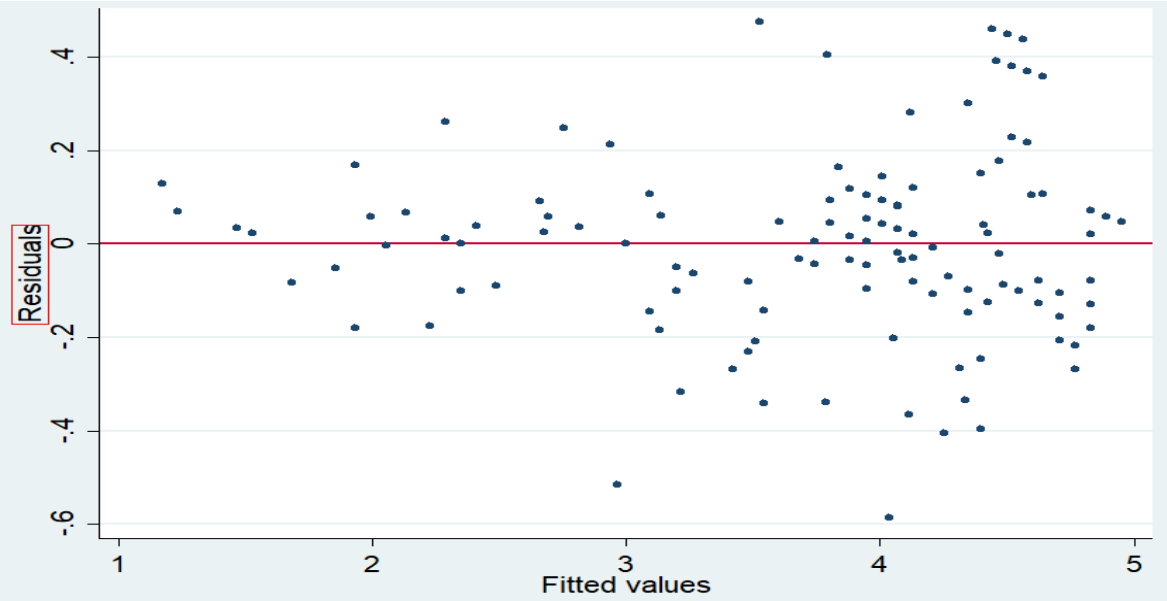
Source: Own Survey Result, 2020

Y: Operational Performance, X1: Supplier Integration, X2: Internal Integration, X3: Customer Integration

In reference to table 4.14, the detail shows P value in both cases greater than 0.05 (p = 0.0737 and 0.1948), which implies that there is no heteroscedasticity problem.

In other hand, heteroscedasticity can be explained by using scatter plots (refer figure 4).

Figure 4: Heteroscedasticity Test (Residuals)



Source: Own Survey Result, 2020

Figure 2 shows that there is no heteroscedasticity problem in the data.

3.8. Ethical Considerations

According to Leedy and Ormrod (2005), the principle of informed consent require that respondents are not to be forced to participate in research. In this study, the participants informed about the purpose of the study and their participation to be in a voluntary basis. In addition, responses to the questions treated with extreme confidentiality and privacy as they have been used solely for the study. Finally, to avoid possibility of plagiarism, the researcher acknowledged that all materials, literatures and other studies have been referred and quoted as required.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1. Introduction

To recall that the objective of this study is to examine the effect of supply chain integration on operational performance in Ethiopian MRO. In this chapter, all the data collected and gathered through questionnaire and interviews are interpreted, analyzed and discussed according to the given objectives and theoretical aspects. The findings are analyzed, discussed and interpreted by using descriptive statistics such as frequency, percentage distribution, mean and standard deviation used to summarize the data into a meaningful form. And also multiple-linear regression has been applied to analyze the cause and effect relationship among dependent and independent variables in order to address the research objectives.

4.2. Demographic Data Presentation

The study gathered data from respondents including department heads who have been involved in a supply chain practice of decision making. Respondents from more than thirteen departments have been participated even if data collection process found challenging due to the current situation of global pandemic (COVID19). Because of the pandemic, Ethiopian Airlines Group announced that employees to take annual leave to keep physical distancing. In that case, email and telephone are the only option and a very few respondents have been replied. Then, paper questionnaires distributed and made a close followed up used to encourage number of respondents.

Based on the predetermined sample size, data collected from 157 respondents which is about 82.2% of the total sample believed that is sufficient to analyze the data. In addition, semi-structured interview was

conducted with four directors of major divisions in Ethiopian MRO to gather their personal opinion together with departmental facts with regards the effect of Supply Chain Integration on Operational Performance of Ethiopian MRO.

The general characteristics of respondents pertaining to gender, age, educational background, work experience and position as follows:

Table 4.1: Demographic Data

Variable	No.	Group	Frequency	Percent
Gender	**1**	Male	123	78.34
	2	Female	34	21.66
		Total	**157**	**100.00**
Age	**1**	Between 25-35	92	58.60
	2	Between 36-45	54	34.39
	3	Between 46-55	8	5.10
	4	Above 55	3	1.91
		Total	**157**	**100.00**
Educational Background	**1**	PhD	0	0.00
	2	Masters	32	20.38
	3	Bachelors	116	73.89
	4	Higher Diploma	0	0.00
	5	Diploma	8	5.10
	6	Certificate	1	0.64
	7	Other	0	0.00
		Total	**157**	**100.00**
Work Experience	**1**	5 years & below	72	45.86
	2	Between 6 to 10 years	38	24.20
	3	Between 11 to 15 years	18	11.46
	4	Between 16 to 20 years	23	14.65
	5	Above 20 years	6	3.82
		Total	**157**	**100.00**
Position	**1**	Junior	32	20.38
	2	Senior	74	47.13
	3	Expert	13	8.28
	4	Management Member	38	24.20
		Total	**157**	**100.00**

Source: Own Survey Finding, 2020

As per table 4.1, the most respondents are male from a total of 157 respondents; those are 123 (78.34%) and the remaining 34 (21.66%) are female. It is clear that more than half of the total respondents (58.60%) age ranged from 25 to 35 years old. Respondents' age between 36-45 years old are 34.39% of the total and between 46-55 years old are 5.10% while the smallest respondents (1.91%) ages are above 55 years old; as a result, most of the respondents are found in the most productive age group.

Educational background of respondents shows that most of them (78.89%) are Bachelor degree holders, they are 116 in number. In other hand 20.38% are secured Masters and the remaining 5.1% and 0.64% are Diploma and Certificate respectively. This implies that respondents have necessary educational background to understand the questions and to provide appropriate answer.

In the case of work experience, most of respondents, 45.86% of them are less than five years of work experience, and 24.20% of them are experienced from 6-10 years. 29.94% of them are above 11 years of experience, that means between 11.46% of them are 11-15 years, 16-20 years (14.68%) and 3.82% of them are above 20 years of work experience. This implies that more than 50% of respondents have remarkable work experience which is above 5 years.

With regards position; even if most of the respondents (75.80%) belong to non-management category, 79.62% of the total respondents are senior and management members. Specifically, 20.38% of respondents are juniors, 47.13% of them are seniors, 8.28% experts (the least responders) and 24.20% management members. This indicates that the survey includes respondents with different positions to ensure to explore the effect of the position and expertise knowledge in handling the given study.

4.3. Data Presentation, Analysis and Discussion

In this section, data has been presented, analyzed and discussed by using descriptive statistics, which are percentage distribution, frequency, mean and standard deviation, and finally multiple linear regression analysis has been applied so as to address research objectives.

4.3.1. Supply Chain Integration

The researcher used statistical methods of percentage distribution, mean and standard deviation of independent variables in order to answer the question related with the level of supply chain integration practice in Ethiopian MRO.

4.3.1.1. Supplier Integration

The level of supplier integration practice is examined through detail activities stated and evaluated below.

Table 4.2: Supplier Integration (Percentage distribution, Mean and Standard deviation)

Supplier Integration Related Variables	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std. Dev.
ET-MRO shares information with suppliers through electronic network/digitalization	5.73	10.83	4.46	40.76	38.22	3.95	1.18
ET-MRO has built partnership with suppliers/supplier relationship management	12.74	18.47	4.46	33.76	30.57	3.51	1.42
ET-MRO is working with suppliers through clear obligation/contracts	1.27	11.46	5.10	42.68	39.49	4.08	1.01
Suppliers of ET-MRO devoted to the essential specifications/quality compliance	3.82	10.19	3.82	47.77	34.39	3.99	1.07
ET-MRO is holding regular meetings with suppliers to review the business matters	5.73	7.64	5.73	40.13	40.76	4.03	1.14
Supplier Integration Practice in ET-MRO						**3.91**	**0.93**

Source: Own Survey Result, 2020

Based on table 4.2, the mean range of activities related with supplier integration is between 3.51 and 4.08 with the standard deviation between 1.42 and 1.01 respectively. In addition, the evaluation shows that 64.33% and above respondents agreed on each practice of supplier integration related variables addressed in the questionnaire, moreover the aggregated mean (mean of mean) of supplier

integration practice is 3.91 with standard deviation of 0.93, which in general indicated that an agreement among respondents about the implementation of supplier integration practices.

Even though the finding shows positive result, supplier integration recognized as one of the improvement area which can highly enhance supply chain integration of Ethiopian MRO. Among the practice of supplier integration related variables addressed in the questionnaire, ET-MRO has built partnership with suppliers/supplier relationship management has the lowest mean value, which is 3.51 with standard deviation of 1.42 since 31.21% of respondents disagreed to the practice of supplier relationship management (SRM) in Ethiopian MRO, which implies that improvement required in SRM practice that can boost cost, quality and time dimensions of the operational performance of the MRO. SRM allows to improve **time** in having smooth information flow enable to secure fast and informed decision making, SRM reduces **cost** through long term relationship with suppliers warrant mutual benefit. SRM develop **quality** through information sharing that can contribute a line share for product, service and process improvement.

In other hand, considerable number of respondents disagreed on ET-MRO shares information with suppliers through electronic network/digitalization (16.56%). This implies that area of the investigation require improvement since the given finding from few respondents shows that unavailability of end-to-end digitalization (a single platform), which might cause inefficiency. ET-MRO is using different IT platform to facilitate flow of information, materials and finances at a division level. In this case requirement of digitalization to support end-to-end process in a supply chain network. It's know that automated system can improve the performance the supply chain and extended to other practices in a supplier integration. As a result, demand in having a single platform or system can assure integration with suppliers and other stakeholders enable the MRO to realise smooth, precise and accurate information flow in a timely manner.

Hence, ET-MRO has built partnership with suppliers'/supplier relationship management; and ET-MRO shares information with suppliers through electronic network/digitalization are practices of supplier integration related issues that are identified for improvement.

