The Effect of Supply Chain Agility Practice on Operational Performance: the case of Ethiopian Airlines Maintenance, Repair and Overhaul Unit (ET-MRO)

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THE EFFECT OF SUPPLY CHAIN AGILITY ON OPERATIONAL PERFORMANCE: THE CASE OF ETHIOPIAN AIRLINES MAINTENANCE, REPAIR AND OVERHAUL UNIT (ET-MRO)

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DECLARATION

I hereby declare that this thesis entitled: The effect of supply chain agility on operational performance: the case of Ethiopian Airlines Maintenance, Repair and Overhaul Unit (ET-MRO) which is submitted by me for the partial fulfillment of the degree of masters of art in Logistics and Supply Chain Management to the Addis Ababa university school of commerce is my own original work and has not been submitted earlier either to Addis Ababa university or to any other institution for the fulfillment of the requirement for any course of study. I also declare that no chapter of this manuscript in completely or in partial is lifted and incorporated in this report from any earlier work done by others or me.

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CERTIFICATE

This is to certify that this thesis is prepared by Bizunesh Zeleke a student of masters of art in logistics and supply chain management had been working under my supervision and guidance for his project entitled: The effect of supply chain agility on operational performance: the case of Ethiopian Airlines Maintenance, Repair and Overhaul Unit (ET-MRO). She is submitting her genuine and original work and complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

Advisory: Teklegiorgis Assefa (Ass. Professor)

Date: January 2021

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Signature:____

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Stay safe from COVID-19 pandemic!

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ACRONYMS AND ABBREVIATIONS

ETG: Ethiopian Airlines Group

MRO: Maintenance Repair and Overhaul

OTP: On Time Performance

PSCM: Procurement and Supply Chain Management

TAT: Turnaround time

ABSTRACT

In most researches related to Supply Chain Management, it is concluded that efficient supply chain management is basic key factor for the success of a company's operational performance. Even though different studies are conducted on the areas of supply chain management in relation to company's operational performance, much is not done on Supply chain agility and company's operational performance particularly in the area of Ethiopian Airlines, Maintenance, Repair and Overhaul (MRO) unit. Thus, this paper examined the effect of supply chain agility on operational performance of Ethiopian Airlines exclusively on Maintenance, Repair and Overhaul (ET- MRO) unit. ET-MRO is a core unit to Ethiopian Airlines Group giving all required MRO service to the Airline as well is a major profit center for Ethiopian Airlines Group (ETG) by selling MRO services to third party Airlines. The study used the most common dimensions of supply chain Agility i.e. Alertness, accessibility, decisiveness, swiftness and flexibility as an ***independent variable*** *and the three important operational performance indicators which are* ***Time****,* ***Cost*** *and* ***Quality*** *as a dependent variable to examine and answer the research objective and questions.* The survey of the study is based on 150 filled questionnaires and 6 interview results from *a sample size of 204 employees from the purposive target population of 290 employees with 95% confidence interval and 0.05 error margin employing Taro Yamane, (1967), simplified formula. Questionnaire and interview that are adopted from previous related studies were used to gather primary data and the company's source like reports, portals etc. are used to gather secondary data. Descriptive and Explanatory research design is employed and the approach was mixed type i.e. Qualitative and Quantitative. Multiple linear regression model was applied to test the association between the independent and dependent variable. The study shows that Ethiopian MRO had adopted Supply Chain Agility practices (Alertness, Accessibility, Decisiveness, Swiftness and flexibility) to a small extent. Besides, the study indicates that Supply Chain Agility practices of the organization have positive and significant effect on the Ethiopian MRO overall operational performance.*

Key words*: Supply Chain Agility, Alertness, Accessibility, decisiveness, swiftness, flexibility, Maintenance Repair and Overhaul (MRO) and Operational Performance*

CHAPTER ONE

INTRODUCTION

The introduction chapter of this study covered background of the study, statement of the problem, objectives of the study, research questions, significance of the study, scope of the study, definition of key terms and organization of the study.

1.1 BACKGROUND OF THE STUDY

A supply chain is a network that includes different activities, people entities, information and resources, between a company and its suppliers to produce and distribute a specific product to the final user. The supply chain characterizes the phases it takes to get the product or service from its original state to the final user. (Will Kenton, 2020)

Currently most business enterprises are forced to give more attention and invest more on the relationship with customers and suppliers due to the current global markets fierce completion, introduction of short life cycle products and the intensified customer's expectation (Simchi-Levi, 2000). Since 1990s Supply Chain Management (SCM) has become part of the senior management agenda. Executives are convinced that the ultimate success of the single enterprise is determined by the successful coordination, integration and management of key business processes across members of the supply chain (Van der Vorst, 2000). According to Christopher (1998) businesses can compete as a supply chains and no longer compete as exclusively independent entities.

On a conference paper published in 2010 (Rouis and Sana), it is stated that Supply Chain Management (SCM) has become a fruitful approach that efficiently associates partnersx alongside a commercial procedure. Supply Chain Management warrants effective cost and time management within the process streams and has become common in a wide range of industries. Technology within the Supply Chain Management system lets the system to be flexible yet agile, giving a quick response time at the same time, a very vital feature during this day and age.

Supply chain agility is a company's ability to efficiently and cost-effectively respond to external market fluctuations. The changes are complex and interconnected, linking everything from development in consumer preferences to competitor interruption to wider economic and market unpredictability (Source: https://www.fdm4.com/supply-chain-agility/, accessed on Jan 2, 2021)

Ability to move quickly and easily is a necessary characteristic in most circumstances particularly in supply chain. Supply chain role is not only to ensure that enterprises has the proper raw material supplies to produce final product but also to ensure that the enterprise is agile enough to meet customer demands in a cost-effective way.

As indicted on the article, The five dimensions of supply chain agility, written by David M. Gligor, 2015, Different studies suggest that the common supply chain agility dimensions are alertness, accessibility, decisiveness, swiftness, and flexibility. An enterprise's ability that must be developed to achieve the required level of agility is represented by those five dimensions. Supply chain agility represents a company's promptness to encounter fluctuations in the face of aggregate demand volatility (source: John Hughes post on https://www.silvon.com/blog/supply-chain-agility/ accessed on Jan 2, 2020)

Operational performance describes the quantifiable aspects of the outcomes of a company's processes, such as reliability, production cycle time, and inventory turns. Operational performance consecutively affects business performance processes such as market share and customer satisfaction (Voss, Åhlström, & Blackmon, 1997). Supply chain Agility can be a vital requisite to address responsiveness matters to develop business performance in a speedily varying environment with a high levels of customization. (Juneho Um, 2017).

As mentioned on the article, Everything MRO, written by Pravin Vazirani, Maintenance, Repair, Overhaul (MRO) in aviation is the repair, service, or inspection of an aircraft or aircraft component. It is fundamentally all of the preservation activities that take place to safeguard wellbeing and airworthiness of all Airplanes by international ethics. Commercial **aircraft** maintenance, repair and overhaul (**MRO**) is a vital obligation to safeguard

that **aircraft** are conserved in pre-determined situations of safety to safely transport travelers and freight.

The Global Commercial Aircraft Market 2018-2028 states "The global commercial aircraft market, valued at just over US$191 billion in 2018, is expected to grow at a CAGR of about 2.9% to be valued at around US$255 billion by 2028. The cumulative market for global expenditure on commercial aircraft is valued at US$2.3 trillion over the forecast period."

As the aviation market increase it is obvious that supporting operations such as the Maintenance, Repair, and Overhaul (MRO) market will also get more demand and also face greater challenges to meet the persistent demands. Aircraft maintenance is firm to keeping up product availability, reliability, and quality. Maintenance and repair service organization is vital for Airline operators to certify safety and obedience with Airworthiness Commands. MRO operators and Airlines require agile supply chain with the aviation industry's thriving development to enable them optimize productivity and keep their operations to fulfill the required demand timely and in a cost effective manner

Ethiopian Airlines which usually referred as “Ethiopian” is the flag carrier of Ethiopia. Ethiopian Airlines is founded in December 21, 1945 and commencing operation on April 08, 1946. Ethiopian Airlines if fully government owned Airline. Ethiopian Airlines Group consists of eight business units namely Ethiopian Airports, Ethiopian Skylight Hotel, In-flight catering, Ground Services, Maintenance, Repair and overhaul (MRO), Aviation Academy and Cargo.

Ethiopian has its own fully integrated, centralized, US- Federal Aviation Administration (FAA) approved MRO which will give all Maintenance, Repair and Overhauls services to the Airline as well as to third party (other Airlines) as a revenue generating business with a strategic goal of full airframe MRO services to all aircraft models owned by Ethiopian and other operators in terms of best turnaround time and quality maintenance in a cost effective manner.

Procurement and Supply Chain Management (PSCM) department supports Aircraft related and Non-Aircraft related material and service requirements. Ethiopian Airline Group has a centralized Procurement and Supply Chain Management (PSCM), which provides supply chain related services throughout the group. The department structured in a matrix organizational structure form in which administratively reports to the Chief Financial Officer for non-aircraft

related supply chain and functionally under the Managing Director of Maintenance, Repair and Overhaul for aircraft related supply chain requirement.

Procurement and Supply Chain department is responsible for activities such as planning, sourcing, procuring, Logistic management, warehousing, distributing, contract management and supplier relationship managements of all material and service requirements of the company including the MRO.

1.2 STATEMENT OF THE PROBLEM

Today's business environment is more volatile than ever, organizations have to conduct business within ever-increasing uncertainty of the market place (Tseng and Lin 2011, 3693). Customers have become more demanding as they seek lower prices, better quality and quicker delivery (Baharun, Yusoff and Anuar 2012, 275; Merschmann and Thonemann 2011, 43; Roberts and Grover 2012, 579; Tang and Tomlin 2008, 12). These external factors have pressured organizations to shorten product life cycles, adapt new technologies and increase product variety (Mershmann and Thonemann 2011, 43). Supply chain agility is critical for the survivability of an enterprise within these dynamic markets (Ganguly, Nilchiani and Farr 2009, 4100; Jain, Benyoucef and Deshmuk 2008, 6650; Rimiene 2011, 892).

While working with strategic partners, MRO providers need to be stay informed, agile and responsive in order to keep well-informed of changes in the aviation landscape. The future of MRO looks optimistic, and the potential for growth is significant. However, since today's aviation and aerospace industry supply chains are global, highly complex, and more vulnerable than ever, aviation companies have to be prepared and ready to adjust quickly to new demands. MRO providers can either win big or lose big. It all depends on how well their supply chain is agile (Viktoria Grokhovskaya, 2018)

As per the data found from 2020 annual internal performance evaluation of Ethiopian MRO, ET-MRO has shortcomings to give its service to the mother Airline as well as to the third party with the required time, cost and quality. According to the data found on the 2020 performance evaluation, ET-MRO has an extended Turnaround Time (TAT) of maintenance which creates

Aircraft shortage to the mother Airline and again affects its competitiveness to the third party revenue generating business. Repetitive extension of Aircraft Maintainance schedules due to extended procurement of parts process, longer lead time of make-to-order parts are also reported. There is also excess inventory of aircraft parts in surplus stores, in opposing shortage and/or stock out of the critical parts. Inaccurate information flow and Dynamic change in customer need is also reported as a major challenge.

As stated on the consecutive weekly performance review meeting of ET-MRO in 2020, Supply chain management affects the performance of ET-MRO significantly. Different theoretical literatures suggest that Supply Chain Agility is one of the most important attribute of effective and efficient supply chain management which will in turn significantly affects the organizations performance. Ethiopian MRO, as an organization, is believed to be affected by some challenges in supply chain Agility which significantly affects the organization performance in delivering the maintenance services to customers (Both Ethiopian Airline and other third party operators) which planned to be provided at the right time and quality in a cost effective manner. Considering the mentioned problems, it is worthy to do a research to assess the problems so as to find a solution.

While reviewing the research conducted particularly on Supply Chain Management and operational performance in Ethiopian Airlines Group, the following researches have been conducted.

Asrat Adamu (2017) assessed the role of strategic sourcing in operational performance of the organization and derived a conclusion that rationalization of supply base highly affects the operational performance of ET-MRO and followed by supplier relationships management, supply chain improvement, and contract management at the end. Daniel Baye (2017) observed the effects of inventory management practices on organizations operational performances and showed that organization has good infrastructure, IT technology and have support from the management. However, demand uncertainty, inefficient internal process and Lack of awareness are the challenges in implementing the inventory management practice in ET. As a result, of this inventory is not well managed in way that it improves the operational performance of the organization. Fasil Birru (2017) assessed the effect of strategic sourcing practice on operational efficiency and concluded that in order to overcome and be capable on the existing market

leadership challenge that Ethiopian Airlines is facing, working on and improving the level of strategic sourcing practice will enable the Airline to improve its internal operational efficiency and can be able to achieve its 15 years' strategic plan. Million Wondimu (2017) observed the role of maintenance repair overhaul supply chain management in an operational and organizational performance and revealed that SCM practice in ET-MRO facility affect both operational and SCM related organizational performances. Samuel Temesgen (2017) assessed effects of sourcing strategy on outbound logistics performance and concluded due to the fact that the misalignment between sourcing and outbound logistics sections, the later sections performance is highly affected and sequentially resulting in Ethiopian airlines paying 450,000 USD every year in the form of late return penalty. Andinet Girma (2018) examined the role of maintenance, repair and overhaul supply chain integration and inventory management in flight dispatch reliability and revealed that internal integration among MRO functions and external integration with suppliers are vital for the overall performance of Ethiopian MRO division and thereby improving flight dispatch reliability. In addition, currently the level of integration between component maintenance and line maintenance, schedule base maintenance and line maintenance needs high attention. Charenet Tesema (2018) evaluated the role of achieving competitive excellence operating system implementation on company's internal supply chain integration and concluded that the study signified a better understanding on the roles of operating tool called Achieving Competitive Excellence (ACE) on the company's internal supply chain integration. Asnake Atnafie (2019) assessed the Effects of Supply Chain Integration on Operational Performance – in the case of Ethiopian Airlines MRO and concluded that supplier integration, internal integration and customer integration are individually useful in predicting the operational performance of Ethiopian Maintenance, Repair and Overhaul which recommends that ET-MRO has to do more on supplier integration, internal integration and customer integration.

