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**ADDIS ABABA UNIVERSITY SCHOOL OF
COMMERCE DEPARTMENT OF LOGISTICS AND
SUPPLY CHAIN MANAGEMENT**

**THE EFFECT OF ERP UTILIZATION ENABLERS ON SUPPLY CHAIN
MANAGEMENT PERFORMANCE IN THE CASE OF ETHIOPIAN AIRLINES**

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**Effect of ERP utilization enablers on Supply chain management performance
In the Case of Ethiopian Airlines**

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DEDICATION

This work is dedicated to my family who inspires me in every moment of my life!

And above all, to the Almighty God!

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Declaration

I declare that this thesis is the result of my independent research work on the topic entitled “The Effect of ERP system utilization enablers on Supply Chain Management Performance in the case of Ethiopian Airlines in partial fulfilment of the requirements for the Degree of Master of Art in Logistics and Supply Chain Management at Addis Ababa University School of commerce. It is my original work and all the references used in the study are acknowledged.

Hirut Moreda _____

Name Signature & Date

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LIST OF ACRONYMS

ERP – Enterprise Resource Planning

SAP –System Application and Product

PP- Production Planning

PS- project system

SD- Sales and distribution

QM-Quality management

MM- Materials management

PM- Plant maintenance

SCM – Supply chain Management

DBMS – Data base management system

SCP – Supply chain performance

MFA- Market feedback analysis

ACE – Achieving competitive excellence

COE- Center of excellence

MRO – Maintenance and overhaul

SBU – Strategic business unit

RCCA – Root cause corrective action

SPSS – Statistical Package for Social Science

Abstract

ERP system is being adopted by international organizations globally; in order to streamline business processes, manage and create seamless integration, and ensure real time information availability for decision making. ERP adoption is considered as one of the biggest and most complex projects a firm could manage even though these projects can vary in size, structure, and methodology. This is due to the extensive requirement of effort, time, resources, and organizational changes. As a result, ERP system implementation critical success factors (CSFs) and project management aspects have gotten much attention by both researchers and business practitioners. However, successful implementation of ERP is only a first step in the accomplishment towards achieving ERP success. Prior studies have revealed that organizations are not achieving the promised business values due to several post-implementation issues and underutilization of the system. This indicates, post-implementation is an essential phase of ERP life-cycle for the system success. The purpose of this study is to assess the effect of post implementation utilization factors on supply chain performance in the context of Ethiopian Airlines. The general approach of this research was a case study in which a combination of quantitative and qualitative methods has been used to collect and analyse data. Based on extensive literature review, a research model was established which constitutes six post implementation utilization factors that influence supply chain performance. The survey questionnaire and interview outline contents were prepared based on the defined research model by fully adopting from existing literatures. The quantitative aspect of the study involved 207 users from Purchasing and supply chain management with different job positions, roles, and work experience. In the qualitative study, direct interviews were used to collect data from 4 management members and 2 senior employees of the airline. The quantitative data were analysed by employing appropriate techniques of descriptive and inferential statistics using SPSS software tool. The qualitative data were analysed using the techniques of open coding. The result of the study indicated that ERP attribute constructs were the most critical determinants of supply chain performance; which make the highest contribution (50%) of the total variance. Furthermore, training (21.06%), Productivity (19.2 %) user involvement (14 %), make second to fourth contribution of the total variance on the supply chain performance. The survey questionnaire and the interview outline contents were reviewed by senior supply chain management employees and ERP experts of the organization to measure the content validity. Subsequently, pilot study was conducted with selected users and the feedbacks were incorporated prior to disseminating the questionnaire to the respondents. Further, to measure the internal consistency of the questionnaire, reliability test was conducted using cronbach's coefficient alpha with a result of .911 which asserted the reliability of the instrument. This research can conclude that ERP post implementation utilization factors have positive and significant effect for the improvement of supply chain performance. Finally, it is recommended that Ethiopian airlines should improve the utilization of the system and attain the desired business result by focusing more on user training as a priority goal.

Key Words: ERP and Supply chain performance.

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

In today's competitive global market, one of the most effective ways towards meeting the ever changing customer demand is through facilitating the supply chain process using ERP (Enterprise Resource Planning) systems. ERP enables a more efficient internal and external supply chain process.

Enterprise Resource Planning (ERP) is one of the fastest growing segments of Information Technology today. It is a software suit that helps organizations to integrate their information flow and business processes. They typically support the different departments and functions in the organization by using a single database that collects and stores data in real time. When ERP systems are fully realized in a business organization, they can yield many benefits: reduce cycle time, enable faster information transactions, facilitate better financial management, lay groundwork for e-commerce, and make tacit knowledge explicit (*Davenport, 2011*).