4.3.1.2. Internal Integration

The level of internal integration practice is examined through detail activities stated and evaluated below.

Table 4.3: Internal Integration (Percentage distribution, Mean and Standard deviation)

Internal Integration Related Variables	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std. Dev.
ET-MRO is constantly determined to unify its culture with stakeholders	10.19	12.74	4.46	34.39	38.22	3.78	1.35
ET-MRO involves different departments during the preparation of strategic plan	5.10	7.64	7.01	49.04	31.21	3.94	1.07
ET-MRO uses MRP system to harmonize forecasting, requisitions, procurement, maintenance works	7.01	14.65	4.46	40.76	33.12	3.78	1.25
ET-MRO allows coordination among departments to participate in problem solving	7.64	14.65	7.01	43.95	26.75	3.68	1.23
ET-MRO holds regular training programs to develop employees competencies	0.64	8.28	5.10	45.86	40.13	4.17	0.90
Internal Integration Practice in ET-MRO						**3.87**	**1.02**

Source: Own Survey Result, 2020

Based on table 4.3, the mean range of activities related with internal integration is between 3.68 and 4.17 with the standard deviation between 1.23 and 0.90 respectively. In addition, the evaluation shows that 70.70% and above respondents agreed on each practice of internal integration related variables addressed in the questionnaire; moreover, the aggregated mean (mean of mean) of internal integration practice is 3.87 with standard deviation of 1.02, which in general indicated that an agreement among respondents about the implementation of internal integration practices.

Even though the finding shows positive result, internal integration recognized as one of the improvement area which can highly enhance supply chain integration of Ethiopian MRO. Among the practice of internal integration related variables addressed in the questionnaire, ET-MRO allows coordination among departments to participate in problem solving has the lowest mean value, which is 3.68 with standard deviation of 1.23 since 22.29% of respondents disagreed to the practice of inter

departmental coordination to participate in problem solving, which implies that improvement required in departmental participation towards problem solving, which leads to the effective way of information sharing to reach at a desired result. Therefore, inter functional relationship warrants **cost** reduction through brain storming, improve **quality** as a result of valuable information sharing, and handling assignments smoothly in a **timely** manner.

In other hand, substantial number of respondents disagreed on ET-MRO is constantly determined to unify its culture with stakeholders (22.93%), which indicate that improvement required on unifying organizational culture towards the road map, vision and mission, which has been developed in consideration with major stakeholders including regulatory body. Culture unification leads to reach at a common goal in keeping the interest of stakeholders. In addition, 21.66% of respondents disagreed on ET-MRO uses MRP system to harmonize forecasting, requisitions, procurement, maintenance works, which require improvement through digitalization (common platform).

Hence, ET-MRO allows coordination among departments to participate in problem solving; ET-MRO is constantly determined to unify its culture with stakeholders; and ET-MRO uses MRP system to harmonize forecasting, requisitions, procurement, maintenance works are practices of internal integration related issues that are identified for improvement.

4.3.1.3. Customer Integration

The level of customer integration practice is examined through detail activities stated and evaluated below.

Table 4.4: Customer Integration (Percentage distribution, Mean and Standard deviation)

Customer Integration Related Variables	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std. Dev.
ET-MRO pursued to achieve customer satisfaction	1.91	10.19	5.10	44.59	38.22	4.07	1.01
ET-MRO has built partnership with customer	3.82	15.29	7.01	37.58	36.31	3.87	1.18
ET-MRO has specialized department dedicated to customer support and relationship management	1.91	12.74	4.46	50.96	29.94	3.94	1.01
ET-MRO is holding regular meetings with customers to review the business matters	8.28	16.56	6.37	47.13	21.66	3.57	1.23
ET-MRO is working with customers through clear obligation/contracts	3.82	11.46	1.91	42.68	40.13	4.04	1.11
Customer Integration Practice in ET-MRO						**3.90**	**0.80**

Source: Own Survey Result, 2020

Based on table 4.4, the mean range of activities related with customer integration is between 3.57 and 4.07 with the standard deviation between 1.23 and 1.01 respectively. In addition, the evaluation shows that 68.79% and above respondents agreed on each practice of internal integration related variables addressed in the questionnaire; moreover, the aggregated mean (mean of mean) of customer integration practice is 3.90 with standard deviation of 0.80, which in general indicated that an agreement among respondents on highly implementation of customer integration practices.

Even though the finding shows positive result, customer integration recognized as one of the improvement area which can highly enhance supply chain integration of Ethiopian MRO. Among the practice of customer integration related variables addressed in the questionnaire, ET-MRO is holding regular meetings with customers to review the business matters has the lowest mean value, which is 3.57 with standard deviation of 1.23 since 24.84% of respondents disagreed to the practice with regards regular meetings with customer to review business related issues, which implies that improvement

required in scheduling continuous meetings that enable to identify, discuss and solve potential issues can affect the relationship. Therefore, periodic meeting with customer can reduce **cost** through discussion of potential areas of savings, improve **quality** based on valuable feedback, and improve **time** as a result of proactive actions.

In other hand, considerable number of respondents disagreed on ET-MRO has built partnership with customer (19.11%), which indicate that improvement required on customer relationship management which benefit the MRO to secure competitive advantage. Partnership with customer can develop customer loyalty, improve communication and information sharing to secure the best customer service. In addition, 15.29% of respondents disagreed on ET-MRO is working with customers through clear obligation/contracts, which require improvement according to the contract management activities implemented in supply chain management.

Hence, ET-MRO is holding regular meetings with customers to review the business matters; ET-MRO has built partnership with customer; and ET-MRO is working with customers through clear obligation/contracts are practices of customer integration related issues that are identified for improvement.

4.3.1.4. Summary of Supply Chain Integration

Table 4.5: Supply Chain Integration (Mean, Standard deviation, Min. and Max.)

Variables	Mean	Std. Deviation	Min	Max
Supplier Integration	3.91	0.93	1.0	5
Internal Integration	3.87	1.02	1.2	5
Customer Integration	3.90	0.80	1.6	5
SCI in ET-MRO	**3.89**	**0.88**		

Source: Own Survey Result, 2020

In reference to the above detail (table 4.5), the mean range based on the statistical analysis of independent variables shows between 3.87 and 3.91 with standard deviation between 1.02 and 0.93 respectively, which indicates the agreement among employees and departmental heads about the implementation of supply chain integration (supplier, internal and customer) practices. The aggregated

mean of the three variables is 3.89 with standard deviation of 0.88, which implies the agreement that describe the higher level implementation of supply chain integration in Ethiopian MRO. In general, the given result shows that all variables are vital and presented that there is an alertness of respondents about the importance of supply chain integration.

From the overall means of independent variables, respondents accept as purposeful supplier integration is the most important than both internal and customer integrations. This shows that respondents well aware of the value of collaboration with suppliers enable the MRO to provide value added products and services to the ultimate customer. The finding shows that supply chain integration is one of the most valuable management tool, which helps to improve the overall performance of the MRO. Ethiopian MRO has been concentrating and applying cost leadership strategy that can mainly be achieved through collaboration with suppliers, and believed that coordination and collaboration among departments and functional units, most importantly with customers empower to take competitive advantage over rivals.

Theoretically, it's known that supply chain integration aims to address market demand with a means of providing value added product or services to the customers. Those value added products and services originated through internal integration and strategic collaboration with suppliers.

4.3.2. Operational Performance

The researcher used statistical methods of percentage distribution, mean and standard deviation of dependent variables in order to answer the question related with operational performance of Ethiopian MRO.

4.3.2.1. Cost

The operational performance in terms of cost dimension is examined through activities stated and evaluated below.

Table 4.6: Cost (Percentage distribution, Mean and Standard deviation)

Cost Related Variables	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std. Dev.
ET-MRO has increased market share and revenue	1.91	9.55	7.01	38.22	43.31	4.11	1.03
ET-MRO has reduced direct maintenance cost	2.55	8.92	5.73	35.03	47.77	4.17	1.05
ET-MRO has reduced wastage and disposal cost	7.64	19.75	5.10	32.48	35.03	3.68	1.34
ET-MRO has reduced inventory holding and surplus stock (vendor stock management and re-buy)	1.27	10.19	3.82	45.86	38.85	4.11	0.97
ET-MRO has reduced expedite fee for critical part and tools requirement	5.73	10.83	6.37	31.85	45.22	4.00	1.21
ET-MRO has reduced penalty fee for late core return of exchanged and loan units	9.55	20.38	3.82	38.85	27.39	3.54	1.34
ET-MRO has reduced penalty fee of past due invoices	7.64	13.38	3.82	45.22	29.94	3.76	1.23
Cost						**3.91**	**0.82**

Source: Own Survey Result, 2020

Cost is one of the critical dimensions which can determine the operational performance of Ethiopian MRO. The given questionnaires attempt to examine the level of cost variables related with the operational performance. As stated on table 4.6, the mean of cost related variables are ranging from 3.54 to 4.17 with the standard deviation between 1.34 and 1.05 respectively. In addition, the evaluation shows that 66.24% and above respondents agreed on each items of cost related variables of the operational performance addressed in the questionnaire, moreover, its aggregated mean (mean of mean) is 3.91 with standard deviation of 0.82, which in general indicates the agreement among respondents about the application of cost variable as a dimension towards operational performance of Ethiopian MRO.

Even though the finding shows positive result, cost recognized as one of the improvement area which can highly enhance the operational performance of Ethiopian MRO. Among those cost related variables addressed in the questionnaire, ET-MRO has reduced penalty fee for late core return of exchanged and loan units has the lowest mean value, which is 3.54 with standard deviation of 1.34 since 29.94% of respondents disagreed to the reduction of penalty fee for the exchanged/loaned components

and tools, which implies that demand for improvement in returning loaned/exchanged items in a timely manner so as to reduce the over cost related; which also required to collaborate with all concerned to address the issue in having valid reason as a justification to convince the providers.

In other hand, substantial number of respondents disagreed on ET-MRO has reduced wastage and disposal cost (27.39%). This demands improvement through collaboration with all concerned stakeholders to minimize wastage and facilitate disposal in a timely manner. In addition, 21.02% of respondents disagreed on ET-MRO has reduced penalty fee of past due invoices, which demands improvement in handling payments in a timely manner.

Hence, ET-MRO has reduced penalty fee for late core return of exchanged and loan units; ET-MRO has reduced wastage and disposal cost; and ET-MRO has reduced penalty fee of past due invoices are cost related issues that are identified for improvement.

4.3.2.2. Quality

The operational performance in terms of quality dimension is examined through activities stated and evaluated below.