As can be concluded from the above, most of the studies do not focus on effects of supply chain Agility on operational performance of Ethiopian MRO. Although all the given researchers conducted a study in the area of supply chain management, the problems still occur as shown on the 2020 annual performance evaluation of ET-MRO and recent weekly performance review meetings and thought that it's vital to make further study. This study emphasis on effects of

supply chain Agility Practice on operational performance of Ethiopian Airlines MRO so as to assess the root causes of the problem and get the problem rectified.

1.3 RESEARCH QUESTIONS

The purpose of this study is to deliver the best potential responses to the following questions:

1. How Supply Chain Agility is being practiced in Ethiopian Airlines Group MRO?
2. How Alertness affects Ethiopian MRO overall operational performance?
3. How Accessibility affects Ethiopian MRO overall operational performance?
4. How Decisiveness affects Ethiopian MRO overall operational performance?
5. How Swiftness affects Ethiopian MRO overall operational performance?
6. How Flexibility affects Ethiopian MRO overall operational performance?

1.4 RESEARCH OBJECTIVES

1.4.1 General Objective

The main purpose of this study is to assess the link between Supply Chain Agility practices and the Ethiopian Airlines Group MRO operational performance

1.4.2 Specific Objectives

The specific objectives of the study are:

1. To assess the Supply Chain Agility practices of the Ethiopian MRO.
2. To examine the effect of Alertness practices on the Ethiopian MRO operational performance.
3. To examine the effect of Accessibility practices on the Ethiopian MRO operational performance.
4. To examine the effect of Decisiveness practices on the Ethiopian MRO operational performance.
5. To examine the effect of Swiftness practices on the Ethiopian MRO operational performance.
6. To examine the effect of Flexibility practices on the Ethiopian MRO operational performance.

1.5 SIGNIFICANCE OF THE STUDY

This study will provide supportive information to all stakeholders mainly for Ethiopian Airlines MRO to develop standard operating procedure and process review for efficient and effective supply chain management. It will help the stakeholders to recognize the effects of internal supply chain agility. This study might be considered as initiative that discover the effect of supply chain agility on operational performance at Ethiopian MRO.

The findings from the study may particularly be useful in providing additional knowledge to existing and future organizations to understand the supply chain management practice of Ethiopian airlines. In addition, the findings will also help as a reference document to stakeholders in the supply chain management practice and academic institutions in their

endeavors to formulate work plan to meet the operational requirement. This study will also be significant in terms of providing the necessary resource in light of the possibility of future research projects that might be proposed or carried out in the same area.

1.6 SCOPE OF THE STUDY

The study will examine the experience of supply chain agility and its effect in Ethiopian Airlines specifically ET- MRO Unit. The study will focus on the five common dimension of supply chain agility i.e. alertness, accessibility, decisiveness, swiftness and flexibility as an independent variable and will be limited on the three operational performance indicators which are cost, quality and time as a dependent variable. The study will not consider operational disruptions caused by non-avoidable factors such as natural disaster, strike actions, crew logistics, civil unrest and other causes not related to mechanical and technical problems of the aircraft.

The study will consider Ethiopian MRO found in Ethiopian Airlines premises located at Bole International Airport, in Addis Ababa, Ethiopia.

1.7 LIMITATION OF THE STUDY

The study only examines the effect of supply chain agility on Ethiopian MRO in Ethiopian context and uses a purposive sampling procedure which will decreases the generalizability of the findings. Therefore, this study will not be generalizable to other industry and in other country. The study considers only the five dimension of Supply chain agility which are Alertness, Accessibility, Decisiveness, Swiftness and Flexibility and the three operational performance measures which are Time, Cost and Quality while there are other indictors/dimensions which might have an impact on the question under the study.

1.8 DEFINITION OF KEY TERMS

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

- **Supply Chain Management**: Is the plan and supervision of continuous, supplementary processes across organizational limits to come across the real desires of the end customer (Stanley Fawcett, Jeffrey Ogden & Lisa Ellram, 2007).
- **Supply Chain Agility**: - It is an enterprise's skill to efficiently and successfully respond to external market variations (John Cutsey, 2020)
- **Alertness:-** An Enterprise's skill to immediately detect deviations, opportunities, and threats (David M. Gligor, 2015)
- **Accessibility:-** An Enterprise's skill to immediately access the applicable data. The skill to immediately notice fluctuations, opportunities, and threats (David M. Gligor, 2015).
- **Decisiveness:**- An Enterprise's skill to make firm choices about how to act(David M. Gligor, 2015)
- **Swiftness:-** An Enterprise's skill to quickly instrument those choices (David M. Gligor, 2015)
- **Flexibility:-** An Enterprise's skill to adapt its range of supply chain strategies and processes to the extent needed to instrument its plan (David M. Gligor, 2015).
- **Operational Performance**: Group of principles and levels that are accepted and used by the organizations to achieve competitive advantage, customer satisfaction, and maximum level of profitability (Vanichchinchai, 2014). Time quality and cost will be used to measure the operational performance in this particular study.

- **Time (Speed)**: refers to the Supply time required by the to deliver the material and/or services to the client according to arranged/agreed schedule.
- **Quality**: Juran and Godfery (1998) defined quality as "those features of products which meets customer needs and thereby provide customer satisfaction". Therefore, in this study quality refers to quality of the maintenance service per the customer demand
- **Cost**: the study refers Total cost incurred in every stage of possession - cost incurred when completing the entire or specific activities and operations within supply chain to meet customers' request (Vanichchinchai 2014).
- **Maintenance Repair and Overhaul (MRO)**: MRO is an institute in the aviation industry that executes repairing, testing, modification and overhauling of aircraft, aircraft components, engines, airframe and determination of the condition of the aircraft (Pravin Vazirani, 2020).

- **Turnaround Time (TAT)**: In this study, the meaning of the word TAT is used to *refer "The total duration of time to return an aircraft or component from repair to service''*

1.9 ORGANIZATION OF THE STUDY

The study is arranged in five chapters. Chapter one deal with the introductory part which contains the background of the study and the organization, statement of the problem, research questions, research objectives, significance of the study, scope of the study, limitations of the study and definition of key terms. The 2nd chapter which is Literature Review focus on the review of related literature consisting of conceptual, theoretical, empirical and identified literature gaps and conceptual framework. Chapter three deals on research methodology parts i.e. the research approach, research design and sampling techniques employed. Chapter four discusses about data presentation, analysis and interpretation. The final chapter which is chapter five include summary of findings, conclusion and recommendations.

CHAPTER TWO

RELATED LITERATURE REVIEW

INTRODUCTION

Supply chain Agility and operational performance is defined by different writers in diverse ways. Each definition was linked according to the nature and objective of the study, industry, and associated with the where about of the organization. Supply chain agility is a company's skill to efficiently and cost-effectively react to external market variations. This chapter will generally deal on the theoretical, empirical and identified literature gaps exclusive to supply chain management practice and operational performance concepts to understand its theoretical background according to different international standards. The literature review of the prevailing research on the effect of supply chain agility on organizational performance will be discussed.

2.1 THEORETICAL LITERATURE REVIEW

Supply Chain Management has been interpreted by various researchers. Based on the relatively recent development of the supply chain literature, there has been much debate as to a specific SCM definition. According to Chopra and Meindl (2001), all phases involved directly or indirectly in fulfilling customer demand is incorporated in a supply chain. Sweeney (2007) stated that Supply Chain Management is the universal, planned organization of the customary business purpose and strategies across these business purposes within a specific firm and across business within the supply chain, for the determination of improving the long term performance of the specific firms and the entire supply chain. Krajewski, Ritzman and Malhotra (2007) defined Supply Chain Management consists of developing a strategy to organize, control and motivate the resources involved in the flow of services and materials within the supply chain.

According to Bozarth and Handfield (2008), Supply Chain Management is the dynamic management of supply chain events and associations in order to exploit customer value and attain a viable economical advantage. Kaminsky and Simchi-Levi (2008) defined Supply Chain

Management as a set of tactics applied to competently mix suppliers, manufacturers, warehouses, and stores, so that goods is produced and dispersed at the accurate quantity, to the accurate locations, and at the accurate time, in order to decrease system wide costs while fulfilling service level requests." For Wisner, Tan and Leong (2012), Supply chain management is the integration of trading partners' key business processes from initial raw material extraction to the final or end customer, including all intermediate processing, transportation and storage activities and final sale to the end product customer.

While analyzing the different definitions of SCM mentioned above, the definition of supply chain and supply chain management can be depicted as "supply chain is the stream of processes of moving goods from the customer order through the raw materials stage, supply, production, and distribution of products to the customer". Depending on the scope and category of merchandise produced, all enterprises have supply chains of variable steps. Managing the chain of events in this process is what is known as supply chain management. Effective management must take into account coordinating all the variable stapes of the chain as fast as possible given all without affecting the quality and customer satisfaction and keeping costs down". The major supply chain agents include the manufacturer, suppliers, transporters, warehouses, retailers, and customers. It is clear that supply chain management has a significant role to play and needs critical attention in the corporate setting. (Mihai Felea and Irina Albăstroiu, 2013)

2.1.1 The Concept of Supply Chain Agility

According to Sharifi and Zhang (2001), the concept of agility consists of two main factors: responding to changes and turning them into opportunities. Thus, agility is the level of response of a firm to a highly competitive environment that follows four basic principles: Customer loyalty, change in control and uncertainty, increased human resource abilities and participation for competition with others, have defined the supply chain agility as the capability in accordance with the rapid response to a changing environment in the market. Christopher believes that an agile supply chain must have distinctive features. Thus, agility can be described as "the managerial concept of responding to turbulent and dynamic markets and customer demands." In

fact, agility not only relates to relationships by responding to the customer but also associated with the exploitation and benefits from the changes (Sharif, Zhang 2001).

Developments in both agility and supply chain management have directed to the start of an agile supply chain. Still agility is widely accepted as an attractive approach for development, it is even considered as a basis for survival in certain business environments and the idea of creating an agile supply chain is considered as a logical step for the organization (Ismail, Sharifi 2006). Agility in a supply chain according to Ismail and Sharifi (2006) is the skill of the whole supply chain and its agents to rapidly organize with the systems and processes to meet the vibrant demands of the customers and market. The major emphasis is on applying business activities in system arrangements while taking into account the acceptable level of agility to act to variations in a way that, it is skilled of predicting variation and looking for developing chances. Bessant et al.'s (2002) reference model for agility development illustrated the knowledge base surrounding organizational agility dimensions, enablers, drivers and practices. The model pursues to explain behavioral routines across an organization's operational procedures and structures. The behavioral practices reached from scanning, strategic thinking and problem solving, to networking, structuring and continuous learning. Bessant et al.'s (2002) study also highlighted the complexity and multidimensional nature of agility development within and external to the organization.

Theoretically, the dimensions of agility have been constructed from a union of directly related factors such as: quickness, time and the rapid introduction of new products. If these dimensions are managed properly, organization's level of agility will be enhanced and will contribute to the organizations success during periods of turbulence (Zhang 2011).

The authors' review and analysis of the agility dimensions shows that these dimensions can be broadly categorized into change expectancy and change response. Change expectancy mentions an organization's ability to sense changes in the external environment, and how these changes affect the internal dynamics of the organization (Fayezi et al. 2015). Pro-activeness, responsiveness, and information system/technology contribute to the ability of organizations to sense and understand changes when dealing with their various stakeholders. Organizations that

implement a proactive posture with respect to these dimensions are able to reconfigure their resource, up-skill their labour, and develop new products and services in response to changes in their business environment (Lee 2004).

As indicted on the article, The five dimensions of supply chain agility, written by David M. Gligor, 2015, in most researches the major five dimensions of agility that are common to the supply chain world are alertness, accessibility, decisiveness, swiftness, and flexibility. The dimension characterizes an ability that firms must develop to attain the anticipated level of agility. Firms can improve their supply chain agility by using a self-assessment survey based on the mentioned five dimensions to determine where they fall on the agility spectrum, whether corrective actions are needed, and where to make those corrections (David M. Gligor, 2015).

Supply chain agility is demonstrated through firm's capability to quickly sense changes, opportunities, and threats (alertness); quickly access relevant data (accessibility); make firm decisions about how to act (decisiveness); quickly implement those decisions (swiftness); and adjust its range of supply chain schemes and actions to the extent needed to implement its strategy (flexibility).

According to John Cutsey, 2020, there are five key frameworks for minimizing uncertainties and owning a competitive Supply chain. He further described the five key frameworks as below:

Alertness: Alert organizations are those best sited to forecast industry changes, growth opportunities, upcoming disruptions and competitor threats. The more alert and aware an organization is to these realities, the quicker they can respond to shifts in product demand, material procurement, supplier trends, customer feedback, market pricing and much more.

Accessibility: Organizations cannot make changes in the dark. After spotting an emerging pattern or trend, those alert businesses must then have immediate access to specific industry data and relevant historical logs that all decision-makers can conveniently view, share and co-analyze.

Decisiveness: Decisive organizations are those that quickly and clearly translate noted industry shifts and the accompanying data into an action plan. In other words, it's the organization whose

leaders have the tools and ability to execute a quick process change then communicate the how and why of that change downstream. The most decisive organizations are often the ones with simplified or unified chains of command, sensibly reducing the number of touchpoints necessary to make a swift judgment call.

Swiftness: Swift companies implement their action plans quickly. There are little-to-no impediments when introducing a process change to relevant value chain functions, as well as few communication silos or enterprise technologies to reconfigure. The swifter changes are made, the more cost-effective the entire supply chain, and the more profitable your business.