Based on *Malik, Saif, Gomez, Khan and Hussain, (2010)* Supply chain efficiency is one of the primary objectives of ERP Systems but supply chain has its own number of variable which may impact its efficiencies along with main impact of ERP. *Themistocleous, Irani and Love, (2004)* declares that a traditional supply chain has four tiers with numerous facilities at each level as supply, manufacturing, distribution and consumer. One of the important factors in supply chain efficiency is the measure of its performance. They also state that the supply chain performance measures are reliability, responsiveness, flexibility cost and asset

Based on *Shatat and Udin (2012)* illustration, there is significant positive relationship between ERP system and performance of SCM as ERP integrates the internal business process, flow of information and collaboration with the suppliers as well as customers.

Rashid, Hossain and Patrick (2002) give the following as some of the core ERP modules that are found in the successful ERP systems: Cost Accounting, Financial, Production, Transportation, Sales and Distribution, Human Capital Management, and Supply chain among others.

In today's age of globalization and competition, it is difficult for companies to continue with the traditional information systems and when the business environment of a company increases and becomes complex with the need of functional units for more inter-functional data flow for better and timely decision making, it becomes impossible to continue with the traditional and separated information systems. ERP is used to integrate all business functions of a company as one single system. The systems are supported and powered by integrated software packages developed and provided by ERP solution vendors.

ERP systems give different strategic and competitive advantages to a company. It provides single point of data entry facility in such a way that when some data is maintained at a module of one end, it is immediately accessible with the modules at the other ends, thus reducing data entry efforts and redundancy. It also enables approval through hierarchical workflow and creates enhanced and paperless work environment. However, Implementation of ERP systems is not an easy task.

Successfully implemented and used ERP systems can boost organization's performance as well as Supply chain performance, while failed implementation can affect the organization's performance on the contrary (*Davenport, 2011*)

Airline industry is working in a highly dynamic environment and under cut-throat competition that requires endurance to sail through the market turbulence. The dynamic nature of the business necessitates fast responsiveness to the market, particularly to the ever-changing customer needs and tastes. In addition, the competition is global which triggered collaboration that is currently being manifested in the industry with strategic partnership and alliances (*Ethiopian Airlines Website, access date Nov. 22, 2018*).

Ethiopian Airlines successfully achieved its vision 2010 and is currently endeavouring to achieve "Vision 2025", a 15-year strategic plan that has been exercised and realized for the last nine years. Currently, the organization is structured with seven strategic business units (SBUs) or profit centres: Ethiopian Domestic and Regional Airline, Ethiopian Passenger Airline, Ethiopian

Cargo, Ethiopian Maintenance and Repair Overhaul (MRO), Ethiopian Aviation Academy, Ethiopian In-Flight Services and Ethiopian Ground Services. In line with its performance achievements; Ethiopian joined the biggest alliance, Star Alliance, in December 2011 (*Ethiopian Airlines Website, access date Nov. 22, 2018*).

In this research, Ethiopian Airlines is being considered for the case study to examine ERP utilization in the post-implementation phase. The study basically concentrated on the utilization of the implemented ERP system with in the Supply Chain Management (SCM). The main reason that the study focused on post-implementation is that the return on information systems' investments can be gained only by effective utilization of the systems after the implementation. Several studies have shown that if the entire functionality of the implemented ERP system is not fully utilized, the organization cannot achieve the expected ERP business benefits (*Davenport et al., 2004; Kouki et al., 2007; Esteves, 2009; Peng & Nunes, 2009; Ononiwu, 2013*). Hence, addressing the post-implementation factors is critical for an organization.

On top of that, the company is selected since the researcher has worked in the organization for 15+ years in the area of Procurement and Supply Chain Management division and currently working as Sr. Business process expert in SAP support section. This will be of an added value for the success of the research.

1.2. Statement of the Problem

With the vision of becoming world class Airline by 2025 & for the effective management of its resources, the company has invested & implemented an IT solution called SAP ERP (enterprise resource planning) for the business functions of supply chain, Finance and human resource since January 2013. Even though the number of passengers boarded is growing in recent years, Ethiopian airlines is struggling to turn increased revenue into profits. The company's profit margin, which is only single digit, remains weak due to the increased competition, high fuel and running costs and lack of realizing business value out of huge IT investment. As a result, the airline business is always under pressure which demands not only investing a huge resource on

IT solution but also ensuring the realization of business values (*Atalik & Arslan, 2009*). Since it is one of the grey area, its effectiveness should be studied.