Table 4.7: Quality (Percentage distribution, Mean and Standard deviation)

Quality Related Variables	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std. Dev.
ET-MRO has reduced workmanship defect	6.37	10.83	8.28	43.95	30.57	3.82	1.17
ET-MRO has reduced non-standard maintenance service and rework	8.92	7.01	7.01	48.41	28.66	3.81	1.19
ET-MRO has improved reliability and dependability	5.73	10.83	4.46	46.50	32.48	3.89	1.15
ET-MRO has reduced removal rate and premature failure of components	5.73	8.92	8.92	40.76	35.67	3.92	1.15
ET-MRO has reduced complain and safety audit issues	7.01	10.83	4.46	36.31	41.40	3.94	1.24
Quality						**3.88**	**1.04**

Source: Own Survey Result, 2020

Quality is the other critical dimensions which can determine the operational performance of Ethiopian MRO. The given questionnaires attempt to examine the level of quality variables related with the operational performance. As stated on table 4.7, the mean of quality related variables are ranging from 3.81 to 3.94 with the standard deviation between 1.19 and 1.24 respectively. In addition, the evaluation shows that 74.52% and above respondents agreed on each items of quality related variables of the operational performance addressed in the questionnaire, moreover, its aggregated mean (mean of mean) is 3.88 with standard deviation of 1.04, which in general indicates the agreement among respondents about the application of quality variable as a dimension towards operational performance of Ethiopian MRO.

Even though the finding shows positive result, quality recognized as one of the improvement area which can highly enhance the operational performance of Ethiopian MRO. Among those quality related variables addressed in the questionnaire, ET-MRO has reduced non-standard maintenance service and rework has the lowest mean value, which is 3.81 with standard deviation of 1.19 since 15.92% of respondents disagreed to the reduction of non-standard maintenance that demands rework, which implies that demand for improvement in handling maintenance work according to the procedure manuals. That also required training, appropriate knowledge sharing and ethical consideration in collaboration with the concerned body so as to improve the quality of maintenance works.

In other hand, substantial number of respondents disagreed on ET-MRO has reduced complain and safety audit issues (17.83%). This demands improvement through monitoring and evaluating internal processes if that has been going as per the acceptable standard enable to tackle the real cause of complaints and audit related issues. In addition, 17.20% of respondents disagreed on ET-MRO has reduced workmanship defect, which demands improvement in handling maintenance activities at the required level of doing things. This may demand proper training and knowledge transfer enable to reduce defective rate which potentially become the cause of massive cost.

Hence, ET-MRO has reduced non-standard maintenance service and rework; ET-MRO has reduced complain and safety audit issues; and ET-MRO has reduced workmanship defect are quality related issues that are identified for improvement.

4.3.2.3. Time

The operational performance in terms of time dimension is examined through activities stated and evaluated below.

Table 4.8: Time (Percentage distribution, Mean and Standard deviation)

Time Related Variables	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	Std. Dev.
ET-MRO has shorten turnaround time (TAT)	5.10	17.83	2.55	50.32	24.20	3.71	1.17
ET-MRO has improved maintenance on time performance (OTP)	7.64	21.66	7.01	51.59	12.10	3.39	1.17
ET-MRO has shorten aircraft hard grounding time	3.82	7.64	4.46	61.78	22.29	3.91	0.96
ET-MRO has shorten time of components waiting for parts	1.91	19.75	8.28	42.04	28.03	3.75	1.13
ET-MRO has improved core return time of exchanged and loan units	4.46	13.38	10.19	45.22	26.75	3.76	1.12
ET-MRO has improved payment processing time	4.46	11.46	5.10	40.13	38.85	3.97	1.14
Time						**3.75**	**0.92**

Source: Own Survey Result, 2020

In addition to cost and quality, time is also the other critical dimensions which can determine the operational performance of Ethiopian MRO. The given questionnaires attempt to examine the level of time variables related with the operational performance. As stated on table 4.8, the mean of time related variables are ranging from 3.39 to 3.97 with the standard deviation between 1.17 and 1.14 respectively. In addition, the evaluation shows that 63.69% and above respondents agreed on each items of time related variables of the operational performance addressed in the questionnaire, moreover, its aggregated mean (mean of mean) is 3.75 with standard deviation of 0.92, which in general indicates the agreement among respondents about the application of time variable as a dimension towards operational performance of Ethiopian MRO.

Even though the finding shows positive result, quality recognized as one of the improvement area which can highly enhance the operational performance of Ethiopian MRO. Among those time related variables addressed in the questionnaire, ET-MRO has improved maintenance on time

performance (OTP) has the lowest mean value, which is 3.39 with standard deviation of 1.17 since 29.30% of respondents disagreed to on-time performance, which implies that demand for improvement in scheduling, coordination with valuable stakeholders and on time delivery can improve on-time performance.

In other hand, substantial number of respondents disagreed on ET-MRO has shorten turnaround time (22.93%). This demands improvement through collaboration with all concerned to secure required information, materials and services at the right time. In addition, 21.66% of respondents disagreed on ET-MRO has shorten time of components waiting for parts, which demands improvement in having cross functional collaboration with regards on time information sharing which may faster delivery of required piece parts, tools and materials enable to make it serviceable and ready for use.

Hence, ET-MRO has improved maintenance on time performance (OTP); ET-MRO has shortened turnaround time (TAT); and ET-MRO has shortened time of components waiting for parts are time related issues that are identified for improvement.

4.3.2.4. Summary of Operational Performance

Table 4.9: Operational Performance (Mean, Standard deviation, Min. and Max)

Variables	Mean	Std. Deviation	Min	Max
Cost	3.91	0.82	1.6	5
Quality	3.88	1.04	1.2	5
Time	3.75	0.92	1.0	5
OP of ET-MRO	**3.84**	**0.91**		

Source: Own Survey Result, 2020

In reference to the above detail (table 4.9), the mean range based on the statistical analysis of dimensions of operational performance is between 3.75 and 3.91, with standard deviation between 0.92 and 0.82 respectively, which indicates the agreement among Ethiopian MRO employees and departmental heads on each dimension of the operational performance. The cumulated mean (mean of mean) of the three constructs is 3.84 with standard deviation of 0.91, this also implies the agreement shows the application of operational performance dimensions (cost, quality and time) in Ethiopian

MRO. In general, the given result indicated that all approaches found vital and implies an understanding of respondents about operational performance dimensions of Ethiopian MRO.

From the overall means, respondents accept cost is the most important dimensions than the remaining two, its mean value is 3.91 with standard deviation of 0.82. This shows that respondents well aware and understand about the importance of cost for that Ethiopian MRO follows cost leadership strategy. Cost reduction in other hand is profit maximization as a result of waste minimization and process improvement. Cost leadership strategy of Ethiopian MRO enable to reduce costs with improved quality as a result enlarging market share that helps to take competitive advantage over rivals.

Then, quality is a dimension of operational performance found at second level with mean value of 3.88 and standard deviation of 1.04, this implies quality is a vital dimension towards operational performance of Ethiopian MRO. In order to maintain the competitive advantages, providing quality product or service has a lion share.

In contrast, time dimension has the lowest mean value, which is 3.75 with standard deviation of 0.92. It doesn't mean that neglecting the importance of time management that helped Ethiopian MRO to succeed in the marker, rather shows that collective improvement is required in coordination with stakeholders so as to secure a timely flow of information, materials and finance. Aviation industry is time sensitive; in maintaining competitive position in the market for which inter departmental collaboration as well as integration with suppliers and customers are highly required.

Generally, the result concluded that the success of Ethiopian MRO is because of cost effective quality maintenance service in a timely manner through inter-departmental collaboration, which extended to suppliers and customers. Theoretically, it's know that supply chain integration empowers the organizations to provide cost effective quality product or services in a timely manner to the end customers.

4.3.3. Analysis of Semi-Structured Interview and Open Ended Questions

In addition to the finding questionnaire survey of the study, the researcher analysed data gathered as a result of semi-structured interview and open ended questions that helps to enrich the findings

attained from the quantitative analysis. To this effect, interviews conducted with four higher management members to gather data with regards the level of supply chain integration practice and its effect on the operational performance of Ethiopian MRO. The open ended questions forwarded together with the survey questioners, given that addressed by few respondents' data analysed together with the interview questions. It's about the benefit of supply chain integration towards the operational performance, in other hand the interview helps to discuss categories of supply chain integration and related loopholes encountered while performing day-to-day activities in consideration with the dimensions of operational performance that are cost, quality and time. Then, the outcome of the interview and open ended question analysed as stated in the following paragraphs. The interviewees were invited to answer the degree of supply chain integration practice in Ethiopian MRO and its effect on operational performance, they were stressed to consider categories of supply chain integration and dimensions of operational performance. All of them agreed and replied that there is supply chain integration practice and the criticality of their impact on the performance of Ethiopian MRO. Moreover, one of the interviewees replied supply chain as a management tool support in sustaining competitive performance on the MRO, in 21 century supply chain is the backbone of the organization business need so as to deal with strategic objectives.

Subsequently, the other explained that supply chain practice in Ethiopian MRO looks good but still there are area needed to be improved from the management point of view, for instant observed that sometimes suppliers seems not committed to the specification that required to be improved, which required enforcement. In this regard the other clarified that supplier integration is about a collaboration based on mutual benefit which has been concluded by different contracts, a contract management which warrants periodic suppliers' performance evaluation according to the obligatory parameters ensures commitment of suppliers to fit with the specification and quality requirements of Ethiopian MRO; additionally advised that every things are not perfect, there are areas demand further improvement, such as supplier relationship management and demand for digitalization, which are crucial so as to improve cost, quality, and time dimensions of operational performance. The other interviewee supports the idea that Ethiopian MRO have regular meeting with supplier which benefit the MRO to discuss the issue, solve the problems, and handle challenges proactively. With regards end-to-end digitalization, not to forget that the MRO has different plat form used for different purposes including tactical procurement and maintenance work management; but it's obvious that having a single platform system can improve efficiency, assure integration with suppliers and other stakeholders enable the MRO to improve its

performance through smooth, precise and accurate information flow in a timely manner, which also supported by data gathered through open ended questions.

Two of the interviewees, the one explained about cross departmental collaboration demand further improvement that enables to solve real time issues in a proper way, and the other advised that there is process improvement tool called ACE (Achieving Competitive Excellence) in Ethiopian MRO, which considered as a working language led by ACE agents and ACE managers assigned from different departments working towards value stream/value chain. ACE is a tool that allows employees to identify and provide any issues they face while performing their day-to-day activities and supports problem solving in a systematic way; moreover, facilitates inter departmental interaction and collaboration so as to address issues in a timely manner. The interviewee finally recommended further improvement in Ethiopian MRO to keep ACE as a working language allows to achieve the ultimate goal. As aforementioned, all of them have the same concern about ACE that can facilitate cross functional coordination intended to address potential issues in a proper way. The data from open ended questions stressed that internal collaboration is fundamental for business success, which to be improved in Ethiopian MRO. In addition, they are concerned MRP system needed to be improved in handling internal processes in an orderly fashion. This is the issue from user side demanded to be improved through proper training in collaboration with IT division.