Flexibility: Flexible organizations have the power and the buy-in to modify ongoing processes when new opportunities present themselves without disrupting the entire business. Those proficient in this dimension understand that action plans are bound to change, even ones initiated under a smooth, data-backed cycle fitting a value chain need at the time. In summary, organizations are not rigid, going at day-to-day operations based on sunk-cost fallacies of what worked in the past.

Amazon offers an example of a company that aims to achieve agility through the five elements discussed in the Five dimensions of Supply Chain Agility by David M. Gligor, 2015. In December 2013, the online retailer secured a patent for what it labeled "anticipatory shipping," which entails delivering products before customers click the "buy" button. The success of this method depends on the company being aware of any changes in customer behavior (alertness). It is based on anticipatory algorithms that take into account previous orders, product searches, wish lists, returns, shopping-cart contents, and even how long a prospective consumer's cursor hovers over specific products (accessibility). Based on the algorithms, Amazon may decide to proactively box and ship products it expects customers in a specific area will eventually order (decisiveness). The packages would then wait at a fulfillment center close to the customer's location until the actual orders arrive. For large apartment buildings, the package might be speculatively shipped to a physical address where a large number of tenants reside. The patent indicates that Amazon might even fill out partial street addresses or postal codes to position items closer to customers, and subsequently complete the shipping labels while in transit

(swiftness). When an order does not materialize, Amazon might consider offering discounts or converting unwanted deliveries into promotional gifts to build goodwill (flexibility).

These five dimensions are helpful not only for defining what supply chain agility is, but also for determining supply chain's level of agility. According to David M. Gligor, 2015, scoring high on one dimension but low on another can be equally problematic. For instance, if a company scores very high on the alertness dimension and low on accessibility, the company is skillful of quickly detecting changes in its environment but does not have the skill to quickly access relevant information to make informed decisions about how it should act in order to capitalize on those changes. The company might be very good in identifying new market requirements or sales opportunities in different regions but lacks the ability to quickly access relevant data that would allow it to develop its supply chain to capitalize on the newly identified opportunities. Thus, excelling in one category but lacking in another will negatively impact supply chain agility. For this reason, companies that desire a high degree of agility should aim for high scores across all five dimensions.

2.2.2 The Concept of Operational Performance

The idea of supply chain operational performance has been developed from supply chain tactic which came from overall business tactic (Chopra and Meindal (2007). Different Authors have examined supply chain performance from various varying angles. Wang, et. al. (2009) established supply chain performance procedures based on competence. Gimenez, et. al. (2011) considered incomes, distribution, quickness and conveyance costs as a performance measures. Vanichchinchai (2014), examined enterprise's supply performance that consisted of flexibility, cost, association and alertness.

Frohlich and Westbrook (2001) and Yu, et. al. (2001) discussed that removing non-added value events, reducing change of orders and speedy product movements influence organizations performance. Hult, et. al. (2002) cited that IT and process innovation can contribute considerably to operational performance. Shah (2009) stated that firms must identify the kind of trade-offs between customer services and costs. Shah (2009) stated that supply chain tactic should certify that supply chain delivers a greater importance to the client in a competent

manner. Zelbst, et. al. (2009) highlighted that firms accomplishment is governed by the achievement of supply chain in which the firms take part as a companion. Wheelen and Hunger (2012) studied Porter's competitive tactics (lower cost, focus and differentiation) and claimed that business tactic focuses on improving the competitive situation of a business unit's, products and/or services within a definite industry or market segment. Wheelen and Hunger (2012) indicated that supplier network resources have a significant impact on firm's performance.

Harrison and New (2002) pointed out the significance of operational performance metrics as a standard framework to measure operational performance that include internal and external organization links. The standards of performance assessment through cost, customer service, productivity, asset measurement, quality, time, innovativeness, price, flexibility/adaptability, ability to collaborate, supplier profile, and marketing measures (Vaidya and Hudnurkar, 2012).

Operational performance is measured by using various approaches and dimensions including issues of performance to schedule, preventive maintenance, productivity measures, lead-time measures, quality measures, inventory measures, utilization, time, speed, cost, efficiency and effectiveness (Birech, 2011). Whilst volatility in MRO market is present, also as important is the unpredictability inherent in the nature of MRO operations leading to stochastic tasks and this requires that the production system is flexible to meet customer demands without compromising on the other aspect of its competitive priorities which are cost, quality and delivery (Aitken et al., 2002). Time, quality and cost are considered as the most common parameters of performance measurement for MRO business in different studies (Aitken J, Christopher M. and Towil D., 2002)

Time (Speed) refers to supply time required by the firm to deliver the material and/or services to the client per the arranged calendar. White (1996) has proposed the perceived relative reliability, reliability relative to competitors, percentage on-time delivery, due date adherence, percentage increase in portion of delivery promises met. Percentage of orders with incorrect amount, schedule attainment, average delay, percentage reduction in lead time per product line, percentage improvements in output, percentage reduction in purchasing lead time and percentage reduction in average service turnaround per warranty claim as the measures of the delivery reliability.

According to Juran and Godfery (1998) quality mentions the characteristics of goods or services which satisfies customer needs so us to delight the client. Quality is the degree to which a commodity meets the requirements of the customer at the start of its life. (ISO 9000).

The third common parameters of operational performance which is cost refers to total cost of ownership incurred when concluding the complete or specific events and operations within supply chain so as to satisfy customer needs. According to Neely and Platts (2005) the measures of the cost performance have been recognized as manufacturing cost, value added cost, selling price, running cost and services cost.

The vital objective of managing supply chain is to deliver the goods or services at the accurate time and accurate quality with a least cost to the client, which is revealed by the client's fulfillment and the general organizational performance. (Mihai Felea and Irina Albăstroiu, 2013)

While working with strategic partners, MRO providers need to be stay informed, agile and responsive in order to keep well-informed of changes in the aviation landscape. The future of MRO looks optimistic, and the potential for growth is significant. However, since today's aviation and aerospace industry supply chains are global, highly complex, and more vulnerable than ever, aviation companies have to be prepared and ready to adjust quickly to new demands. MRO providers can either win big or lose big. It all depends on how well their supply chain is agile (Viktoria Grokhovskaya, 2018).

In the competitive context, successful companies either have a productivity advantage (or cost advantage) or value advantage, or a combination of these two (Christopher 1998, McKinnon 2001). Since agile supply chain is a persuasive tactic for development, and lean supply chain a pre-requisite for the formation of an agile supply chain, it is apparent that it is a strategy for competitive advantage (Ross, 1998). Agile supply chain is activated by "change" which is the only continuous thing in the business atmosphere. Moreover, relevant literature has shown that business victory can merely be achieved through active synchronization of all the member firms from corner to corner of the supply chain (Van Hoek, 2001) to shorten product life cycle and reduce product cost (Levary, 2000) as supply fluctuates more rapidly than ever before. Breaking through this challenge, it is necessary that organizations focus their effort upon achieving greater agility such

that it can respond in shorter time frames both in terms of volume change and variety change (Christopher, 2005). Agility is reflected as a dynamic factor for business achievement in difficult business settings as it allows competing firms to proficiently perform under time-to-market pressures. The key to the success of a firm is to align agile supply chain strategy to the difference strategy to meet the overall objective for competitive performance, hence competitive advantage. Therefore, agile supply chain is a strategy for competitive advantage. If a company is not agile, it can't do it, because customer expectations are never static (Intaher Marcus Ambe, 2010)

2.2 REVIEW OF EMPIRICAL STUDIES

In today's competitive era and business world, to bring operational efficiency in logistics processes has become a prime driver of competition in improving customers' service (Gligor, Holcomb, & Stank, 2013; Xiaomin & Yi, 2017). Agility plays a crucial role in supply chain management (SCM) that facilitates the operational activities due to its flexibility, alertness, and swiftness (Gligor, 2016; Gligor et al., 2013). Currently organizations experience an extreme pressure on how to improve operational efficiency by managing uncertainties in different supply chain stages. Such pressure may include during the introduction of new product, understanding customers' need, delivery of a product, product lifecycle, agitation from the shareholders for a higher return on investment (ROI), and during the development of manufacturing processes (Blome, Schoenherr, & Rexhausen, 2013). Agility is a flourishing concept that assists to promote all operations of the organizations, including logistic operations of supply chain management (Gligor, 2016; Gligor et al., 2013).

According to experts, time is a competitive weapon where supply chain agility facilitates the logistic operations to deliver the product in a timely manner (Chiadamrong & Tham, 2016; Christopher, 2000; Tarafdar & Qrunfleh, 2017). Supply chain agility is a market sensitive and consists of diverse networks, processes, and virtual supply chains (Christopher, 2000). The agility assists to bring a dynamic change in the operational activities (Dove, 2002; Mangan & Lalwani, 2016). According to Lee (2004), agility is known as a most significant component of the SCM. Over the past few decades, several researchers have categorized supply chain agility into unlike dimensions, including cognitive and physical dimension (Gligor et al., 2013). The concept of agility is entirely different relatively than effectiveness, efficiency, lean, and proactive

supply chains (Power, Sohal, & Rahman, 2001). According to Christopher (2000), there is a distinction between speed and agility where speed is concerned to meet customers' demand pertaining to shortened lead time. While agility is related to quick response on sudden customers' demand concerning to variety and volumes (Christopher, 2000). According to Power et al. (2001), agility in the supply chain operations can bring the positive outcomes for firms.

To deliver a timely product is a core competency of SCM which might be possible by integrating responsiveness and efficiency (Christopher, 2000; Lau & Wang, 2013). In contrast, Supply chain agility helps to improve organizational performance such as financial performance, operational performance, non-financial performance, and overall firms' performance (Blome et al., 2013; Chan, Ngai, & Moon, 2017; DeGroote & Marx, 2013; Gligor et al., 2013; Yusuf et al., 2014).

Daniel Baye (2017) examined the effects of inventory management practices on organizations operational performances and revealed that organization has good infrastructure, IT technology and have support from the management. However, demand uncertainty, inefficient internal process and Lack of awareness are the challenges in implementing the inventory management practice in ET. As a result, of this inventory is not well managed in way that it improves the operational performance of the organization. Asrat Adamu (2017) surveyed the role of strategic sourcing in operational performance of the organization and determined that rationalization of supply base highly affects the operational performance of ET-MRO followed by supplier relationships management, supply chain improvement, and contract management.

Andinet Girma (2018) observed the role of maintenance, repair and overhaul supply chain integration and inventory management in flight dispatch reliability. The study concluded that internal integration among MRO functions and external integration with suppliers are iportant for the overall performance of Ethiopian MRO division and thus improving flight dispatch of the Airline.

Charenet Tesema (2018) studied the role of achieving competitive excellence operating system application on enterprise's internal supply chain integration. The study indicated a better understanding on the roles of the operating tool on the company's internal supply chain integration.

Asnake Atnafie (2020) examined the result of supply chain integration on the operational performance of Ethiopian Maintenance, Repair and overall and found out that further improvement is required on Supplier integration, Internal Integration and customer integration to improve the operational performance of Ethiopian MRO to the required level.

2.3 IDENTIFIED LITERATURE GAP

From the reviewed studies, Kim (2006) observed the effect of supply chain integration on the alignment between corporate competitive capability and supply chain operational capability nevertheless the study didn't include external supply chain integration on operational performance. Fawcett, et. al. (2007) investigated information sharing and supply chain performance study the role of connectivity and willingness, intended at understanding the role of information technology to improve supply chain performance however the study didn't include means other than information involved in supply chain performance. Gwako Zedekia (2008) surveyed supply chain performance measurement in the aviation industry. The study emphasis on the Airline operator and didn't consider MRO and operational performance. Its main objective was to examine the challenges encountered in supply chain performance measurement. Huo (2012) surveyed the effect of supply chain integration on company performance while the focus was not on Aviation industry. Zhang and Huo, (2012) surveyed the effect of dependence and trust on supply chain integration, intended at examining the combined impact of dependency and trust in supply chain relationships on supply chain integration and financial performance nevertheless the study didn't consider the major measurements of operational performance. Zhao, et. al. (2013) surveyed the effect of supply chain risk on supply chain integration and company performance. The major objective of the study was to examine on global supply chain risk towards company performance in a global framework while supplier, internal, and customer integration affects the competitive performance, and customer satisfaction. Alam, et. al. (2014) observed the mediating effect of logistics integration on operational performance but didn't consider categories of supply chain integrations. Vanichchinchai, (2014) surveyed that supply chain management, supply performance and total quality management aimed at assessing the level of supply chain management practices, total quality management practice on firm's supply performance but didn't consider the overall dimensions of operational performance. Asrat Adamu (2017) studied the role of strategic sourcing in operational performance of the

organization and found out that rationalization of supply base highly affects the operational performance of Ethiopian MRO nevertheless the study didn't consider the categories of supply chain integrations in the direction of operational performance. Daniel Baye (2017) surveyed the impacts of inventory management practices on organizations operational performances but the research didn't consider categories of supply chain integrations in the direction of operational performance. Andinet Girma (2018) assessed the role of maintenance, repair and overhaul supply chain integration and inventory management in flight dispatch reliability the major focus of the study is on the operational performance of Ethiopian Airline (the operator) not the MRO unit. Charenet Tesema (2018) assessed the role of achieving competitive excellence operating system implementation on company's internal supply chain integration and the objective was to study the roles of the operating tool on the company's internal supply chain integration. Asnake Atnafie (2020) examined the effect of supply chain integration on the performance of Ethiopian MRO and found out that further improvement is required on Supplier integration, Internal Integration and customer integration to improve the operational performance of Ethiopian MRO to the required level.

Over the past decades, the empirically testing between supply chain agility and corporate performance, especially toward operational performance was not well-examined consequently no well-known study found examining the relationships between supply chain agility and operational performance within the Aviation Industry especially in MRO business of Ethiopian Airlines. Given the above fact, studying the relationship of supply chain agility and operational performance to explore the effect of supply chain agility on operational performance at Ethiopian MRO is worthy.

2.4 CONCEPTUAL FRAMEWORK OF THE STUDY

According to he reviewed theoretical and empirical literature, the researcher developed Supply Chain Agility (alertness, accessibility, decisiveness, swiftness, and flexibility) as an independent variable and the three common operational performance measure i.e. Time, Cost and Quality used as dependent variable.