The company has invested for the purchase of the ERP solution and for the implementation of the project in order to replace the legacy system with integrated and automated business process. Hence, in order to improve its supply chain performance, the company has successfully implemented SAP ERP Logistics module. Which comprised of six sub modules, namely Materials Management (MM), Sales and Distribution (SD), Production Planning (PP), Quality Management (QM), Project System (PS) and Plant Maintenance (PM). However, the report generated from the incident management system shows the number of incident records coming from the users of these modules are not decreasing as much as it had been expected to be. Moreover, there is also a gap from the user's perspective that utilization of the implemented ERP is not satisfactory

Based on the anecdotal information, the below summarized feedback is gathered from five respondents among the randomly selected ten supply chain management employees from Maintenance repair and over hall (MRO) plant, central plant and Catering plant of the supply chain management division.

As per respondents, all of them agreed that ERP system implemented success fully however the utilization of the system is not satisfactory as compared to the ample functionality it offers. They believe it is due to lack of sufficient knowledge in operating the system, high turnover of the experienced employees who had good manipulation skills in operating the system is also mentioned as problem, and most employees work on the system on trial and error basis without understanding the impact that it would result on subsequent processes/functions. Lack of inventory information on the system is also another issue raised by the respondent where they cannot rely on the figure that the system is giving due to this duplicate purchase, stock variance and manual checking of the balance by going to ware houses physically are observed many times. The final comment that the respondent gave were no continuous training is given and there is redundant system problem that is happening every time which is disappointing for them since it hindered their effectiveness in their routine job. Thus they recommend the support

section to carry out Root cause corrective action (RCCA) to remove this recurring problem once and for all. *(the raw data gathered from employees is shown in Appendix F)*

A company can have the best package, knowledgeable users, substantial resources, but although these elements play a part, they are not enough to guarantee the success of ERP (Kumar, 2004). The ERP system eases the smooth flow of communal information and practices across the entire organization. Furthermore, it improves the performance of the supply chain and reduces the cycle times. However, “without top management support, user involvement and education, organizations cannot hold the full benefits of such complex system and the risk of failure might be at a high level” *(Addo-Tenkorang & Helo, 2011)*

Currently, there are limited researches of ERP system that are conducted in the context of Ethiopia. *Abiot and Gomez (2012)* conducted a case study examining the successful implementation of an ERP system at private company called Mesfin Engineering. *Sintayehu (2014)* examined the critical success factors of ERP implementation by conducting a case study at Ethiopian Airlines. However, these studies didn't address post-implementation ERP utilization. *Elsa (2015)* conducted a case study at Ethiopian airlines on Post implementation management frame work and proposed thirteen Post implementation management frame work issues and recommended for future researchers to measure the impact of the implemented ERP system using ROI, identify gaps and address the issues accordingly. Thus, her study hasn't addressed the realization for the business result that the post implementation utilization brought.

Adane (2017) studied on effect of ERP implementation on internal supply chain performance in Ethio-Telecom. In his research he studied the effect of ERP implementation on the three supply chain processes. Plan, Source & Deliver to measure the internal supply chain process. However, his study mainly focused on assessing supply chain activities and he didn't address how the implemented system impact the supply chain performance.

Thus, the aim of this study is to assess the effective utilization of the ERP system in reference to the post implementation factors and assess the supply chain performance using SCOR measurement matrix.

1.3. Research Question

The basic research questions addressed in the study are:

1. What are the post implementation utilization enablers?
2. Which ERP utilization enablers have significant effect on the supply chain management performance?
3. How do ERP utilization enablers affect the supply chain management performance?

1.4. Objective of the Study

1.4.1. General Objective

The general objective of the study was to assess the effects of ERP utilization enablers on the supply chain performance of Ethiopian Airlines.

1.4.2. Specific Objectives

In order to achieve the general objective of this study, the following specific objectives were identified.

- To identify ERP utilization enablers.
- Study the effect of ERP utilization enablers on supply chain management performance.
- Based on the research result, to identify gap and improvement areas where the management can work on in order to improve the supply chain performance through effective utilization of the ERP system.

1.5. Significance of the Study

In addition to being a requirement to fulfil the academic program, this research is believed to produce results that will provide information to the management of Ethiopian Airlines to know the utilization of the ERP system and to focus & work on those post implementation factors that have direct effect on supply chain performance.

The result of the research can also be used as an input to substantiate decision making for other industries in Ethiopia who wishes to install the system in their company by looking at the effect that it brought to the supply chain performance in Ethiopian airlines context.

Another important significance of the study is that; the result can be used as an input for other researchers to further study with additional variables to come up with a better output. This study will only focus on the Logistics module of ERP system. However, it will bring a holistic performance view, if the Human Capital Management and Financial modules are also studied so that it would help the management know the overall organizational performance achieved through ERP implementation. From the system utilization point of view, the contribution of this research is to provide the guidance for company to get the maximum benefit from the costly ERP system.

1.6. Scope of the Study

This study focuses on periods of post implementation that is since the time the system gone live in January 2013. This study was conducted in Addis Ababa Ethiopia and the case company was Ethiopian airlines head quarter particularly the purchasing and supply chain management division was the focal area of the study.