One of the interviewees explained about customer relationship management (CRM) that demand further improvement in having regular discussion. Customers become more demanding in today's business, having stronger relationship with them sustain competitive advantage of Ethiopian MRO. In the same area of discussion, the other interviewee advised about contract management related activities with customer. Both of them are concerned about customer development in having large number of loyal clients that can be achieved through strong relationship with customers. One of them explained that customer relationship can be maintained with or without contract through a clear way of information sharing, discussion, continuous improvement, and exceed expectation.

All of them stressed about people, process and technology those needed to be streamlined in order to improve productivity and the business need of Ethiopian MRO. One of the interviewee, replied in connection with supply chain management: supply chain integration plays a vital role in process improvement through internal integration that improves external integration (integration with suppliers and customers). The objective of Ethiopian MRO can be achieved through well-organized supply chain

network, the reason for success is considered as strong collaboration (internal and external) that has an impact on the overall operational performance. All of them explained about demand for further improvement in different areas in consideration with cost, quality and time parameters. Apparently, described for further improvement towards disposal of surplus and excess stock, wastage handling and payments related with late return and past due invoices. And they advised, these are the areas needed to be improved that has a direct impact on cost. Two of the interviewees stressed about further improvement on quality dimension that demands avoidance of non-standard maintenance and defects which affects the company incurring too much costs as a result of reworks. The other area raised by one of the interviewees for further improvement are related with time, and concerned with on-time performance and turnaround time in handling maintenance work and timely payment processes. The interview stressed that a minor loophole across the value chain may end up with extended turnaround time that can influence on-time performance.

The concern raised by the other interviewee, supply chain integration ensure the flow of information, materials, finance and technology, which highly affects operational performance of Ethiopian MRO. Supply chain integration warrants to improve time in having smooth information flow which enable to secure fast and informed decision making; warrants cost reduction through long term relationship with suppliers; warrants in having improved quality through experience sharing, benchmarking, trainings/development that can contribute a line share for product, service and process improvement.

Finally, two of the interviewees advised that the outcome of the finding and research result should have a vital role in Ethiopian MRO in having further improvement on the areas forwarded for discussion.

4.3.4. Regression Analysis

The study applied multiple linear regression to examine and measure the cause and effect relationship among variables of supply chain integration and the dimensions of operational performance of Ethiopian MRO. As stated in chapter three, tests of assumptions such as normality, multi-collinearity, linearity and heteroscedasticity or homoscedasticity of residuals have been fulfilled. Hence, it is

acceptable to proceed with multiple regression analysis. This section includes regression analysis between variables of supply chain integration and the overall operational performance of Ethiopian MRO. And then the regression analysis for individual constructs of dependent variable in relation with the independent variables has been applied in order to find out the similarities or differences of results among the aggregated and individual constructs of the operational performance.

4.3.4.1. Multiple Linear Regression (Aggregated Dependent Variable in relation with Independent Variables)

The intention of the study is to find out the best and valuable answers to the given research questions, which intended to address research objectives with regards the effect of supply chain integration on operational performance at Ethiopian MRO. Therefore, multiple linear regression analysis has carried out among variables of supply chain integration and the aggregated operational performance of Ethiopian MRO as indicated in the table below.

Table 4.10: Multiple Linear Regression Analysis (Regressing Variables of SCI and Total Operational Performance)

Source	Sum of Squares	Degrees of Freedom	Mean Squares	Details	
Model	122.780	3	40.927	**Number of obs**	157
Residual	5.657	153	0.037	**F(3, 153)**	1106.88
Total	**128.437**	**156**	**0.823**	**Prob > F**	0.0000
				R-squared	0.9560
				Adj R-squared	0.9551
				Root MSE	0.1923

Y	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
X1	0.3900	0.0418	9.3300	0.0000	0.3074	0.4725
X2	0.3096	0.0407	7.6100	0.0000	0.2292	0.3901
X3	0.3075	0.0400	7.6800	0.0000	0.2284	0.3866
_cons	-0.0832	0.0792	-1.0500	0.2950	-0.2396	0.0732

Dependent Variable: Operational Performance

Source: Own Survey Result, 2020

In reference to the assumed causal relationship provided in the conceptual framework, the analysis carried out in order to answer research questions.

What is the effect of supplier integration on operational performance at Ethiopian MRO?

Table 4.10 shows that a direct relationship between supplier integration and operational performance in Ethiopian MRO given that $R^2 = 0.9560$, which implies the operational performance depends on supplier integration as a result of strong correlation. And also the p-value is less than 0.05, which implied that the regression model is statistically significant, in other words the relationship between supplier integration and operational performance is statistically significant since p-value is 0.000. On the other hand, the coefficient of supplier integration is positive (0.3900), which shows that positive relationship between supplier integration and operational performance. The findings are confirmed by the following equation:

$Y = -0.0832 + 0.3900X1 + 0.3096X2 + 0.3075X3;$

Where:

Y: Operational performance

X1: Supplier integration

X2: Internal integration

X3: Customer integration

This means, for every additional extent of supplier integration practice, the expected level of operational performance increased by 0.3900 on average, holding all other variables constant. Therefore, supplier integration positively and significantly affects the operational performance of Ethiopian MRO.

In order to address the question, the analysis shows that supplier integration positively and significantly affects the operational performance of Ethiopian MRO. To investigate how supplier integration affects the operational performance of Ethiopian MRO, the findings and the two where regressed are indicated in table 4.10.

What is the effect of internal integration on operational performance at Ethiopian MRO?

Table 4.10 shows a direct relationship between internal integration and operational performance Ethiopian MRO given that $R^2 = 0.9560$, which implies the operational performance depends on internal integration as a result of strong correlation. And also the p-value is less than 0.05, which implied that the regression model is statistically significant, in other words the relationship between internal integration and operational performance is statistically significant since p-value is 0.000. On the other hand, the coefficient of internal integration is positive (0.3096), which shows that positive relationship between internal integration and operational performance. The findings are confirmed by the following equation:

$Y = -0.0832 + 0.3900X1 + 0.3096X2 + 0.3075X3;$

Where:

Y: Operational performance

X1: Supplier integration

X2: Internal integration

X3: Customer integration

This means, for every additional level of internal integration practice, the expected extent of operational performance increased by 0.3096 on average, holding all other variables constant. Therefore, internal integration positively and significantly affects the operational performance of Ethiopian MRO.

In order to answer the question, the analysis shows that internal integration positively and significantly affects the operational performance of Ethiopian MRO. To investigate how internal integration affects operational performance of Ethiopian MRO, the findings and the two where regressed are indicated in table 4.10.

What is the effect of customer integration on operational performance at Ethiopian MRO?

Table 4.10 shows a direct relationship between customer integration and operational performance of Ethiopian MRO given that $R^2 = 0.9560$, which implies the operational performance depends on customer integration as a result of strong correlation. And also the p-value is less than 0.05, which implied that the regression model is statistically significant, in other words the relationship between customer integration and operational performance is statistically significant since p-value is 0.000. On the other hand, the coefficient of customer integration is positive (0.3075), which shows that positive relationship between customer integration and operational performance. The findings are confirmed by the following equation:

$Y = -0.0832 + 0.3900X1 + 0.3096X2 + 0.3075X3;$

Where:

Y: Operational performance

X1: Supplier integration

X2: Internal integration

X3: Customer integration

This means, for every additional level of customer integration practice, the expected extent of operational performance increased by 0.3075 on average, holding all other variables constant. Therefore, customer integration positively and significantly affects the operational performance of Ethiopian MRO.

In order to answer the question, the analysis shows that customer integration positively and significantly affects the operational performance of Ethiopian MRO. To assess how customer integration affects operational performance of Ethiopian MRO, the findings and the two where regressed are indicated in table 4.10.

Generally, based on the above multiple regression analysis, the t-values of the three independent variables are statistically significance because of the corresponding p values are less than 0.05. Therefore, X1, X2 and X3 are independently useful to predict Y. In other words, supplier integration, internal integration and customer integration are individually useful in predicting the operational performance of Ethiopian MRO.

4.3.4.2. Multiple Linear Regression (Individual Dimension of Dependent Variables in relation with Independent Variables)

The intention of this analysis is to examine the impact of supply chain integration variables on individual construct of operational performance (Cost, Quality and Time) to supplement the aggregated variable. Therefore, multiple linear regression analysis has carried out among individual Variables of Operational Performance and Variables of Supply Chain Integration of Ethiopian MRO.

Table 4.11: Multiple Linear Regression Analysis (Regressing Variables of SCI and Cost)

Source	Sum of Squares	Degrees of Freedom	Mean Squares	Summary	
Model	99.608	3	33.203	**Number of obs.**	157
Residual	6.027	153	0.039	**F(3, 153)**	842.9000
Total	**105.635**	**156**	**0.677**	**Prob > F**	0.0000
				R-squared	0.9429
				Adj R-squared	0.9418
				Root MSE	0.1985

Y1	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
X1	0.3627	0.0431	8.4100	0.0000	0.2775	0.4480
X2	0.2641	0.0420	6.2900	0.0000	0.1811	0.3471
X3	0.2826	0.0413	6.8400	0.0000	0.2010	0.3643
_cons	0.3682	0.0817	4.5100	0.0000	0.2067	0.5296

Dependent Variable: Cost

Source: Own Survey Result, 2020

Table 4.11 shows direct relationship among independent variables and cost of Ethiopian MRO given that $R^2 = 0.9429$, which implies cost (one of the dimensions of operational performance) depends on each variables of supply chain integration as a result of strong correlation. And also the p-value is less than 0.05, which implied that the regression model is statistically significant, in other words the relationship among variables of supply chain integration and cost is statistically significant since p-value is 0.000. On the other hand, the coefficient of supplier integration (0.3627), internal integration (0.2641) and customer integration (0.2826) are positive, which shows that positive relationship among all variables of supply chain integration and cost. The findings are confirmed by the following equation:

$$Y1 = 0.3682 + 0.3627X1 + 0.2641X2 + 0.2826X3;$$

Where:

Y1: Cost

X1: Supplier integration

X2: Internal integration

X3: Customer integration

This means, for every additional level of supplier integration practice, the expected amount of cost affected by 0.3627 on average, holding the other variables constant. The same is true for internal integration that for every additional level of internal integration practice, the expected amount of cost affected by 0.2641 on average, holding the other variables constant. Finally, for every additional level of customer integration practice, the expected amount of cost affected by 0.2826 on average, holding the other variables constant. Therefore, the analysis shows that supplier integration, internal integration and customer integration are positively and significantly affects the cost variable of the operational performance of Ethiopian MRO.