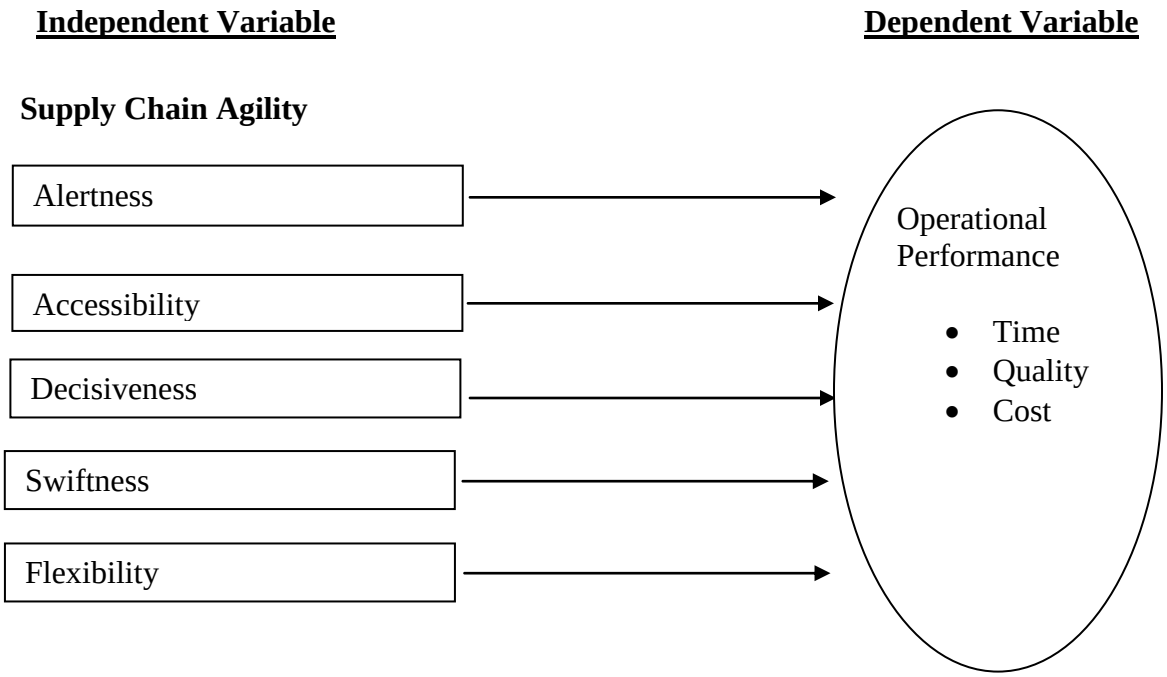

Figure 2. 1: Conceptual framework has been adapted from Shambachew O. (2015).

CHAPTER THREE

RESEARCH METHODOLOGY

INTRODUCTION

In this chapter the methodology employed for the study is discussed. The chapter elaborates specifically the research design, population and sample of the study, data collection methods and analysis including the data presentation methods.

3.1 RESEARCH DESIGN

In this study both descriptive and explanatory research design is employed as the research uses primary and secondary source of data. A Descriptive research is used to identify characteristics, frequencies, trends, and categories and an explanatory research is used to explain the data found from secondary resources like different records of the organization. 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 findings are described and discussed using descriptive statistics, such as mean, standard deviation and percentage distribution. Explanatory research design is employed to address research objectives and surveyed the source and result association between variables of supply chain agility and operational performance of Ethiopian MRO.

3.2 RESEARCH APPROACH

The study used structured questionnaires and interview to gather data. The research employed a mixed approach of qualitative and quantitative based on the research questions and objectives since the source of data used is both primary and secondary. The study applied mixed approach and took Ethiopian MRO as a case company. The research examined the effect of supply chain

agility practice in the MRO on its operational performance so as to present the result for the analysis.

3.2 POPULATION AND SAMPLING DESIGN

3.3.1. Population

A population is defined as a complete set of individual cases or objects with some common observable characteristics (Mugenda, 2012). This study emphasized on management member of Ethiopian MRO business unit, all Procurement and Supply Chain Management (PSCM) team and all MRO Marketing & Sales team. Management member of Ethiopian MRO manages the operation of the MRO in coordination with PSCM team. P&SCM team have the knowledge about the supply chain practice in Ethiopian Airlines MRO which justifies that they are the right sources of the study. MRO Marketing & Sales team coordinates to fulfill the requirement of MRO third party customers by closely working with PSCM team and MRO Management Team. As MRO non-management team are involved on the routine technical activities and have no relationship with PSCM or MRO Marketing staffs, the study didn't consider them. Accordingly, a total of 290 employees from which 50 Management member of Ethiopian MRO, 220 employees of PSCM and 20 employees of MRO Marketing & Sales were measured as valid target population of the study (Data taken from ETG Human Resource Record of 2020)

3.3.2. Sampling Design

Sampling design includes selecting some of the elements in a population from which a researcher may draw conclusions about the whole population. In this study purposive sampling in which the target population is selected and divided in to characteristics of importance of their working division was used. A simple random sampling was applied to get a representative sample from each target population

3.3.3. Sampling Frame

The study-sampling frame is the list of the study target population, from where the study select the sample size (Kothari, 2008). The sampling frame of this study was found from list of staff in Ethiopian MRO including PSCM and MRO Marketing & Sales.

3.3.4. Sampling Technique

Depending on the nature of population and the information desired through sampling from it, there are many ways in which the sample may be drawn (Schreuder, H. T., T. G. Gregoire, and G. B. Wood. 1993). Purposive sampling is an informant selection tool which is widely used. The purposive sampling technique, also called judgment sampling, is the deliberate choice of an informant due to the qualities the informant possesses. Select the 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 research. In this study, the researcher used both probability and non-probability sampling. Simple random sampling from probability sampling was used for the questionnaires while non-probability sampling especially purposive sampling was used for Interview questions

3.3.5. Sample Size

The researcher selected target population from Management staff of ET-MRO, PSCM and MRO Marketing and Sales staff. A simple random sampling was applied to get a representative sample from each target population. Taro Yamane, (1967), simplified formula is used to calculate the sample size as below:

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

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

e = 0.05 with 95%confident interval

n= 290/(1+290(0.05)2)

n = 204

Table 3. 1 Sample Size Determination

Departments	Population	Sample
PSCM	220	141
MRO Marketing & Sales	20	19
MRO Managers and Directors	50	44
Total	**290**	**204**

Source: Adopted from The Research Advisors, 2006

Based on table 3.1, 204 respondents will be approached from the total 290 population size

3.3 DATA COLLECTION METHOD

The procedure to be used to collect data was influenced by the research instruments used (Kombo & Tromp, 2006). The task of data collection begins after research problem and research design have been defined (Kothari, 2004).

Questionnaire from the previous related studies was adopted and used to carry out a pilot test. Undertaking the pilot test helped to refine the questionnaire to enable the respondents answer the questions easily and ease data recording (Saunders, M., Lewis, P. and Thornhill, A. 2009). The pilot test was made on 15 respondents of the target population which facilitated in warranting that the information collected are reliable and valid, assisted to manage the data collection process with respondents so that to reduce vagueness. Primary data were collected through questionnaire survey and semi structured interview. Questionnaires survey was distributed to the sample respondents at their working offices after explaining the purpose of the research, confidentiality of their response and the importance of their sincerity to the study. In order to enable the respondents to commit enough time to fill the questionnaire, drop-and- pick- later method was used. Semi-structured interview was conducted with directors and managers from Ethiopian MRO, PSCM and MRO Marketing & Sales at their working area for a total duration ranging between 25 to 55 minutes separately at their suitable time. Interview were conducted with Management staff as they are engaged in performance review and strategy and policy formulation. In addition they have limited time which didn't allow them to fill questionnaires. Secondary data was also collected from the company sources.

3.4 DATA ANALYSIS METHODS

The purpose of data analysis is to prepare raw data for presentation and statistical inference (Kombo & Tromp, 2006). Data for this study was analyzed using descriptive statics like mean, percentage, frequencies, as well as standard deviation to summarize the data in to meaningful form. STATA -14 software was used to analyze, interpret and discuss the collected data. In addition, multiple linear regression model is applied to test the association between the

independent and dependent variable. Regression is used to examine the nature and the strength of association.

Multiple linear regression model of the study: $Y = \beta0 + \beta1X1 + \beta2X2 + \beta3X3 + \beta4X4 + \beta5X5$

Where: Y: Operational performance, β: coefficients of independent variables, X1: Alertness, X2: Accessibility, X3: Decisiveness, X4: Swiftness, X5: Flexibility.

3.5 RELIABILITY AND VALIDITY TEST

In order to ensure the quality of a research, it should be evaluated using its reliability and validity test.

3.6.1 Validity Test

Validity refers to how accurately a method measures what it is intended to measure. If research has high validity that means it produces results that correspond to real properties, characteristics, and variations in the physical or social world. As Kerlinger and Lee (2000) stated, validity is measured in the form of content and construct. The extent to which a measure covers the variables of interest is Content validity. To ensure the content validity of this study, the questionnaires have been evaluated by experts from the target group and content updated per their feedback. The researcher made a pilot study on fifteen selected participants before distributing the questionnaire to the actual participants and an update is made accordingly. Construct validity measures how well the constructs measure the dependent variables.

3.6.2 Reliability Test

According to Grad, 2011, reliability basically means consistent or dependable results. Reliability refers to how consistently a method measures something. If the same result can be consistently attained by using the same methods under the same circumstances, the measurement is considered reliable. This study used standard questionnaires and Interview questions from previous study which was developed by David M. Gligor, (2015) and (Aitken J, Christopher M. and Towil D., 2002). As can be seen from the below summarized table on the reliability test conducted based on the survey questionnaire, the result of the Cronbach's alpha coefficient is

between 0.7947 and 0.9792 which is greater than the minimum alpha value of 0.7. The reliability test is conducted using the whole data of the research and it showed the internal consistency and reliability of the study tool.

Table 3. 2 Summary of Cronbach's Alpha Coefficient Result

Itm No.	Variables	No. of Items	Cronbach's alpha coefficient
1	Alertness	3	0.7947
2	Accessibility	3	0.8168
3	Decisiveness	3	0.8073
4	Swiftness	3	0.8551
5	Flexibility	3	0.8761
6	Time	6	0.8686
7	Quality	6	0.8917
8	Cost	6	0.8967
	Overall	33	0.9792

3.6 ETHICAL CONSIDERATION

According to Bryman and Bell (2007), the principle of informed consent require that respondents are not to be forced to participate in research. In this study, the researcher explained the purpose of the study while distributing the survey and informed participants that their participation should be in a voluntary basis. The researcher also assured the participants that their responses to the questions is treated with extreme confidentiality and is used exclusively for the study. To avoid possibility of plagiarism, the researcher acknowledged that all materials, literatures and other studies are referred and quoted as required.

CHAPTER FOUR

DATA ANALYSIS and PRESENTATION

INTRODUCTION

Chapter four comprised of presentation and analysis of both quantitative and qualitative data found from the distributed survey and different written records of the organization as per the given objective and theoretical aspects. Quantitative data for this study is analyzed, interpreted and discussed using STATA -14 software in-order to address the research objective. Multiple linear regression model is applied to examine the association between the independent and dependent variable.

4.1 DATA PRESENTATION AND ANALYSIS

The survey of the study is based on 150 filled questionnaires from MRO Operation, PSCM and Marketing & Sales staff and 6 interview results from MRO VP and 3 MRO Directors, 1 PSCM Director and 1 Marketing & Sales Mgr. The researcher succeeded to gather 150 filled questionnaires out of 204 distributed questionnaire as per the sample size. The researcher believed that the collected data from questionnaire are sufficient to undertake the study as it constitutes about 73.5% of the sample size.

4.1.1 DEMOGRAPHY CHARACTERISTIC

In this section the Demographic characteristics of the respondents is presented, analyzed and discussed. The demographic characteristics considered were gender, age, educational background, Company experience and position.

Table 4. 1 Summary of Demographic Data

Category	Item No.	Cluster	Frequency	Percent
Gender	**1**	Male	114	76
	2	Female	36	24
		Total	**150**	**100.00**
Age	**1**	Between 25-35	77	51.33
	2	Between 36-45	40	26.66
	3	Between 46-55	29	19.34
	4	Above 55	4	2.67
		Total	**150**	**100.00**
Level of Education	**1**	PhD	0	0
	2	Masters	7	4.67
	3	Bachelors	143	95.33
	4	Higher Diploma	0	0
	5	Diploma	0	0
	6	Certificate	0	0
	7	Other	0	0
		Total	**150**	**100.00**
Experience in the organization	**1**	5 years & below	10	6.67
	2	Between 6 to 10 years	94	62.67
	3	Between 11 to 15 years	26	17.33
	4	Between 16 to 20 years	12	8
	5	Above 20 years	8	5.33
		Total	**150**	**100.00**
Position	**1**	Junior	9	6
	2	Senior	116	77.33
	3	Expert	11	7.33
	4	Management Member	14	9.34
		Total	**150**	**100.00**
		Total	**150**	**100.00**

Source: Own Survey Finding, 2020

As depicted from the above table majority of the respondents were Male and majority of the respondents age category fall between 25 to 35 years followed by 36 to 45 years. The minimum level of education of the respondents is BA which we can conclude that the respondents

understand the question and responds very well. Majority of the respondents have 6 to 10 years work experience in the organization which will make the respondents fit to answer the questions based on knowledge and experience. In addition most of the respondents are senior staff who have the job knowledge and believed that they gave a reliable response.

In general, the demographic data of respondents shows that all respondents from different categories of positions with enough job knowledge and expertise participated on the survey.