Table 4.12: Multiple Linear Regression Analysis (Regressing Variables of SCI and Quality)

Source	Sum of Squares	Degrees of Freedom	Mean Squares	Summary	
Model	161.118	3	53.706	**Number of obs**	157
Residual	7.315	153	0.048	**F(3, 153)**	1123.3400
Total	**168.433**	**156**	**1.080**	**Prob > F**	0.0000
				R-squared	0.9566
				Adj R-squared	0.9557
				Root MSE	0.2187

Y2	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
X1	0.4347	0.0475	9.1500	0.0000	0.3408	0.5287
X2	0.4282	0.0463	9.2500	0.0000	0.3367	0.5196
X3	0.2684	0.0455	5.9000	0.0000	0.1784	0.3583
_cons	-0.5269	0.0900	-5.8500	0.0000	-0.7048	-0.3491

Dependent Variable: Quality

Source: Own Survey Result, 2020

Table 4.12 shows direct relationship among independent variables and quality of Ethiopian MRO given that R^2 = 0.9566, which implies quality (one of the dimensions of operational performance) depends on each variables of supply chain integration as a result of strong correlation. And also the p-value is less than 0.05, which implied that the regression model is statistically significant, in other words the relationship among variables of supply chain integration and quality is statistically significant since p-value is 0.000. On the other hand, the coefficient of supplier integration (0.4347), internal integration (0.4282) and customer integration (0.2684) are positive, which shows that positive relationship among all variables of supply chain integration and cost. The findings are confirmed by the following equation:

Y2 = -0.5269 + 0.4347X1 + 0.4282X2 + 0.2684X3;

Where:

Y2: Quality

X1: Supplier integration

X2: Internal integration

X3: Customer integration

This means, for every additional level of supplier integration practice, the expected degree of quality affected by 0.4347 on average, holding the other variables constant. The same is true for internal integration that for every additional level of internal integration practice, the expected degree of quality affected by 0.4282 on average, holding the other variables constant. Finally, for every additional level of customer integration practice, the expected degree of quality affected by 0.2684 on average, holding the other variables constant.

Therefore, the analysis shows that supplier integration, internal integration and customer integration are positively and significantly affects the quality variable of the operational performance of Ethiopian MRO.

Table 4.13: Multiple Linear Regression Analysis (Regressing Variables of SCI and Time)

Source	Sum of Squares	Degrees of Freedom	Mean Squares	Summary	
Model	122.376	3	40.792	**Number of obs**	157
Residual	9.403	153	0.061	**F(3, 153)**	663.7200
Total	**131.780**	**156**	**0.845**	**Prob > F**	0.0000
				R-squared	0.9286
				Adj R-squared	0.9272
				Root MSE	0.2479

Y3	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
X1	0.3425	0.0539	6.3600	0.0000	0.2360	0.4490
X2	0.2784	0.0525	5.3000	0.0000	0.1747	0.3820
X3	0.4036	0.0516	7.8200	0.0000	0.3016	0.5056
_cons	-0.2410	0.1021	-2.3600	0.0200	-0.4426	-0.0393

Dependent Variable: Time

Source: Own Survey Result, 2020

Table 4.13 shows direct relationship among independent variables and time of Ethiopian MRO given that $R^2 = 0.9286$, which implies time (one of the dimensions of operational performance) depends on each variables of supply chain integration as a result of strong correlation. And also the p-value is less than 0.05, which implied that the regression model is statistically significant, in other words the relationship among variables of supply chain integration and time is statistically significant since p-value is 0.000. On the other hand, the coefficient of supplier integration (0.3425), internal integration (0.2784) and customer integration (0.4036) are positive, which shows that positive relationship among all variables of supply chain integration and time. The findings are confirmed by the following equation:

$$Y3 = -0.2410 + 0.3425X1 + 0.2784X2 + 0.4036X3;$$

Where:

Y3: Time

X1: Supplier integration

X2: Internal integration

X3: Customer integration

This means, for every additional level of supplier integration practice, the expected length of time affected by 0.3425 on average, holding the other variables constant. The same is true for internal integration that for every additional level of internal integration practice, the expected length of time affected by 0.2784 on average, holding the other variables constant. Finally, for every additional level of customer integration practice, the expected length of time affected by 0.4036 on average, holding the other variables constant.

Therefore, the analysis indicated that independent variables: supplier integration, internal integration and customer integration are positively and significantly affects the time variable of the operational performance of Ethiopian MRO.

Generally, based on the above multiple regression analysis (table 4.11, 4.12 and 4.13), the t-values of X1, X2 and X3 are statistically significance because of the corresponding p values are less than 0.05. Therefore, X1, X2 and X3 are independently useful to predict Y1, Y2 and Y3. In other words, supplier integration, internal integration and customer integration are individually useful in predicting each dimension of the operational performance of Ethiopian MRO.

4.3.5. Summary of Findings

1. Finding from Descriptive Statistics

Based on the findings, the researcher determines all variables of supply chain integration practice have been highly implemented in Ethiopian MRO. The result showed that supplier integration practice is a little bit higher graded, then customer integration followed by internal integration. The preference of the respondents indicated that the three variables of supply chain integration are almost similarly preferred, which implies all of them have been employed in parallel. The finding indicated that all variables of supply chain integration are very important and strongly interdependent, which implies the one positively correlated with the other. Therefore, collaboration with suppliers enable the MRO to be able to provide value added products and services to the ultimate customer.

Based on the findings, the importance and application of dimensions' operational performance has been confirmed. The given result indicated that all approaches found vital implies that there is an understanding of respondents about operational performance dimensions of Ethiopian MRO. The outcome shows that cost has highest value than quality and time even if all of them are almost equally valuable. Cost reduction in other hand is profit maximization as a result of waste minimization and process improvement. Cost leadership strategy of Ethiopian MRO enable to reduce costs with improved quality as a result enlarge market share that helps to take competitive advantage over rivals. Result shows, the relationship among all dimensions of operational performance is very strong given that they are positively correlated each other.

Based on the finding, quality is a dimension of operational performance found at second level, this implies quality is a vital dimension towards operational performance of Ethiopian MRO. In order to maintain the competitive advantages, providing quality product or service has a lion share. In contrast,

time is the one helped Ethiopian MRO to succeed in the marker, rather shows that collective improvement is required in coordination with stakeholders so as to secure a timely flow of information, materials and finance. The finding shows that the industry is time sensitive, in maintaining competitive position in the market for which inter departmental collaboration as well as integration with suppliers and customers are highly required. Generally, the researcher determined that all dimensions of operational performance are interrelated and equally valuable. Cost effective and quality maintenance service in a timely manner through inter departmental collaboration extended to suppliers and customers. It's know that supply chain integration needed to provide cost effective quality product or services in a timely manner to the end customers.

2. Finding from Semi-Structured Interview

The result from the interview shows that supply chain integration plays a vital role in process improvement through internal integration that improves external integration (integration with suppliers and customers). It stated that the objective of the Ethiopian MRO can be achieved through well-organized supply chain network, internal and external collaboration that impact the overall operational performance. The result indicates the improvement in Ethiopian MRO is in consideration with cost, quality and time parameters. Apparently, described for further improvement towards disposal of surplus and excess stock, wastage handling and payments related with late return and past due invoices. Further improvement in quality dimension that demands avoidance of non-standard maintenance and defects which affects the company to incur too much costs as a result of reworks. The other areas raised for further improvement are related with time, and concerned with on-time performance and turnaround time in handling maintenance work and timely payment processes, and minor loophole across the value chain may end up with extend turnaround time that can influence on-time performance.

Generally, the researcher finds out strong and positive integration between supply chain and operational performance of Ethiopian MRO.

3. Finding from Regression Analysis

In reference to the regression analysis (table 4.10), the researcher determines each variable of supply chain integration has an effect on operational performance at Ethiopian MRO. Supplier integration found to be the highest effect (Beta = 0.3900, t = 9.3300, p = 0.000), then internal integration (Beta = 0.3096, t = 7.6100, p = 0.000), followed by customer integration (Beta = 0.3075, t = 7.6800, p = 0.000).

And also based on (table 4.11, 4.12 & 4.13), the researcher concluded each dimensions of operational performance affected by variables of supply chain integration. In reference to **cost** dimension analysis, supplier integration found to be the highest effect (Beta = 0.363, t = 8.41, p = 0.000), then customer integration (Beta = 0.283, t = 6.84, p = 0.000), followed by internal integration (Beta = 0.264, t = 6.29, p = 0.000). In reference to **quality** dimension analysis, supplier integration found to be the highest effect (Beta = 0.435, t = 9.15, p = 0.000), then internal integration (Beta = 0.428, t = 9.25, p = 0.000), followed by customer integration (Beta = 0.268, t = 5.90, p = 0.000). In reference to **time** dimension analysis, customer integration found to be the highest effect (Beta = 0.404, t = 7.82, p = 0.000), then supplier integration (Beta = 0.342, t = 6.36, p = 0.000), followed by internal integration (Beta = 0.278, t = 5.30, p = 0.000).

The researcher accepts as true the criticality of supplier integration refers to the employees' awareness about the importance of supplier integration and its relationship with internal and customer integrations. The researcher believed that the multiple regression result (aggregated variable) of t-values of supplier, internal and customer integrations are statistically significance because of the corresponding p values that are less than 0.05. Therefore, supplier integration, internal integration and customer integration are individually useful in predicting the operational performance of Ethiopian MRO.

In addition, based on multiple regression of individual dependent variable shows that t-values of supplier, internal and customer integrations are statistically significance because of the corresponding p values that are less than 0.05. Therefore, supplier, internal and customer integrations are independently useful to predict cost, quality and time. In other words, supplier integration, internal integration and customer integration are individually useful in predicting each dimension of the operational performance of Ethiopian MRO.