4.1.2 PRACTICES OF SUPPLY CHAIN AGILITY IN ETHIOPIAN MRO

One of the objectives of this study is to assess the practice of supply chain agility in Ethiopian MRO. The practice will be analyzed and interpreted as below using the five dimensions (Alertness, Accessibility, Decisiveness, Swiftness and Flexibility) practice related questions. The respondents were requested to choose the best answer from a Likert scale of 1 to 5 where; 1 = strongly disagree, 2 =disagree, 3 = Neutral, 4 = agree and 5 strongly agree

Though, in this study, the calculated mean scores are inferred using the key as stated in the below table

Table 4. 2 Key for Scale Interpretation

Scale	Interpretation
1-1.4999	Very Low
1.50-2.4999	Low
2.50-3.4999	Moderate
3.50-4.4999	Large
4.50-5.000	Very Large

Source: Samuel Kinyanjui (2017)

4.1.2.1 Alertness practice

The practice of Alertness in Ethiopian MRO is examined as below

Table 4. 3 Summary of Exercise for Alertness

Concepts of Alertness	Mean	St. Deviation
Quick to detect changes in its environment	1.4	0.7
Quick to detect opportunities in its environment	2	1
Quick to detect threats in its environment	3	1
Overall Mean	2.31556	

As can be referred from the above table, the mean result of 1.4 indicated that ET- MRO is not quick enough to detect changes in its environment and also did not detect opportunities as showed by the mean result of 2. On the other hand, the Unit moderately detect threats in the environment. The overall value of the mean, which is, 2.31556 indicate that the Unit is not Alert enough which implies that the practice of Alertness in ET-MRO is low.

4.1.2.2 Accessibility practice

The practice of data Accessibility in Ethiopian MRO is examined as below.

Table 4. 4 Summary of Exercise of Accessibility

Concepts of Accessibility	Mean	St. Deviation
Suppliers are quick to share relevant information with ET-MRO	1.5	0.7
Customers are quick to share relevant information with ET-MRO	2.6	0.7
Employees, usually, can quickly access the data required to make decision	3.4	0.9
Overall Mean	2.49	

From the above data, ET MRO Suppliers are not quick enough to share relevant information with the Unit as showed by the mean value of 1.5. The mean value of 2.6 showed that ET-MRO customers are moderately quick to share relevant information with the unit while the mean value of 3.4 indicated that the employees in the Unit, usually, can quickly access the data required to make decision. In general, the overall mean value of 2.49 showed that there is low practice of data Accessibility in the Unit (ET-MRO)

4.1.2.3 Decisiveness practice

The below analysis is to show the practice of Decisiveness in Ethiopian MRO.

Table 4. 5 Summary of Exercise of Decisiveness

Concepts of Decisiveness	Mean	St. Deviation
ET-MRO has processes in place that allow for quick decision making	1.2	0.5
ET-MRO is fast at making decisions regarding supply chain operation	2.3	0.9
ET-MRO is fast at making decisions regarding supply chain tactics	2.08667	1.1
Overall Mean	2.08	

As depicted from the above data, ET-MRO has no process in place that allow for quick decision making as indicated by the mean value of 1.2. The organization is not fast at making decisions regarding supply chain operation as well as supply chain tactics as showed by the mean value of 2.3 and 2.08667 respectively. The overall mean value of 2.49 indicated that the practice of Decisiveness is low in the organization (ET-MRO).

4.1.2.4 Swiftness practice

In the below data, the practice of Swiftness in ET-MRO will be examined.

Table 4. 6 Summary of Exercise of Swiftness

Concepts of Swiftness	Mean	St. Deviation
When it makes decision regarding a change in its supply chain operations, ET-MRO, can quickly implement it	1.35	0.7
When it makes decisions regarding a change in its supply chain tactics, ET-MRO, can quickly implement it	2.33	0.97
ET-MRO is quick at implementing changes to its supply chain	3	1.2
Overall Mean	2.2	

As referred from the above table, the mean value of 1.35 showed that there is very low practice of quick implementation of decisions made in regard to a change in supply chain operations. As the mean value of 2.33 indicated there is also a low practice of quick implementation of decisions made regarding a change in the supply chain tactics. On the other hand, ET-MRO is moderately quick in implementing changes to its supply Chain. The Overall Mean value of 2.2 indicated that there is generally low practice of implementing decisions made.

4.1.2.5 Flexibility practice

The level of Flexibility has been examined in the below table

Table 4. 7 Summary of Exercise of Flexibility

Concepts of Flexibility	Mean	St. Deviation
ET-MRO's suppliers can quickly meet an increase in order size	2	1
ET-MRO's suppliers can quickly adjust the specification of orders	3	0.7
ET-MRO suppliers can quickly adjust/expedite their delivery lead time	3.7	1
Overall Mean	2.85111	

The mean value of 2 showed that ET -MRO's suppliers are not flexible to quickly meet an increase in order size while they are moderately flexible to adjust the specification of orders as indicated by mean value of 3. The mean value of 3.7 showed that the organization suppliers can quickly adjust/expedite their delivery lead time as required. The overall Mean of 2.85111 showed that there is moderate practice of Flexibility in the organization.

4.1.2 Summary of adoption of Supply Chain Agility

The below table summarized the analysis of Supply Chain Agility practice in ET-MRO

Table 4. 8 Supply Chain Agility Practice

Supply Chain Agility Practice	Mean Value	Rank
Alertness	2.31556	3rd
Accessibility	2.49	2nd
Decisiveness	2.08667	5th
Swiftness	2.22	4th
Flexibility	2.85111	1st
Overall Mean	2.39267	

As shown in the above table, the overall mean value of 2.39267 for the five dimension of Supply chain agility indicated that the practice of Supply chain agility in ET-MRO is low. The Mean value showed that except Flexibility, which is moderately practiced in the organization, all the other dimension of supply chain agility has been practiced to low extent. As can be referred on the rank column of the supply chain agility practice table, the level of practice for Flexibility is 1st ranked with a mean value of 2.85111 followed by Accessibility with a mean value of 2.49, Alertness with a mean vale of 2.31556 is ranked 3rd while swiftness and Decisiveness took 4th and 5th place with a mean value of 2.22 and 2.08667 respectively.

4.1.3 OPERATIONAL PERFORMANCE

To examine the effects of Supply Chain Agility on the Operational performance of ET-MRO in terms of Time, quality and cost is also the other main objective of this study. Accordingly the effect of Supply chain Agility on the Operational performance of ET-MRO in terms of Time, quality and cost will be examined below.

4.1.3.1 Operational performance in regard to Time

The below table will examine ET-MRO operational performance in regard to Time

Table 4.9 Operational performance in terms of time

Concepts related to Time	Mean Value	St. Deviation
The MRO is committed to provide fast service to its customers	3.4	1
The MRO is committed to deliver orders/maintenance service to customers within the agreed delivery times	4.5	0.7
Suppliers are committed to supply orders by the agreed timetables	3.5	0.7
The MRO reserves the minimum limit of stock which could continue of work in the case of raw material, parts, components, tools delay	4.5	0.7
The MRO bears the differences in transportation costs in order to meet the deadlines of supplying orders/providing service to customers	4.24	0.69
The MRO is characterized by quick exchange of information with other business units and stakeholders	4.47	0.68
Overall Mean	4.1	

As depicted on the above table, the mean value of 3.4 showed that ET-MRO is moderately committed to provide fast service to its customer while 4.5 value of the mean indicated that the organization is highly committed to deliver orders/maintenance service to customers within the agreed delivery times. Suppliers are also committed to supply orders by the agreed timetables which is indicated by the mean value of 3.5. ET MRO is highly committed to reserve the minimum limit of stock which could continue of work in the case of raw material, parts, components and tools delay as showed by the mean result of 4.5. On the other hand, the mean value of 4.24 and 4.47 respectively indicated that ET-MRO committed to bear the differences in transportation costs in order to meet the deadlines of supplying orders/providing service to customers and the MRO is characterized by quick exchange of information with other business units and stakeholders. In general, the aggregate mean value of 4.1 showed that ET-MRO performance in regard to time is good.

4.1.3.2 Operational Performance in regard to Quality

In the below table the operational performance of ET-MRO in terms of Quality will be examined.

Table 4. 10 Operational performance in terms of Quality

Concepts of Quality	Mean Value	St. Deviation
ET-MRO is committed to provide the maintenance service according to world-class aviation standard	4.3	0.9
ET-MRO performs various types of maintenance service to suits customers' needs (provide Aircraft light and heavy, Component, Engine, etc maintenance)	3.43	0.94
ET-MRO uses transportation means that maintain the products quality (such as Special engine stand, regulated packaging and refrigerated cars to keep the temperature)	4.2	0.8
ET-MRO is committed to proper storage conditions according to the specifications and aviation regulations	3.2	0.79
ET - MRO has control tracking system to keep the inventory valid (expiry date)	3.97	0.91
ET- MRO choses its suppliers on the basis of high-quality	3.9	1
Overall Mean	3.83889	

As can be seen from the above table, the mean value of 4.3 showed that ET-MRO is highly committed to provide the maintenance service according to world-class aviation standard. The mean of quality related variables as seen in the above table ranges from 3.2 up to 4.3 and the overall mean is 3.83889 which can be concluded that ET-MRO's performance in terms of Quality is to the large extent.

Even though the result shows that the ET-MRO's performance in terms of Quality is to the large extent, as compared to the environment ET-MRO is operating and its target, it needs to reach to very large extent.

4.1.3.3 Operational Performance in regard to Cost

Table 4. 11 Operational performance in terms of Cost

Concepts of Cost	Mean Value	St. Deviation
ET- MRO is seeking to reduce the wasteful use or resources (electricity, water, raw materials, consumables, parts, tools)	3.9	1
ET- MRO is working to reduce defective output (the proportion of damaged products, non-standard maintenance service and rework)	3.06	1.03
ET - MRO arrange its internal processes in a manner to shorten performing activities (layout/ACE)	3.75	0.7
ET- MRO is working to reduce the inventory to minimum level to the extent that does not hinder the continuation of work	4.33	0.74
ET- MRO has reduced surplus stock	4.18	0.817
ET- MRO is working on economy of scale (large-scale maintenance service to reduce the cost per unit), volume/frequency of requirement	3.41	1.03
Overall Mean	3.773333	

As shown in the above table, ET-MRO's performance to the cost related variable ranges from moderate to large extent as indicated by the mean value ranged from 3.06 to 4.33. ET-MRO is moderately working to reduce defective output and on economy of scale while its performance is large on surplus stock reduction, in its internal process, reduction of wastage and maintaining minimum level of stock.

Even though the overall mean result of the cost related variables show a mean value of 3.77 which is to the large level, ET-MRO is expected to achieve more and reach to a mean value of above 4.5 considering the environment ET-MRO is engaged and its target.

4.1.3 Summary of operational performance

Table 4. 12 Summary of operational performance

Performance	Mean Value
Time	**4.10**
Quality	**3.84**
Cost	**3.77**
Overall Mean	**3.90**

As indicated in table 4.10 above, the mean values of 4.10, 3.84 and 3.77 indicates that the ET-MRO performance in terms of Time, Quality and Cost are large respectively. Also the overall mean value of 3.90 indicates that the overall performance of ET-MRO is large. Even though the overall performance is to the large extent, ET-MRO operational performance in terms of time quality and cost should be to the very large extent as customers need their scarce Aircraft to be maintained in no time with a very least cost and the very large extent quality level compared to the target and the market condition the MRO is engaged.

4.1.4 DIAGNOSTIC TESTS

In order to show that the data collected is consistent with the assumption of regression analysis, the four major diagnostic tests which are Normality test, Linearity Test, Multicollinearity Test and Heteroscedasticity Test are made based on the collected data attached with this paper as Annex. The detail test result for the four diagnostic tests are also attached with this paper as Annex.

Accordingly, Sharpiro-Wilk test was used to test the normality and all the values of P for all independent variables X1 (Alertness), X2 (Accessibility), X3 (Decisiveness), X4(Swiftness) and X5 (Flexibility) are greater than 0.05 which shows that the data is normally distributed (The detail of the test can be referred on the Annex). As per the result of acrplot graph test, the smoothed line is narrowly to the ordinary regression line and can be conclude that there is no non linearity problem for all the variables. Variance Inflation Factor (VIF) values of the collected data are less than 10 which implies that there is no Multicollinearity problem. In addition the

White test findings showed that all the P values for the models are below the significant levels of 0.05 which proved that there is no heteroscedastic problem.

REGRESSION ANALYSIS

The regression analysis of supply chain agility with performance is as follows.

Table 4. 13 Regression analysis

```
. regress Y X1 X2 X3 X4 X5
```

Source	SS	df	MS	Number of obs	=	150
				F(5, 144)	=	1603.44
Model	56.9291313	5	11.3858263	Prob > F	=	0.0000
Residual	1.0225231	144	.007100855	R-squared	=	0.9824
				Adj R-squared	=	0.9817
Total	57.9516544	149	.388937278	Root MSE	=	.08427

Y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
X1	.1859254	.0283052	6.57	0.000	.1299781	.2418727
X2	.1830815	.0286679	6.39	0.000	.1264171	.2397458
X3	.1849666	.0249537	7.41	0.000	.1356437	.2342895
X4	.1906824	.0251279	7.59	0.000	.1410153	.2403495
X5	.1413598	.0260961	5.42	0.000	.089779	.1929406
_cons	1.804452	.0351566	51.33	0.000	1.734962	1.873942

Source: Research data (2021)

Dependent variable: Y = Operational Performance

Independent variable: X1=Alertness, X2=Accessibility, X3=Decisiveness, X4=Swiftness and X5=Flexibility

The R-square value of 0.9824 shows that the independent variables Supply chain agility (Alertness, Accessibility, Decisiveness, Swiftness and Flexibility) accounted for 98.24% of the variation in the dependent variable (operational performance). The P-value is 0.000< 0.05 and it indicates that the regression model is fit and significant. As per the result, the effect of Alertness, Accessibility, Decisiveness, Swiftness and Flexibility on operational performance were positive and significant since its P values (0.00) are less than 0.05 and also its coefficients (β1

=0.1859254, β2 =0.1830815, β3 =0.1849666, β4 =0.1906824 and β5 =0.1413598) respectively are positive.

These regression model presented as follows:

Y=1.804452 + 0.1859254X1+0.1830815X2+ 0.1849666X3+ 0.1906824 X4+0.1413598X5

Where: Y= operational performance, X1=Alertness, X2=Accessibility, X3=Decisiveness, X4=Swiftness and X5=Flexibility.

The result implies that a unit change in Alertness, Accessibility, Decisiveness, Swiftness and Flexibility results 0.1859254, 0.1830815, 0.1849666, 0.1906824 and 0.1413598 respectively unit increase in operational performance of Ethiopian MRO.

The study result is summarized and presented in the table 4.11 below.

Table 4. 14 Result finding summary

Objective	Indictors	Indictors Result
Objective 1; To assess the Supply Chain Agility practices of the Ethiopian Airlines Group.	Alertness	Small extent
	Accessibility	Small extent
	Decisiveness	Small extent
	Swiftness	Small extent
	Flexibility	Moderate extent
	Operational Performance Indicators	**Results**
Objective 2; To examine the effect of Alertness practices on the Ethiopian MRO performance	Overall operational performance (Y)	Positive and significant
Objective 3; To examine the effect of Accessibility practices on the Ethiopian MRO performance		Positive and significant
Objective 4; To examine the effect of Decisiveness practices on the Ethiopian MRO performance		Positive and significant
Objective 5; To examine the effect of Swiftness practices on the Ethiopian MRO performance		Positive and significant
Objective 6; To examine the effect of Flexibility practices on the Ethiopian MRO performance		Positive and significant

Source: Research data (2021)

4.2 Analysis of Semi-Structured Interview and Open Ended Questions

The researcher distributed open ended questions with the survey questionnaire. The open ended questions comprised of six questions related to the benefits of supply chain agility including its major five dimensions (Alertness, Accessibility, Decisiveness, Swiftness and Flexibility) on the operational performance of ET-MRO and supply chain agility practice in ET- MRO.

The respondents for the open ended request for the benefits of supply chain agility towards the performance of ET-MRO explained as Airline operators need their Aircraft to be airworthy and on the air carrying passengers as well as cargos, the performance of ET-MRO should be to the expectation level of customers so that to be competitive and stay in the market. The operating cost of Airlines is very expensive due to different regulatory body requirement and Airlines need to minimize their cost as they can only be competitive by reducing their cost as the ticket pricing is very competitive. Safety is another mandatory requirement for Airlines to build passengers confidence and be the choice of Airline to Customers and to meet different strict regulatory bodies requirement and need their Aircraft to be maintained as per the regulatory body requirements – quality cannot be compromised as it indicates safety. All the respondents agreed on the conclusion that in order to stay in the business and be competitive, ET-MRO is required to give its services to the customer Airline and its mother Airline as per their demand which is with the least possible TAT, least cost and maximum quality. According to the summarized reply in order to meet customer's expectation, the supply chain should be very agile to detect changes and proactive to grab opportunities and change tactics when there is a threat in the business as it is a survival kit.

The reply from the open ended request also explained the benefits of Alertness towards the performance of Ethiopian MRO is that if Ethiopian MRO, like any business organization, is able to quickly detect changes, the organization can develop a strategy to proactively interact with the changes. If ET-MRO is quick enough to detect opportunities, the organization can grab the opportunities and can have a competitive advantage. Same goes to quickly detect threats so as to develop tactics to react on challenges. All respondents in general agreed that if ET-MRO is sensing and detecting market trends, listening to customers, interchanging information with suppliers, monitoring demand and sensing imminent disturbances, the

organization can develop a strategy proactively to deliver its services to the customers at their expectation level.

The respondents discussed that data accessibility is a major pre-requisite to do sound business decision. ET MRO suppliers, customers and ET MRO employees should share and access quality and complete data on the changes identified so as to make the necessary decision and to understand what kind of strategy to be formulated in order to proactively react on the changes so as to deliver ET-MRO services as per its customers demand with shortest time, least cost possible and required quality maintenance. According to the respondents, the detected changes can be used to formulate the right strategy on how to handle the changes is only possible when there is a quality and complete data. Generally all the respondents agreed that data sharing and accessibility is a key factor to ET-MRO so as to give its service per customers demand.

The respondents discussed about the benefit of Decisiveness towards the performance of Ethiopian MRO as there should be best practice and process in place that enable the decision maker to decide proactively. All respondents agreed that making quick decision based on quality and complete data will enable the organization to give its services at the customers' expectation level. Quick decision making is a very important and key factor to improve ET-MRO performance so as to give services with the least possible time, cost and the required quality.

The respondents replied for the benefits of Swiftness towards the performance of Ethiopian MRO as ET-MRO should quickly implement the decision made in order to address the detected changes and give service as per customer's expectation. Making a quick decision (swiftness) for ET-MRO is crucial to improve its operational performance and stay in business. All the respondents agreed and responded that ET-MRO Supplier's ability to adjust their order level, lead time and specification of the product as per the change in tactics and operation will enable ET-MRO to quickly adjust its tactics and operations as per the changes which will enable the organization to give its services with the least time, least possible cost and the required quality.

In addition to the questionnaire and open ended questions, 6 interview results from MRO operation Vice president and 3 MRO Directors, 1 PSCM Director and 1 Marketing & Sales Manager were collected. Accordingly all were requested to mention their overall view of current ET-MRO practice in related to five dimension of supply chain agility (alertness, accessibility, decisiveness, swiftness and flexibility).

Vice president of MRO operation explained that currently ET-MRO is not practicing all the supply chain agility (alertness, accessibility, decisiveness, swiftness) at the required level. The MRO business is booming. Customers need their Aircraft maintained and return to service in no time as it is their scarce resources. As their operating cost is very high and the Airline market on both cargo and passenger services is very competitive in terms of price, customers need to reduce their maintenance costs significantly in order to have competitive advantage. Customers need quality of maintainace as safety is the major issue in the Airline industry and there are also a lot of regulator body requirements Passengers confidence can only be maintained as per the safety records of an Airline. Given the above and an increase in movement in the world, MRO business is booming and ET-MRO is expected to be a huge profit making center to the Airline. In order to fulfill the above mentioned customers expectation and remain in business, ET-MRO is expected to implement all the major supply chain agility dimensions (alertnesss, accessibility, decisisveness, swiftness and flexibility) to the maximum level.

Director Procurement and Supply Chain also discussed that the practice of all the five supply chain agility is not yet practiced to the required level. He further explained that accessibility should be mainly practiced across the supply chain in addition to the other four dimensions. He added that each supply chain agility dimensions should be practiced to the full level as one goes with the other for example if changes are detected quickly, there should be a way for data accessibility to have a sound decision and if decision is made and same is not swiftly implemented, the required result will not be achieved same goes to flexibility, the strategy should be flexibility enough to entertain the operational changes.

Director Line Mainatainace added that compared to the current business environment ET MRO is engaging, ET-MRO is not practicing all the supply chain agility to the required level. Director Base Manatainance explained the importance of practicing all the five dimension of supply chin agility to the MRO operation in relation to the current customers increasing demand, volatile and ever-changing business environment. He added that ET-MRO needs to invest more and practice all the supply chain agility dimensions to the very large extent to stay in the business and advised that currently the MRO unit is not practicing the five dimensions of supply Chain Agility. Manager MRO Sales and Marketing explained that MRO customers are demanding to get their Aircraft maintained in no time with a very least cost with the required quality level. He further explained that ET-MRO is not giving its service to their expectation level in addition there is a stiff competition to get the market as there are currently MRO business providers with aggressive target. Given this, he further explained that ET-MRO is not practicing all the five supply chain Agility to the required level. Director Component Mainatance discussed that currently ET-MRO is challenged by the ever increasing customers demand and volatile business environment and supply chain agility should be practiced to the large extent in order to be competitive enough to the market. According to Director component Maintanance, ET-MRO is not practicing supply chain agility dimensions to the required level.

According to Vice president MRO operation, Supply Chain Management and MRO Marketing & Sales should support the improvement of ET-MRO performance in terms of the major metrics of performance for ET-MRO (Time, Quality and cost) by quickly addressing the ever-changing customers need, market trend and quickly adjusting measures on tactics and operations so as to give service at the customer's expectation level with the least possible cost, time and required level of quality. All interviewees advised that there is a gap for ET-MRO to exercise the supply chain agility measures which hinders ET-MRO to give the service to customers with least TAT (Turn Around Time), least possible cost and to the expected quality level.

CHAPTER FIVE

SUMMARY CONCLUSION AND RECOMMENDATION

5.1 SUMMARY OF FINDINGS

The study result shows that Alertness, Accessibility, Decisiveness and Swiftness are adopted by the Ethiopian MRO to a small extent as indicated by the mean values of 2.31556, 2.49, 2.08667 and 2.22 respectively. However, the result shows moderate extent for flexibility as it indicated by the mean value of 2.85111. Also, the study result shows that the independent variables supply chain agility (Alertness, Accessibility Decisiveness, Swiftness, and Flexibility) strongly explained the dependent variables of operational performance as it's indicated by its R values 0.9824. In addition, the study shows that the conducted model is fit as it indicated by its P values of 0.000 which is less than 0.05. Further, the study result shows that the effect of Alertness, Accessibility Decisiveness, Swiftness, and Flexibility on operational performance were positive and significant since its P values (0. 000) are less than 0.05 and also its coefficients ($\beta 1$ =0.1859254, $\beta 2$ =0.1830815, $\beta 3$ =0.1849666, $\beta 4$ =0.1906824 and $\beta 5$ =0.1413598) respectively are positive.

The summarized result from the open ended questions and interview replies showed that the practice level of all supply chain agility dimensions are not to the required level that can bring the required performance of Ethiopian MRO. It is also found that all the five dimensions of supply chain agility have positive and significant effect on Operational performance of ET-MRO. The respondents also agreed that cost, time and quality is the major performance indicator of ET-MRO.

5.2 CONCLUSIONS

The study shows that Alertness, Accessibility, Decisiveness and Swiftness are adopted by the Ethiopian MRO to a small extent. However, the result shows moderate extent for Flexibility. It can be concluded that Ethiopian MRO had adopted Supply Chain Agility practices to a small extent. Besides, the study result established that the Ethiopian MRO overall operational performance was large. Also, the study investigated that the effect of Alertness, Accessibility,

Decisiveness, Swiftness and Flexibility on Ethiopian MRO overall performance were positive and significant. Thus, it leads to conclude that Supply Chain Agility practices of the organization have positive and significant effect on the Ethiopian MRO overall operational performance.

5.3 RECOMMENDATION OF THE STUDY

As per the study result, the adoptions of Supply Chain Agility practices by the Ethiopian Airlines group were to a small extent. In addition, the study shows that the effect of Supply Chain Agility practices has a positive and significant effect on the Ethiopian MRO overall operational performance. The study therefore recommends that the Ethiopian airlines group MRO should invest more in Supply Chain Agility especially on Alertness, Accessibility, Decisiveness, Swiftness and so as to enhance an extended Turnaround Time (TAT), Repetitive extension of Aircraft Maintenance schedules, longer lead time, excess inventory of aircraft parts in surplus stores, in opposing shortage and/or stock out of the critical parts, inaccurate information flow. In order to improve the practice of supply chain Agility dimensions, Ethiopian-MRO management should work specifically on the below major ways of Supply Chain Agility improvement as depicted by John Cutsey, 2020.

4.3 ADJUST EXPECTATIONS

Factual agility is how an organization responds to changes happening in the broader industry landscape. It improves the organization's ability to see what's happening in the marketplace, why it's happening and what an organization can convincingly do about it. Leaders expect everything and anything to change, from labor to inventory practices to product development to third-party logistic (3PL) relationships. Yes, some of these processes will adapt with the investment in supply chain agility — but never permanently, and never without objective data backing its improvement.

4.4 BETTER ENGAGE POINT-OF-SALE-DRIVEN DEMAND DATA

Many organizations push themselves to use software for demand planning. Pulling insights from aggregate historical data, many have focused on improving inventory ordering and shipping schedules based on previous cycles, assuming similar patterns in the future. While this is an

essential part of supply chain agility, it's not the only one. Ethiopian-MRO can see equal, and sometimes more, success by balancing demand-driven planning capabilities as well. Specifically, the demand information cued from real-time point-of-sale systems allows even more granular production and fulfillment responses translated instantly.

4.5 FOCUS TRAINING ON KEY TECHNOLOGY

In fact, industry surveys continually report the top pain point in implementing an agile supply chain isn't a lack of direction, funds or strategic buy-in — but skilled talent to use the agile technology itself.

4.6 PRIORITIZE AUTOMATED ALERTS

Automated inventory alerts, such as ones integrated into the organizaions enterprise resource planning (ERP) system, make a range of business functions easier.

4.7 REINVEST IN INDUSTRY BOTS

Modernizing your supply chain involves more technologies than ever. Few technologies contribute as fundamentally to supply chain agility as robotic process automation (RPA). This allows employees to move on from menial data entry and communications tasks to value-additive work, such as mediating exceptions or customer service issues requiring human intervention.

4.8 REVIEW GEOGRAPHIC WAREHOUSING

Analyzing the organizations' warehousing and distribution network is a core place to see supply chain improvements. Performing these can reveal serious flux in regional demands as well as seasonal cycles, which directly informs more cost-effective shipping and storage operations. In some cases, it can even show full or part-time outsourcing opportunities far more profitable for the current scale, plus reduce stock outs and improve order fulfillment timelines.

In general, the study recommends the Ethiopian MRO to increase the adoption level of Supply chain agility practices in order to improve its operational performances to a very large extent of

giving services by exceeding the customers' expectation level which is a major target of ET-MRO.

5.4 SUGGESTIONS FOR FURTHER RESEARCH

The focus of this study was to assess the link between each Supply Chain Agility (Alertness, Accessibility Decisiveness, Swiftness, and Flexibility) and Ethiopian MRO performance based on the performance indicators (Time, Quality and Cost). The study therefore, recommends an additional research assessing the effect of supply chain agility practices on the operational performances in terms of each operational performance indicators on the other case organizations by including additional operational performance indicators.