Table 4.14: Summary of Findings/Result Summary based on Research Questions and Objectives

Research Objectives	Research Questions	Performance Indicators		Rank	Result
		Operational Performance	Supply Chain Integration		
To investigate the effect of SI on OP of ET-MRO	What is the effect of SI on OP of ET-MRO?	Cost (1)	Supplier Integration (1)	1	Significant/Positive
			Internal Integration (3)	3	Significant/Positive
			Customer Integration (2)	2	Significant/Positive
To investigate the effect of II on OP of ET-MRO	What is the effect of II on OP of ET-MRO?	Quality (2)	Supplier Integration (1)	1	Significant/Positive
			Internal Integration (3)	2	Significant/Positive
			Customer Integration (2)	3	Significant/Positive
To investigate the effect of CI on OP of ET-MRO	What is the effect of CI on OP of ET-MRO?	Time (3)	Supplier Integration (1)	2	Significant/Positive
			Internal Integration (3)	3	Significant/Positive
			Customer Integration (2)	1	Significant/Positive
To investigate the effect of SCI on OP of ET-MRO	What is the effect of SCI Variables on OP of ET-MRO?	Operational Performance	Supplier Integration (1)	1	Significant/Positive
			Internal Integration (3)	2	Significant/Positive
			Customer Integration (2)	3	Significant/Positive
To investigate the effect of SCI on OP of ET-MRO	What is the effect of SCI Variables on OP of ET-MRO?	Operational Performance	Supply Chain Integration	–	Significant/Positive

SCI = Supply chain integration, SI = Supplier integration, II = Internal integration, CI, Customer integration, OP = Operational performance

Source: Own Survey Result, 2020

Table 4.14 shows the result according to research questions and objectives that supports to make conclusions and recommendations in the following chapter.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMENDATION

5.1. Introduction

In this section, summary of the research, conclusion drawn from the study; and recommendations presented based on the findings obtained during the course of the study; and also includes suggestion about the areas of future research based on research limitation.

5.2. Summary

The summary of findings indicated that positive and significant relationship between variables of supply chain integration and operational performance. In addition, the independent variables: supplier, internal and customer integrations are positively related each other, and the same is true for the dimensions of operational performance.

The result of the analysis indicated that supplier integration positively and significantly affects the operational performance of Ethiopian MRO. In reference to regression analysis, the coefficient of supplier integration is positive, which is 0.3900 implied that positive relationship between supplier integration and operational performance. The R^2, which is 0.9560 (95.60%), indicated that the operational performance depends on supplier integration as a result of strong correlation. And the p-value is less than 0.05, which shows the relationship between supplier integration and operational performance is statistically significant.

The result of the analysis indicated that internal integration positively and significantly affects the operational performance of Ethiopian MRO. In reference to regression analysis, the coefficient of

internal integration is positive, which is 0.3096 implied that positive relationship between internal integration and operational performance. The R^2, which is 0.9560 (95.60%), indicated that the operational performance depends on internal integration as a result of strong correlation. And the p-value is less than 0.05, which shows the relationship between internal integration and operational performance is statistically significant.

The result of the analysis indicated that customer integration positively and significantly affects the operational performance of Ethiopian MRO. In reference to regression analysis, the coefficient of customer integration is positive, which is 0.3075 implied that positive relationship between customer integration and operational performance. The R^2, which is 0.9560 (95.60%), indicated that the operational performance depends on customer integration as a result of strong correlation. And the p-value is less than 0.05, which shows the relationship between customer integration and operational performance is statistically significant.

Generally, the result of the analysis shows that independent variables or categories of supply chain integration positively and significantly affects the operational performance of Ethiopian MRO. In addition, variable individually useful in predicting the operational performance of Ethiopian MRO given that the t-values of the three independent variables are statistically significance because of the corresponding p-values are less than 0.05.

5.3. Conclusion

In today's competitive business environment, most of the organizations bearing in mind that supply chain management is a vital management tool in which be able to take competitive advantage over rivals. As one of an international organization, Ethiopian MRO established supply chain management division back in 2010 in order to embrace best practices implanted in the industry, which is incorporation of policies, procedures and processes for a better decision making exercise to get things done in an efficient and effective manner.

The study considered Ethiopian MRO as a case organization to investigate the effect of supply chain integration on operational performance. It has been set out to examine supplier, internal and customer integrations with dimensions of operational performance in Ethiopian MRO and constructs a

framework in addressing the identified problems. Quantitative and qualitative data analysis and justification of findings are applied with the intention of addressing the research questions and objectives.

To define a research model which contains important concepts about supply chain integration and operational performance, broader literature review has been conducted. Accordingly, data collection tools have been prepared, the questionnaire includes 33 items and which are categorized based on the identified concepts. To achieve the given objective of research, most of the questionnaires are newly developed for which pilot test has been done, in addition to those adapted from the reviewed literatures. To reach at answering the research questions, the study has been addressed the effect of each variable of supply chain integration on the aggregated operational performance as well as on each constructs of operational performance of Ethiopian MRO.

The study represents a substantial effort to explore the underlying relationships between supply chain integration and operational performance in the case of Ethiopian MRO. The finding shows that supply chain integration is significantly important in Ethiopian MRO, which means the three variables of supply chain integration found vital and exercised well in Ethiopian MRO. The findings indicated that Ethiopian MRO has well-organized supply chain department dedicated in handling the flow of information, material, finance and technology, which implied the concept of supply chain integration has been recognized in Ethiopian MRO. In addition, the result of the findings directed that the dimensions of operational performance are critical in Ethiopian MRO, which shows employees and management member at Ethiopian MRO have knowledge about the parameters used to measure the operational performance. Moreover, they are using these dimensions of parameter continuously so as to evaluate periodic performance of the MRO, which warrants future improvements and sustainability.

Based on the descriptive statistics of independent variables, supplier integration is the most important variable in comparison with the remaining two, which are customer integration and internal integration. The researcher accepts as a true that employees and managers are well aware of the value of collaboration with suppliers enable the MRO to provide value added products and services to the ultimate customer. As a result, Ethiopian MRO has been concentrating and applying cost leadership strategy that can mainly be achieved in collaboration with suppliers, and believed that coordination and collaboration among departments and functional units, and most importantly with customers enable to take competitive advantage over rivals. From the constructs of operational performance respondents

accept cost is the most important dimension than the remaining two, which are quality and time. This shows that respondents well aware and understand about the importance of cost for that Ethiopian MRO follows cost leadership strategy. Cost reduction in other hand is profit maximization as a result of waste minimization and process improvement. Cost leadership strategy of Ethiopian MRO enable to reduce costs with improved quality as a result enlarging market share that helps to take competitive advantage over rivals.

In reference to regression analysis, the research questions addressed through the investigation, which has been concluded that variables of supply chain integration positively and significantly related with the operational performance of Ethiopian MRO. To this effect, the outcome of the analysis validates supply chain integration as the backbone and mandatory for the entire activities of the MRO that mainly involved in an interaction with suppliers and customers. And also reflect departments and divisions are well advanced about the concept of supply chain and their enthusiasm towards the improvement and success of Ethiopian MRO.

According to multiple linear regression analysis, the researcher determines each variable of supply chain integration has an effect on operational performance at Ethiopian MRO. Supplier integration found to be the highest effect (Beta = 0.3900, t = 9.3300, p = 0.000), then internal integration (Beta = 0.3096, t = 7.6100, p = 0.000), followed by customer integration (Beta = 0.3075, t = 7.6800, p = 0.000). In line with the detail above, the result of aggregated dependent variable shows that t-values of independent variables: supplier, internal and customer integrations are statistically significance because of the corresponding p values that are less than 0.05. Therefore, supplier integration, internal integration and customer integration are individually useful in predicting the operational performance of Ethiopian MRO.

In addition, based on regression analysis of individual dependent variables, the researcher concluded each dimensions of operational performance affected by variables of supply chain integration. In reference to cost dimension analysis, supplier integration found to be the highest effect (Beta = 0.363, t = 8.41, p = 0.000), then customer integration (Beta = 0.283, t = 6.84, p = 0.000), followed by internal integration (Beta = 0.264, t = 6.29, p = 0.000). In reference to quality dimension analysis, supplier integration found to be the highest effect (Beta = 0.435, t = 9.15, p = 0.000), then internal integration (Beta = 0.428, t = 9.25, p = 0.000), followed by customer integration (Beta = 0.268, t = 5.90, p = 0.000). In reference to time dimension analysis, customer integration found to be the highest effect (Beta =

0.404, t = 7.82, p = 0.000), then supplier integration (Beta = 0.342, t = 6.36, p = 0.000), followed by internal integration (Beta = 0.278, t = 5.30, p = 0.000). In line with the detail above, the result of aggregated dependent variable shows that t-values of supplier, internal and customer integrations are statistically significance because of the corresponding p values that are less than 0.05. Therefore, supplier, internal and customer integrations are independently useful to predict cost, quality and time, which are constructs of operational performance. In other words, supplier integration, internal integration and customer integration are individually useful in predicting each dimension of the operational performance of Ethiopian MRO.

Generally, the relationships among categories of supply chain integration and dimensions of operational performance are positive and significant in Ethiopian MRO, this result is similar with Huo (2012) and Zhao, Huo and Zhao (2013) even if the later study included related risks within the supply network. The independent variables; supplier, internal and customer integrations are positively and significantly related each other, and also with the dimensions of operational performance (dependent variables). In other hand, dimensions of dependent variables; cost, quality and time are positively and significantly related each other, and also with individual variables of supply chain integration (independent variables). The regression analysis shows that supply chain integration positively and significantly affects the operational performance of Ethiopian MRO. This implies the effect of supply chain integration practice in Ethiopian MRO on its operational performance.

5.4. Recommendations

In reference to the study results, conclusions and questions of the research, the following recommendations are proposed:

5.4.1. Recommendations for Practice

The outcome of the research expected to be a reference for directors, managers, supply chain employees, officers and experts, technical experts and supervisors of Ethiopian Airlines Group, specifically to Ethiopian MRO as an organization. In which directly or indirectly involved in activities related with supply chain integration to realize the intended business result or operational performance. The recommendation makes all concerned to consider dimensions of decision making excellence which are people, process and technology helps to deal with processes, moreover to achieve the objectives of the organization.

In reference to the findings of the study and conclusions, the researcher forwarded the following recommendations in order to address research objectives and questions.

The following recommendations forwarded to answer the research question: 'What is the effect of supplier integration on operational performance at Ethiopian MRO?'

- Ethiopian MRO required to improve supplier relationship management through digitalization, timely payment, and detail agreement/contract as a part of supplier integration. In today's business environment especially in MRO industry where a monopolistic market is involved, relationship with suppliers is the most valuable connection given that can make everything's easy in a supply network, therefore, Ethiopian MRO suggested to invest and acquire digital platform enable to keep the entire information about suppliers in one place.
- Ethiopian MRO required to handle payments in a timely manner as a reliable customer to its suppliers that potentially improve supplier relationship management, in other way detail justification with a planned payment date needed to be provided in case of failure to make a payment in the intended period of time.

- Ethiopian MRO suggested to improve contract management as a part of supplier relationship management process through clear obligations, terms and conditions that helps to avoid issues that may end up with misunderstanding and disputes.
- Ethiopian MRO required to improve on surplus and excess stock reduction through collaboration with suppliers with the help of integrated automated system that can allow vendor stock management and re-buy mechanisms.
- Ethiopian MRO suggested to improve reduction of non-standard maintenance service and rework through collaboration with suppliers, original equipment manufacturers, other potential MROs, regulators and concerned stakeholder so as to improve the quality of maintenance works that will support to reduce complaints and audit related issues.