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ANNEX I: INTRODUCTION LETTER

Dear Respondents,

This is Bizunesh Zeleke working at Ethiopian Airlines and I am studying my Master of Arts program on Logistic and Supply Chain Management at Addis Ababa University, School of Commerce. Currently I am undertaking a research on the topic "The effect of Supply Chain Agility on Operational Performance: The case of Ethiopian Maintenance, Repair and Overhaul(ET-MRO)" as a requirement in partial fulfillment for the degree of Masters of Arts in Logistics and Supply Chain Program. I have chosen you as a respondent on the below questionnaire which is developed solely for the academic research stated above purpose due to your expertise and knowledge on the subject matter. I can assure you that your response will be treated with high confidentiality and will be employed only for the mentioned academic research purpose. Your reply should be with full voluntary and should be based on current and actual situation. The survey may take maximum of 15 minutes. I would like to request you to spare some minute from your precious time to fill the below questionnaire with honesty based on current and actual situation.

Thank you in advance for your patience and honest reply!.

Yours Faithfully,

Bizunesh Zeleke,

Researcher

Email: bizuneshzeleke20202@gmail.com

ANNEX II: QUESTIONNAIRE

I would like to request you to respond to all the requests. The questionnaire is organized in two section. The 1st section which is Section A is regarding the general information of the respondent and please put a tick (√) on the appropriate space. The 2nd section which is Section B is intended to gather information on supply chain agility and effects of supply chain agility on operational performance

Use the following scale to rate your best answer for section B

Scale 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree based on how you feel about the statement. Please also try to give your best answer on the subjective questions on the space provided based on the current and actual situation. These questions will help to gather information on the overall overview of the impact of supply chain agility and operational performance

Section A: Demographic Data –

please put a tick (√) on the appropriate space

1. Gender
    i. Male ( )
    ii. Female ( )

2. Educational background. Please select the highest level of education you have currently?
    i. PhD ( )
    ii. Masters ( )
    iii. Bachelors ( )
    iv. Higher Diploma ( )
    v. Diploma ( )
    vi. Certificate ( )
    vii. Other, please specify _____

3. How long have you served in this organization?
    i. Less than 5 years ( )
    ii. between 6 to 10 years ( )
    iii. Between 11 to 15years ( )
    iv. Between 16 to 20years ( )
    v. Above 20 years ( )

4. What is your current position in this organization?
    i. Junior ()
    ii. Senior
    iii. Expert
    iv. Management member

5. How long have you served with the current position?
    i. Less than 5 years ( )
    ii. Between 5 to 10years ( )
    iii. Between 10 to 15years ( )
    iv. between 15 to 20years ( )
    v. Above 20 years ( )

Section B:

The following questions are intended to gather information on supply chain agility and effects of supply chain agility on operational performance. Please 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.

Supply Chain Agility	Scale				
	1	2	3	4	5
Alertness	1	2	3	4	5
ET- MRO is quick to detect changes in its environment					
ET- MRO is quick to detect opportunities in its environment					
ET-MRO is quick to detect threats in its environment					
Accessibility	1	2	3	4	5
ET- MRO suppliers are quick to share relevant information with ET-MRO					
ET-MRO customers are quick to share relevant information with ET-MRO					
ET-MRO employees, usually, can quickly access the data required to make decision					
Decisiveness	1	2	3	4	5
ET-MRO has processes in place that allow for quick decision making					
ET-MRO is fast at making decisions regarding supply chain operation					
ET-MRO is fast at making decisions regarding supply chain tactics					
Swiftness	1	2	3	4	5
When it makes decision regarding a change in its supply chain operations, ET-MRO, can quickly implement it					
When it makes decisions regarding a change in its supply chain tactics, ET-MRO, can quickly implement it					
ET-MRO is quick at implementing changes to its supply chain					
Flexibility	1	2	3	4	5
ET-MRO's suppliers can quickly meet an increase in order size					
ET-MRO's suppliers can quickly adjust the specification of orders					
ET-MRO suppliers can quickly adjust/expedite their delivery lead time					
Operational Performance					
Time (Speed)	1	2	3	4	5
The MRO is committed to provide fast service to its customers					

The MRO is committed to deliver orders/maintenance service to customers within the agreed delivery times					
Suppliers are committed to supply orders by the agreed timetables					
The MRO reserves the minimum limit of stock which could continue of work in the case of raw material, parts, components, tools delay					
The MRO bears the differences in transportation costs in order to meet the deadlines of supplying orders/providing service to customers					
The MRO is characterized by quick exchange of information with other business units and stakeholders					
Quality	1	2	3	4	5
ET-MRO is committed to provide the maintenance service according to world-class aviation standard					
ET-MRO performs various types of maintenance service to suits customers' needs (provide Aircraft light and heavy, Component, Engine, etc maintenance)					
ET-MRO uses transportation means that maintain the products quality (such as Special engine stand, regulated packaging and refrigerated cars to keep the temperature)					
ET-MRO is committed to proper storage conditions according to the specifications and aviation regulations					
ET - MRO has control tracking system to keep the inventory valid (expiry date)					
ET- MRO choses its suppliers on the basis of high-quality					
Cost	1	2	3	4	5
ET- MRO is seeking to reduce the wasteful use or resources (electricity, water, raw materials, consumables, parts, tools)					
ET- MRO is working to reduce defective in output (the proportion of damaged products, non-standard maintenance service and rework)					
ET - MRO arrange its internal processes in a manner to shorten performing activities (layout/ACE)					
ET- MRO is working to reduce the inventory to minimum level to the extent					

that does not hinder the continuation of work					
ET- MRO has reduced surplus stock					
ET- MRO is working on economy of scale (large-scale maintenance service to reduce the cost per unit), volume/frequency of requirement					

Please give your best answer on the following subjective questions on the space provided based on the current and actual situation. These questions will help to gather information on the overall overview of the impact of supply chain agility and operational performance

i. What are the benefits of Supply Chain Agility towards the performance of Ethiopian MRO?

_____

_____

_____

ii. What are the benefits of Alertness towards the performance of Ethiopian MRO?

_____

_____

_____

iii. What are the benefits of Accessibility towards the performance of Ethiopian MRO?

_____

_____

_____

_____

iv. What are the benefits of Decisiveness towards the performance of Ethiopian MRO?

_____

_____

_____

v. What are the benefits of Swiftness towards the performance of Ethiopian MRO?

_____

_____

_____

_____

vi. What are the benefits of flexibility towards the performance of Ethiopian MRO?

_____

_____

_____

_____

Section C: Interview Questions

1) For PSCM and MRO Marketing & Sales

a. Please mention your overall view of current Ethiopian MRO practice regarding the five dimension of supply chain agility (alertness, accessibility, decisiveness, swiftness and flexibility)

b. Please identify major gaps which you are observing in your day to day activates related with Supply Chain agility

2) For Management member of MRO

c. To what extent PSCM and MRO Marketing & Sales are supporting for the improvement of operational performance of Ethiopian MRO (in terms of Time, Quality & Cost)?

Thank you for your time

ANNEX III: TEST RESULT

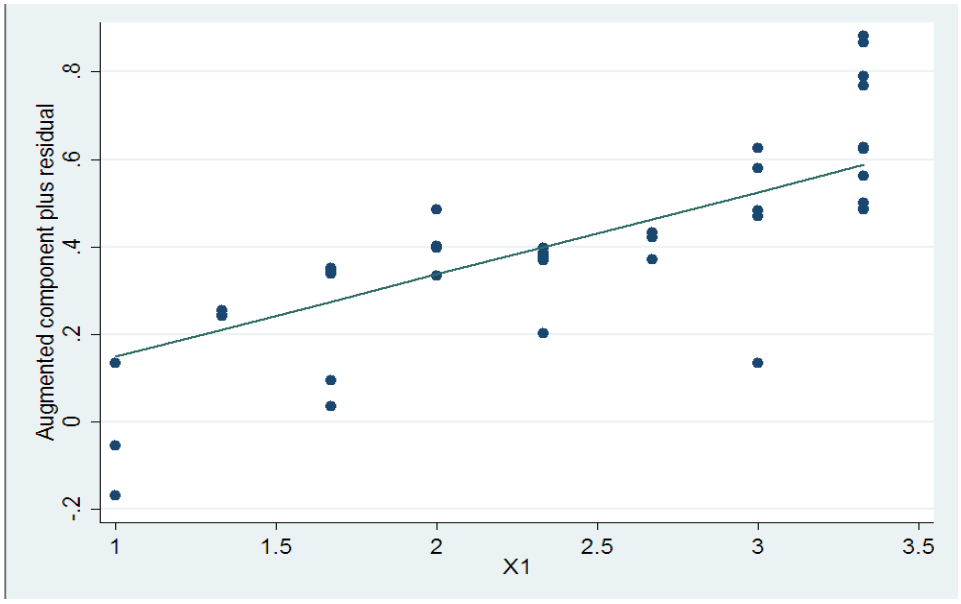
1. Normality Test

```
. swilk X1 X2 X3 X4 X5
```

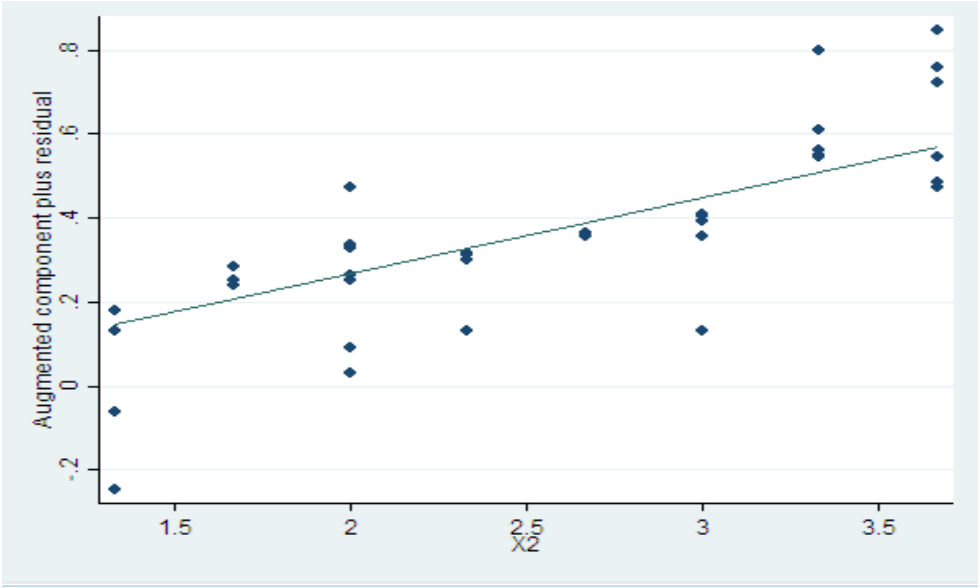
Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
X1	150	0.99251	0.871	-0.312	0.62243
X2	150	0.99126	1.017	0.038	0.48501
X3	150	0.98895	1.285	0.569	0.28468
X4	150	0.98320	1.955	1.519	0.06433
X5	150	0.98412	1.848	1.392	0.08201

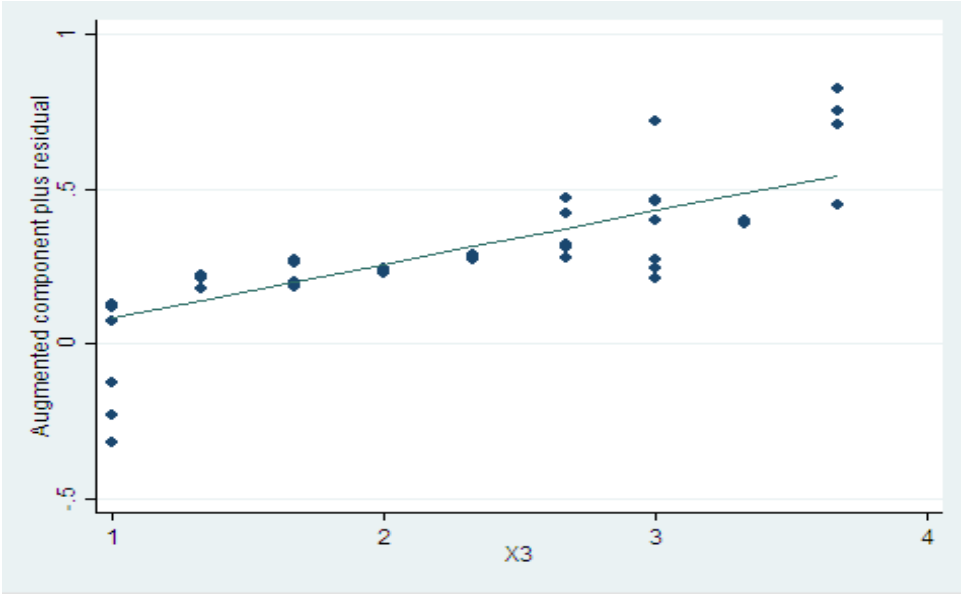
2. Linearity Test



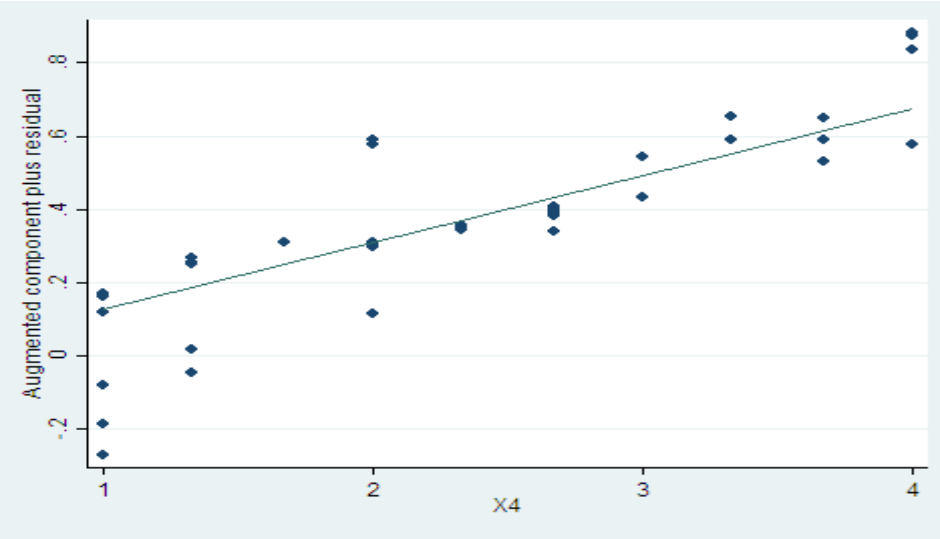
For X1


Augmented component plus residual
-.2
0
.2
.4
.6
.8
1.5
2
2.5
3
3.5
X2

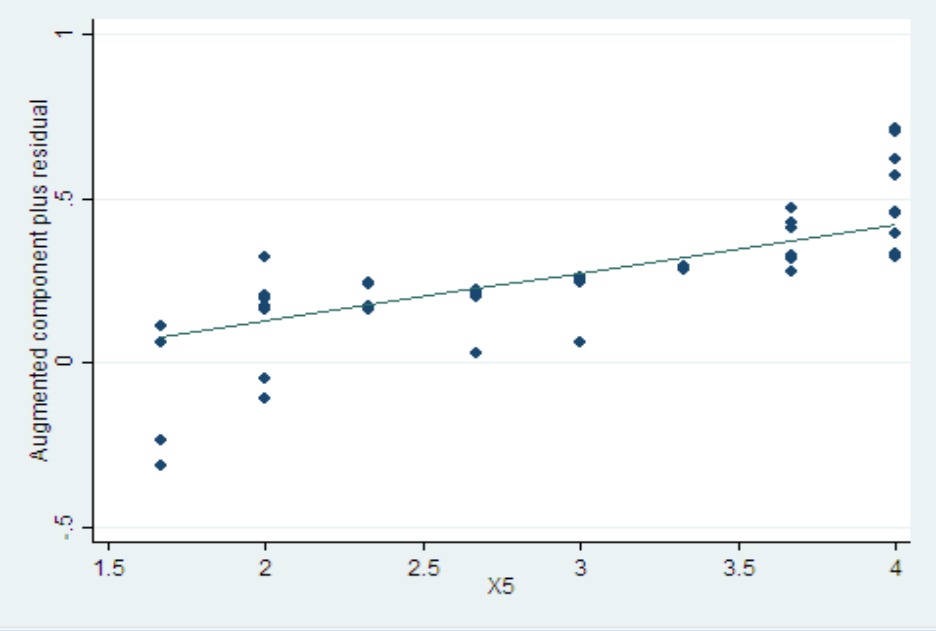
For X2


Augmented component plus residual
-.5
0
.5
1
1
2
3
4
X3

For X3



For X4



For X5

3. Multi-Collinearity Test

```
. estat vif
```

Variable	VIF	1/VIF
X4	9.79	0.102186
X5	8.13	0.123027
X2	7.43	0.134612
X1	7.34	0.136308
X3	6.68	0.149799
Mean VIF	7.87	

4. Heteroscedasticity Test

```
. imtest,white

White's test for Ho: homoskedasticity
          against Ha: unrestricted heteroskedasticity

          chi2(20)      =    142.15
          Prob > chi2   =    0.0000

Cameron & Trivedi's decomposition of IM-test
```

Source	chi2	df	p
Heteroskedasticity	142.15	20	0.0000
Skewness	30.06	5	0.0000
Kurtosis	4.36	1	0.0369
Total	176.57	26	0.0000

Where;

X1 = Mean of Alertness practice

X2 = Mean of Accessibility practice

X3 = Mean of Decisiveness practice

X4 = Mean of Swiftness practice

X5 = Mean of Flexibility practice

Y = Mean of the Ethiopian MRO Overall operational performance

ANNEX IV: DATA SUMMARY

I/N	X1	X2	X3	X4	X5	Y
1	3.33	3.33	3.00	2.00	4.00	4.83
2	2.67	3.00	2.33	2.67	3.33	4.22
3	2.33	2.33	2.00	2.00	2.67	3.78
4	1.33	1.67	1.33	1.00	2.00	3.11
5	2.67	3.00	2.67	2.67	3.67	4.28
6	2.33	2.33	3.00	2.00	2.67	3.78
7	1.67	1.67	1.33	1.33	2.00	3.28
8	3.00	3.00	2.67	3.00	3.67	4.44
9	2.67	3.00	2.33	2.67	3.33	4.22
10	1.33	1.67	1.00	1.00	1.67	3.00
11	3.33	3.33	3.00	3.33	4.00	4.83
12	3.00	3.33	2.67	3.00	3.67	4.61
13	2.33	2.67	2.00	2.33	3.00	3.94
14	1.67	2.00	3.00	1.33	2.00	3.39
15	3.00	3.33	2.67	3.33	3.67	4.72
16	2.33	2.67	2.33	2.33	3.00	4.00
17	2.00	2.00	1.67	1.33	2.33	3.50
18	1.33	1.67	1.00	1.00	1.67	3.00
19	3.00	3.00	2.67	3.00	3.67	4.44
20	1.67	2.00	3.00	1.33	2.00	3.33
21	3.33	3.33	3.00	3.67	4.00	4.89
22	1.00	3.00	1.00	1.00	1.67	2.83
23	2.33	2.67	2.33	2.67	3.33	4.11
24	2.00	2.00	1.67	2.00	2.33	3.56
25	1.00	1.33	1.00	1.00	1.67	2.83
26	2.67	2.67	2.33	2.67	3.33	4.17
27	2.33	2.00	1.67	2.00	2.67	3.67
28	1.67	2.00	1.33	1.33	2.00	3.33
29	1.33	1.67	1.00	1.00	1.67	3.00
30	2.00	2.00	1.67	1.67	2.33	3.56
31	3.33	3.67	3.00	3.67	4.00	4.89
32	1.33	1.67	1.00	1.00	2.00	3.06
33	2.67	3.00	2.33	2.67	3.33	4.22
34	2.33	2.33	2.00	2.00	2.67	3.78
35	1.33	1.67	1.33	1.00	2.00	3.11
36	3.00	3.00	2.67	2.67	3.67	4.39
37	2.33	2.33	2.00	2.33	2.67	3.83
38	2.00	2.00	1.67	1.67	2.33	3.56
39	1.67	2.00	1.33	1.33	2.00	3.33
40	2.33	2.33	1.67	2.00	2.67	3.72
41	3.33	3.67	3.33	3.67	4.00	4.89
42	1.67	2.00	1.33	1.33	2.00	3.33
43	3.00	3.33	2.67	3.33	3.67	4.72
44	2.33	2.67	2.00	2.33	3.00	3.94
45	1.67	2.00	1.67	1.33	2.33	3.44
46	3.00	3.33	2.67	3.33	3.67	4.72
47	2.33	2.67	2.33	2.33	3.00	4.00
48	2.33	2.33	1.67	2.00	2.67	3.72
49	2.00	2.00	1.67	1.67	2.33	3.56
50	2.33	2.67	2.00	2.33	3.00	3.94
51	3.33	3.67	3.33	3.67	4.00	4.89
52	2.00	2.00	1.67	1.67	2.33	3.56
53	1.00	1.33	1.00	1.00	1.67	2.83
54	2.67	2.67	2.33	2.67	3.33	4.17
55	2.00	2.00	1.67	2.00	2.33	3.56
56	1.33	1.33	1.00	1.00	1.67	2.94
57	2.67	2.67	2.33	2.67	3.33	4.17
58	2.33	2.33	2.00	2.33	3.00	3.89
59	2.33	2.33	1.67	2.00	2.67	3.72
60	2.33	2.67	2.33	2.33	3.00	4.00
61	3.33	3.67	3.33	3.67	4.00	4.89
62	2.33	2.33	2.00	2.00	2.67	3.78
63	1.33	1.67	1.00	1.00	2.00	3.06
64	2.67	3.00	2.33	2.67	3.33	4.22
65	2.33	2.33	2.00	2.00	2.67	3.78
66	1.67	1.67	1.33	1.33	2.00	3.28
67	3.00	3.00	2.67	3.00	3.67	4.44
68	2.33	2.67	2.33	2.33	3.00	4.00
69	2.33	2.33	2.00	2.33	3.00	3.89
70	2.67	3.00	2.33	2.67	3.33	4.22
71	3.33	3.67	3.33	3.67	4.00	4.89
72	2.33	2.67	2.00	2.33	3.00	3.94
73	1.67	2.00	1.33	1.33	2.00	3.33
74	3.00	3.33	2.67	3.33	3.67	4.72
75	2.33	2.67	2.33	2.33	3.00	4.00
76	2.00	2.00	1.67	1.33	2.33	3.50
77	3.33	3.33	3.00	3.33	3.67	4.78
78	2.67	3.00	2.33	2.67	3.33	4.22
79	2.33	2.67	2.33	2.33	3.00	4.00
80	3.00	3.00	2.67	3.00	3.67	4.44
81	3.33	3.67	3.33	4.00	4.00	4.94
82	2.33	2.67	2.33	2.67	3.00	4.06
83	2.00	2.00	1.67	2.00	2.33	3.56

84	1.00	1.33	1.00	1.00	1.67	2.83
85	2.67	2.67	2.33	2.67	3.33	4.17
86	2.33	2.00	1.67	2.00	2.33	3.61
87	1.33	1.67	1.00	1.00	1.67	3.00
88	3.00	3.00	2.67	3.00	3.67	4.44
89	2.67	3.00	2.33	2.67	3.33	4.22
90	3.00	1.33	1.00	1.00	1.67	2.83
91	3.33	3.67	3.33	4.00	4.00	4.94
92	2.67	3.00	2.33	2.67	3.33	4.22
93	2.33	2.33	2.00	2.00	2.67	3.78
94	1.33	1.67	1.33	1.00	2.00	3.11
95	3.00	3.00	2.67	2.67	3.67	4.39
96	2.33	2.33	2.00	2.33	2.67	3.83
97	1.67	2.00	1.33	1.33	2.00	3.33
98	1.33	1.67	1.00	1.00	1.67	3.00
99	3.00	3.00	2.67	3.00	3.67	4.44
100	1.33	1.67	1.00	1.00	1.67	3.00
101	3.33	3.67	3.67	4.00	2.00	5.00
102	3.00	3.33	2.67	3.00	3.67	4.61
103	2.33	2.67	2.00	2.33	3.00	3.94
104	1.67	2.00	1.67	1.33	2.00	3.39
105	3.00	3.33	2.67	3.33	3.67	4.72
106	2.33	2.67	2.33	2.33	3.00	4.00
107	2.00	2.00	1.67	1.67	2.33	3.56
108	1.67	2.00	1.33	1.33	2.00	3.33
109	1.33	1.67	1.00	1.00	1.67	3.00
110	1.67	2.00	1.33	1.33	2.00	3.33
111	3.33	3.67	3.67	2.00	4.00	5.00
112	1.00	1.33	1.00	1.00	1.67	2.83
113	2.33	2.67	2.33	2.67	3.33	4.11
114	2.00	2.00	1.67	2.00	2.33	3.56
115	1.33	1.33	1.00	1.00	1.67	2.94
116	2.67	2.67	2.33	2.67	3.33	4.17
117	2.33	2.33	1.67	2.00	2.67	3.72
18	2.00	2.00	1.67	1.67	2.33	3.56
119	3.33	3.33	3.00	3.33	4.00	4.83
120	2.00	2.00	1.67	1.67	2.33	3.56
121	3.33	3.67	3.67	4.00	4.00	5.00
122	1.33	1.67	1.00	1.00	2.00	3.06
123	2.67	3.00	2.33	2.67	3.33	4.22
124	2.33	2.33	2.00	2.00	2.67	3.78
125	1.33	1.67	1.33	1.00	2.00	3.11
126	3.00	3.00	2.67	2.67	3.67	4.39
127	2.33	2.33	2.00	2.33	3.00	3.89
128	2.33	2.33	1.67	2.00	2.67	3.72
129	3.33	3.33	3.00	3.33	4.00	4.83
130	2.33	2.33	2.00	2.00	2.67	3.78
131	3.33	2.00	3.67	4.00	4.00	5.00
132	1.67	2.00	1.33	1.33	2.00	3.33
133	3.00	3.33	2.67	3.33	3.67	4.72
134	2.33	2.67	2.00	2.33	3.00	3.94
135	2.00	2.00	1.67	1.33	2.33	3.50
136	3.00	3.33	2.67	3.33	3.67	4.72
137	2.33	2.67	2.33	2.33	3.00	4.00
138	2.33	2.33	2.00	2.33	3.00	3.89
139	3.33	3.33	3.00	3.33	4.00	4.83
140	2.33	2.67	2.00	2.33	3.00	3.94
141	2.00	3.67	3.67	4.00	4.00	5.00
142	2.00	2.00	1.67	2.00	2.33	3.56
143	1.00	1.33	1.00	1.00	3.00	2.83
144	2.67	2.67	2.33	2.67	3.33	4.17
145	2.00	2.00	1.67	2.00	2.33	3.56
146	1.33	1.33	1.00	1.00	1.67	2.94
147	2.67	2.67	2.33	2.67	3.33	4.17
148	2.33	2.67	2.33	2.33	3.00	4.00
149	3.33	3.33	3.00	3.33	4.00	4.83
150	2.33	2.67	2.33	2.67	3.00	4.06

Where;

X1 = Mean of Alertness practice

X2 = Mean of Accessibility practice

X3 = Mean of Decisiveness practice

X4 = Mean of Swiftness practice

X5 = Mean of Flexibility practice

Y = Mean of the Ethiopian MRO Overall operational performance