The following recommendations forwarded to answer the research question: 'What is the effect of internal integration on operational performance at Ethiopian MRO?'

- Ethiopian MRO suggested to improve inter departmental relationship that enables to increase the level of collaboration among employees across the value chain through information sharing, discussion and coordination in consideration with the common objective of Ethiopian MRO. In this case, the process improvement tool ACE together with ERP and other systems needed to be used towards the improvement of internal integration and problem solving process.
- Ethiopian MRO required to improve reduction of penalty fee of past due invoices, late return of exchanged and loaned units through internal collaboration in handling on time return and timely settlement of payments.
- Ethiopian MRO suggested to improve in providing valuable information with justification to suppliers and providers of loan unit with the newly planned date in the case of failure to return exchanged/loaned unit and failure to settle payments in a timely manner. The cooperation across the value chain and the process must be monitored and warrants quick solution and continuous improvement.
- Ethiopian MRO suggested to reduce surplus and excess stock through inter functional coordination in having improved information flow that enables to address the cause of the issues in a timely manner. Similarly, Ethiopian MRO required to reduce wastage and disposal cost

through improved and efficient inventory management that can ensure optimum quantity at the right time to the right schedule.

- Ethiopian MRO required to improve the reduction of non-standard maintenance service and rework through improvement in handling maintenance work according to the procedure manuals. Most importantly, it requires training, benchmarking, knowledge sharing and ethical consideration in collaboration with departments so as to improve the quality of maintenance works that will support to reduce complaints and audit related issues.
- Ethiopian MRO required to improve on reduction of workmanship defect in having advanced training, benchmarking and experience sharing that warrants the reduction of defective rate which potentially become the cause of massive cost.
- Ethiopian MRO suggested to improve on-time performance that becomes an end result of strong cooperation across the value chain that should be improved through efficient and effective information flow, scheduling, coordination among the concerned stakeholders and timely delivery of required resources. Ethiopian MRO needed to improve turnaround time by using proper technology, streamlining the process and through advanced training and experience sharing.
- Ethiopian MRO required to improve on reduction of unserviceable components that are waiting for parts in having cross functional collaboration with regards smooth and a timely flow of information, which facilitates faster delivery of required piece parts, tools and materials that enable to make it serviceable and ready for use.

The following recommendations forwarded to answer the research question: 'What is the effect of customer integration on operational performance at Ethiopian MRO?'

- Ethiopian MRO suggested to improve customer relationship management in having clear contract that can be a base line of the relationship, and also regular meetings considered as a part of customer integration.
- Ethiopian MRO required to have regular meetings with customer to review business related issues, scheduling a meetings enable to identify, discuss and solve the potential concerns can affect the relationship. Therefore, periodic meeting with customer can reduce cost through

discussion of potential areas of savings, improve quality based on valuable feedback, and improve time as a result of proactive actions.

- Ethiopian MRO required to reduce surplus and excess stock through collaboration with customer in having proactively planned requirement which warrants inventory reduction through vendor stocking management.
- Ethiopian MRO suggested to improve in handling timely payments and core/tools return as a reliable customer to its suppliers. ET-MRO extended the services found from its suppliers to its customers, such as component exchange performance and longer payments terms. This is therefore integration with customers in having the right information about payments and return related issues enable the MRO to deal with its suppliers for smooth relationship.
- Ethiopian MRO required to improve on-time performance through integration with customers in having proactive information and scheduling required to allocate resources.

As stated above, recommendations forwarded in line with specific research question, which were divided based on categories of supply chain integration. The one recommendation can be handled through the other integrations since the solution in a supply chain can be made in an integrated and networked way of doing things.

The following recommendations are general and forwarded to address the general objective of the research, which intended to study the effect of supply chain integration on operational performance at Ethiopian MRO.

- Ethiopian MRO suggested to improve the relationship among the three variables of supply chain integration altogether since all of them are strongly interconnected toward the operational performance. Supply chain integration ensures the flow of information, materials, finances and technology from point of origin to destination with the purpose of providing value added product or services to the end customer. Therefore, Ethiopian MRO required to improve integrations among the players in the supply chain network in order to secure cost effective quality produce and services in a timely manner.
- Ethiopian MRO suggested to improve on reduction of premature failure of components which considered as the cause of the higher removal rate through strong collaboration among functional

units, and also with customers and suppliers to secure valuable technical support based on industry experience that empowers to identify the root cause of the failure in a timely manner helps to ensure continuous improvement.

The recommendations forwarded above with the intention of solving the problems identified in which the MRO enable to improve its operational performance.

5.4.2. Recommendations for Future Study

The following suggestions forwarded to be considered in future studies in consideration with the limitation of the research:

- This research has been worked out in the case of MRO business unit, therefore, it's advisable to study supply chain integration in other business units of Ethiopian Airlines Group, and even in another organization.
- It's advisable to study the same topic in the same company to evaluate the improvement level of the recommended areas.
- The study used three categories of supply chain integration, which are supplier, internal and customer integrations, therefore, it's advisable to study by including other categories and environmental impacts.
- The study considered first tier integrations, and it's advised to study by including extended tiers, if possible, end-to-end supply chain integration.
- The study applied three dimensions of operational performance, which are cost, quality and time, therefore, it's advisable to study by including other dimension and environmental impacts.
- The study collected data from employees of Ethiopian-MRO, it's advisable to collect data from other parties that involve or affect the supply chain network, more advisable in having data from customers and suppliers have been involved in the supply chain network.
- The study used the data collected from employees to analyze the result, it's advisable to extend source of having data including secondary data to deal with the result found from individual perceptions.

REFERENCES

Abdurazak, M., Berhanu, D. and Matiwos E. (2014). Research Methods. Addis Ababa University School of Commerce, Ethiopia.

Aitken, J., Christopher, M., and Towill, D. (2002). Understanding, Implementing and Exploiting Agility and Leanness. International Journal of Logistics, vol. 5, no. 1, pp. 59-74.

Alam, A., Kim, B., Mitra, C. and Seabra, F. (2014). The mediating effect of logistics integration on operational performance. The International Journal of Logistics Management, vol. 25, no. 3, pp. 553-580.

Andinet G. (2018). The role of MRO supply chain integration and inventory management in flight dispatch reliability.

Asrat A. (2017). The role of strategic sourcing in operational performance of organization.

Birech, K. (2011). The effect of performance contracting on the performance of state corporations in the energy sector in Kenya.

Bowersox, D., Closs, D. and Stank, T. (1999). 21st Century logistics of Making Supply Chain Integration a reality. Council of logistics management, USA.

Cagliano, R., Caniato, F., and Spina, G. (2006). The Linkage between Supply Chain Integration and Manufacturing Improvement Programs. International Journal for Operations and Production Management, vol. 26, no. 3, pp. 282-299.

Charenet T. (2018). The role of achieving competitive excellence operating system implementation on company's internal supply chain integration.

Chris, (2016). Strategy versus operation and their difference. [online] Available at: https://cmoe.com/strategyvs-operations-understanding-the-difference/ [Accessed 04 January 2020].

Chopra, S. and Meindl, P. (2007). Supply chain management: Strategy, Planning and Operation. 3rd ed. Printice-Hall, New Jersey.

Cirtita, H. and Segura, D. (2012). Measuring downstream operational performance. Journal of Manufacturing Technology Management, Vol. 23, no. 3, pp. 299- 314.

Cooper and Schindler (2006). Business Research Method.

Creswell, J. (2003). Research design, 2nd ed. Quantitative, qualitative and mixed approaches, Thousand Oaks: Sage publication, Inc.

Daniel, A. and Shambachew, O. (2015). The Effect of Supply Chain Integration on Operational Performance: The Case of Chemical Industry in Ethiopia: European Journal of Business and Management, vol. 7, no. 28, pp. 25.

Darli, R. and Paula, L. (2016). Fundamentals and Strategies of MRO: Overview of Aeronautical Industry. International Journal of Computer Applications, vol. 135, no. 12, pp. 21.

Devaraj, S., Wei, J. and Krajewski, L. (2007). Impact of e-Business technologies on operational performance. The role of information integration for production in the supply chain. Journal of Operations Management, no. 25, pp. 1199-1216.

Fawcett, S., Magnan, G., Brau, J. and McCarter, M. (2007). Information sharing and supply chain performance. An International Journal, Vol. 12, no. 7, pp. 358-368.

Flynn, B., Huo, B. and Zhao, X. (2010). The impact of supply chain integration on performance: Journal of Operations Management, vol. 28, no. 1, pp. 58-71.

Forslund, H. and Jonsson, P. (2009). Obstacles to supply chain integration of the performance management process. International Journal of Operations Management, vol. 29, pp. 77-95.

Frohlich, M. and Westbrook, R. (2001). Arcs of integration, an international study of supply chain strategies: Journal of Operations Management, vol. 19, no. 2, pp. 185-200.

Gimenez, C., Vaart, T. and Donk, D. (2011). Supply chain integration and performance: the moderating effect of supply complexity. Supply Chain Management: An International Journal, vol. 17, no. 6, pp. 596-610.

George, D. & Mallery, P. (2003). Reliability test: A simple guide and reference.

Grad (2011). A primer on the validity of assessment instruments, vol. 3, no. 2, pp. 119-120.

Hamad, Z. (2013). The impact of supply chain integration on organizational performance and the role of environmental turbulence: An empirical study on food industry firms in Jordan. Middle East University, pp. 1-160.

Handfield, R. and Nichols, E. (1999). Introduction to Supply Chain Management. Prentice Hall: NJ, Harrington.

Monthly Activity Report, (2019). [online] Available at: http://portal.ethiopianmro.com/Ops/MRO.aspx [Accessed 09 January 2020].

Huo, B. (2012). The impact of supply chain integration on company performance: an organizational capability perspective. Supply Chain Management: An International Journal, vol. 17, no. 6, pp. 596-610.

Jingyao, G. (2015). Efficient aircraft spare parts inventory management under demand uncertainty. Journal of Air Transport. [online] Available at: http://scholar.uwindsor.ca/odettepub/96/ [Accessed 04 January 2020].

Jr, K., Whitten, D. and Inman, R. (2008). The impact of aligning marketing strategies throughout the supply chain. Center of Business and Economic Development at Sam Houston State University, pp. 1-16.

Juran, M. and Godfery, A. (1998). Juran's Quality Handbook. 5th ed. McGraw-Hill, New York.

Kahn, K. and Mentzer, J. (1998). Marketing's Integration with Other Departments, Journal of Business Research, vo. 42, no. 1, pp. 53-62.

Kenneth L. and Brian F. (2016). Procurement and Supply Chain Management. 9th ed. Pearson Education Limited, Edinburgh Gate, UK.

Kim, S. (2006). The effect of supply chain integration on the alignment between corporate competitive capability and supply chain operational capability. International Journal of Operations Management, Vol. 26, no. 10, 10841107.

Kombo and Tromp (2006). The Extent of E-Commerce Adoption among Small and Medium Enterprises in Nairobi, Kenya.

Kothari, C. (2004). Research Methodology. 2nd ed. Methods and Techniques: New Age International Publishers, New Delhi.

Krajewski, L., Ritzman, L. and Malhorta, M. (2013). Operation Management: Processes and Supply Chain. 10th ed. Pearson Education Limited, England.

Larson and Rogers (1998). Supply Chain Management, Definition and Approaches, University of Nevada, Reno, USA.

Leedy, P. and Ormrod, J. (2005). Practical Research: Planning and Design, Prentice Hall, Upper Saddle River.

Mugenda, O. and Mugenda, A. (2003). Research methods: quantitative and qualitative approaches. African Centre for Technology Studies, Nairobi.

Neely, A., Gregory, M. and Platts, K. (2005). Performance measurement system design, International Journal of Operation and Production Management, vol. 25, no. 12, pp. 1228-1263.

Paulraj, A. and Chen, I. (2007). Strategic buyer-supplier relationships, information technology and external logistics integration. Journal of Supply Chain Management, vol. 43, no. 2, pp. 2–14

Peterson, K., Handfield, R. and Ragatz, G. (2005). Supplier integration into new product development: Journal of Operations Management, no. 23, pp. 371-388.

Power, D. (2005). Supply Chain Management Integration and Implementation, Supply Chain Management: An International Journal, vol. 10, no. 4, pp. 252-263.

Public Communication, (2018). Ethiopian Fact Sheet, Ethiopian Airlines Group.

Rosenzweig, E., Roth, A., and Jr, D. (2002). The influence of an integration strategy on competitive capabilities and business performance, no. 21, pp. 437-456.

Schreuder, H., Gregoire, T., and Wood, G. (1993). Sampling Methods for Multisource Inventory: J. Wiley & Sons, Inc., New York, pp. 446.

Solutions of ERP Oodles, (2019). Supply Chain Management in the Aviation Industry. [online] Available at: https://medium.com/@aditi.dutt/supply-chain-management-in-the-aviation-industry-f7829ac29348 [Accessed 18 January 2020].

Fawcett, S., Ogden, J., and Ellram, L. (2007). Supply Chain Management: From Vision to Implementation, Pearson Education, Inc., Upper Saddle River, New Jersey.

Stank, T., Keller, S., and Closs, D. (2001). Performance benefits of supply chain integration. Transportation Journal, vol. 41, no. 2, pp. 31-46.

Tharenou, R. & Lamp, B. (2007). Management research methods, Cambridge University Press. [online] Available at: https://doi.org/10.1017/CBO9780511810527 [Accessed 04 January 2020].

UKEssays, (2018). Importance of Integration within a Supply Chain Business Essay. [online] Available at: https://www.ukessays.com/essays/business/importance-of-integration-within-a-supply-chain-business-essay.php?vref=1 [Accessed 11 January 2020].

Vaidya, M. and Hudnurkar, M. (2012). Multi-criteria operational performance evaluation. International Journal of Productivity Management, vol. 62, no. 3, pp. 293- 316.

Vanichchinchai, A. (2014). Supply chain management, supply performance and total quality management. International Journal of Organizational Analysis, vol. 22, no. 2, pp. 126-148.

Vieira, D. and Loures, P. (2016). MRO Fundamentals and Strategies: The overview of Aeronautical Industry.

Wheelen, T. and Hunger, J. (2012). Strategic Management and Business Policy. 13th ed. Pearson Education, Inc. New Jersey, USA, pp. 231-236.

White, G. (1996). A survey and taxonomy of strategy-related performance measures for manufacturing. International Journal, vol. 16, no. 3, pp. 42–61.

Zedekia, G. (2008). Supply Chain Performance Measurement: Kenya Airways Ltd, Kenya

Zelbst, P., Jr, K. and Sower, V. (2009). Impact of supply chain linkages on operational performance. Industrial Management & Data Systems, vol. 109, no. 5, pp. 665-682.

Zhang, M., and Huo, B. (2012). The impact of dependence and trust on supply chain integration. International Journal of Physical Distribution & Logistics Management, vol. 43, no. 7, pp. 544-563.

Zhao, L., Huo, B., and Zhao, X. (2013). The impact of supply chain risk on supply chain integration and company performance: a global investigation. Supply Chain Management: An International Journal, vol. 18, no. 2, pp. 115-131.

Zhao, X., Huo, B., Selen, W., and Yeung, J. (2011). The impact of internal integration and relationship commitment on external integration. Journal of Operations Management, vol. 29, no. 1/2, pp. 17-32.

APPENDICES

Appendix A: Letter of Request

I am postgraduate student in Addis Ababa University School of Commerce (AAUSC) and currently undertaking a research study to fulfill the requirement of the MA in Logistics and Supply Chain Management on **The Effect of Supply Chain Integration on Operational Performance in the case of Ethiopian MRO**.

I would like to inform you that you are in an ideal position and selected to participate in this attractive study as an Aviation/MRO professional to give us valuable first-hand, truthful and complete information from your experience in Ethiopian Airlines - MRO. Responses to the questions will be treated with extreme confidentiality and privacy as they will be used solely for the study.

The study will only be used for academic research and you are required to participate voluntarily. Kindly please spare a few minutes to complete the questionnaire attached.

Thank you for your co-operation in advance.

Yours Sincerely,

Asnake Atnafie,
Researcher

Appendix B: Questionnaire & Semi-structured Interview

This questionnaire is divided into three sections. **Section A** will be used to obtain general information about the respondent. **Section B** will be used to obtain information about categories of supply chain integration and dimension on operational performance. **Section C** will be the interview question to obtain general information about practice of supply chain integration and its effect on operational performance.

Section A: Demographic Data

1. What is your gender?
    i. Male ( )
    ii. Female ( )

2. What is your age (years)?
    i. Between 23-35 ( )
    ii. Between 36-45 ( )
    iii. Between 46-55 ( )
    iv. Above 55 ( )

3. What is your highest level of education?
    i. PhD ( )
    ii. Masters ( )
    iii. Bachelors ( )
    iv. Higher Diploma ( )
    v. Diploma ( )
    vi. Certificate ( )
    vii. Other, please specify _____

4. How long have you been working in this organization?
    i. Less than or equal to 5 years ( )
    ii. Between 6 to 10 years ( )

iii. Between 11 to 15 years ( )

iv. Between 16 to 20 years ( )

v. Above 20 years ( )

5. What is your position/seniority/expertise level in this organization?

   i. Junior ( )

   ii. Senior ( )

   iii. Expert ( )

   iv. Management member ( )

Section B:

1. **The following questions are objective about the practice of supply chain integration and its effect on operational performance of ET-MRO. Please answer the questions based on actual and current situation and not on beliefs.**

Use the following scale to rate your answer:

Scale 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree based on how you feel about the statement and use the "√" mark to answer accordingly.

Supply Chain Integration Practice	**Scale**				
Supplier Integration	1	2	3	4	5
ET-MRO shares information with suppliers through electronic network					
ET-MRO has built partnership with suppliers/supplier relationship management					
ET-MRO is working with suppliers through clear obligation/contracts					
Suppliers of ET-MRO devoted to the essential specifications/quality compliance					
ET-MRO is holding regular meetings with suppliers to review the business matters					
Internal Integration	1	2	3	4	5
ET-MRO is constantly determined to unify its culture with stakeholders (mission and vision)					

ET-MRO involves different departments/sections during the preparation of strategic plan and execution					
ET-MRO uses MRP system (SAP & Maintenix) to harmonize forecasting, requisitions, procurement, maintenance and service sales					
ET-MRO allow coordination among employees/departments to participate in problem solving					
ET-MRO holds regular training programs to develop employees competencies					
Customer Integration	1	2	3	4	5
ET-MRO pursued to achieve customer satisfaction					
ET-MRO has built partnership with customer					
ET-MRO has specialized department dedicated to customer support and relationship management					
ET-MRO is holding regular meetings with customers to review the business matters					
ET-MRO is working with customers through clear obligation/contracts					
Dimensions of Operational Performance	**Scale**				
Cost	1	2	3	4	5
ET-MRO has increased market share and revenue					
ET-MRO has reduced direct maintenance cost					
ET-MRO has reduced wastage and disposal cost					
ET-MRO has reduced inventory holding and surplus stock (vendor stock management and re-buy)					
ET-MRO has reduced expedite fee for critical part and tools requirement					
ET-MRO has reduced penalty fee for late core return of exchanged and loan units					
ET-MRO has reduced penalty fee of past due invoices					
Quality	1	2	3	4	5
ET-MRO has reduced workmanship defect					
ET-MRO has reduced non-standard maintenance service and rework					
ET-MRO has improved reliability and dependability					
ET-MRO has reduced removal rate and premature failure of components					
ET-MRO has reduced complain and safety audit issues					

Time	1	2	3	4	5
ET-MRO has shorten turnaround time (TAT)					
ET-MRO has improved maintenance on time performance (OTP)					
ET-MRO has shorten aircraft hard grounding time					
ET-MRO has shorten time of components waiting for parts					
ET-MRO has improved core return time of exchanged and loan units					
ET-MRO has improved payment processing time					

2. **The following questions are subjective about the practice of supply chain integration and its effect on operational performance of ET-MRO. Please answer the questions based on actual and current situation and not on beliefs.**

1) What are the benefits of Supplier Integration towards the operational performance of Ethiopian MRO in consideration with the three constructs of operational performance, which are cost, quality and time?

_____

_____

_____

_____

2) What are the benefits of Internal Integration towards the operational performance of Ethiopian MRO in consideration with the three constructs of operational performance, which are cost, quality and time?

_____

_____

_____

_____

3) What are the benefits of Customer Integration towards the operational performance of Ethiopian MRO in consideration with the three constructs of operational performance, which are cost, quality and time?

Section C: Interview Questions

1. Please state the level of supply chain integration practice and its effect on the operational performance of Ethiopian MRO in terms of cost, quality and time. Please provide by using the following three categories of supply chain integration:

    i. Supplier Integration
    ii. Internal Integration
    iii. Customer Integration

2. Please identify major gaps which you are observing in your day to day activities related with the practice of supply chain integration and its effect on operational performance of Ethiopian MRO in terms of cost, quality and time, and state based on the following three categories of supply chain integration:

    i. Supplier Integration
    ii. Internal Integration
    iii. Customer Integration

Thank you for your time,