This study mainly focused on the assessment of effects of ERP utilization enablers on the supply chain performance of Ethiopian airlines and the Logistics module of the SAP ERP was the main area of the study.

1.7. Limitations of the Study

The limitations of the research were the input data for the analysis is restricted only to Logistics and supply chain modules of the SAP ERP system of Ethiopian Airlines. The result would have been more holistic if it could also include other core modules like Human resource and Finance of ERP system.

The second limitation in this research was the performance of the internal supply chain had been considered from the perspective of the Supply chain reliability, supply chain responsiveness and

supply chain flexibility perspective. However, the study didn't consider the cost and asset management aspect of the supply chain performance since the data related to these performance attribute is not disclosed to public and is was against the case company policy.

The third limitation was, this case study research is bound only in one organization, Ethiopian Airlines, ERP system post-implementation utilization since January, 2013 which is the go-live date of the implementation.

The fourth limitation was the accessibility of recent literatures that are published with in the last five years is limited which ultimately affects the researchers' understanding of the area and the current research findings.

1.8. Organization of the Thesis

This thesis report is organized into five chapters. Chapter one, the present chapter, is a general introduction to the problem and includes the objective of the research along with the significance and scope of the study. Chapter two is devoted to literature review. It discusses concepts of ERP in two sections. In the first section, the basic concepts of ERP implementation and its success factors and also the concept of supply chain and its performance model are discussed in sufficient detail. In the second section, related literatures from international and local sources are reviewed and presented. In chapter three, the research methodology is described. Data presentation, analysis and discussions are presented in chapter four. Finally, chapter five presented general conclusions and recommendations along with future research directions based on observations and results from the study.

CHAPTER TWO

LITERATURE REVIEW

INTRODUCTION

In this chapter, the theoretical background of ERP is discussed based on the availability of previous scientific researches. In addition, ERP post implementation related literatures are reviewed to analyse existing research and to clearly show the research gap to justify the significance of this study. With the aim of searching for literature to understand the theoretical background of ERP post implementation utilization and supply chain performance, the researcher attempted to retrieve various articles.

With the aim of searching for literature to understand the theoretical background of ERP and Supply chain management, the researcher attempted to retrieve number of articles. The search parameters and synonyms that were used to logically guide the search engines included ERP, ERP overview, ERP post implementation issues, and the ERP utilization, Supply chain performance and SCOR model. At the second stage, the researcher identified literatures that are related to ERP post-implementation and articles related to supply chain management performance. The articles were searched in Google, Google Scholar, Emerald Insight and Research gate using the above mentioned keywords.

2.1. Theoretical background

Nowadays, globalization has forced multi-national firms to face a stiff in the levels of competition and to operate in a more dynamic business environment. As a result, firms are engaged in adopting best business practices, with the notion of continuous design improvements, speeding up the product development life cycle, managing logistics channels and streamlining sourcing arrangements in order to manage such competitive pressures and environmental uncertainties. Organizations are profoundly investing in IT systems to effectively manage and

integrate the activities of the firm across their supply chains and also shape up the way they conduct business to meet customers' as well as their own needs. One of the most popular and effective enterprise systems adopted by thousands of companies over the last two decades is the ERP system. While IT systems can bring benefits in general terms, ERP system offers additional benefits due to the larger and integrated scope of the system itself (*Dijk, 2013*).

ERP systems are primarily designed to solve the fragmentation of information in large business firms by integrating and standardizing processes flows of various functional units with the core concept of a single comprehensive database (*Davenport, 1998*). The database collects data and integrates it into different modular applications to virtually support the entire firm's business activities: across functions, business units, and across the world. To further explain the concept of ERP, various definitions that are published in literatures are discussed here.

ERP can further be described as an enterprise system with a suite of integrated software applications used to manage enterprise resources through company-wide business processes by using standard procedures, common database and data sharing among different functional areas with in and across organizations (*Soltanzadeh & Khoshsiraf, 2012*).

Business firms collect, generate, and store vast amounts of data and information which is unthinkable when managing without computerized information systems. More importantly, in the absence of an ERP system, these vast amounts of data and information is spread across dozens or even hundreds of separate and mostly incompatible legacy computerized information systems; each handled by separate business units, regions and functions. Each of these silo legacy systems may provide important support for a particular business unit of an organization; however, enterprise-wide performance is hindered by the lack of integration (*Davenport, 1998*).

An ERP system is defined as a cross-functional and enterprise-wide system operating through a bundle of integrated modules that support the standard business processes of an organization. The ERP system contains standard functionalities that can be applied in different types of industries. One of the main goals of an ERP system is to support the business' core processes and

routine transactions through integrating both data and cross-functional processes into the system. Today, ERP systems can be leased as hosted software in a cloud-based technology. In a cloud, the vendor provides the users access to a system, hardware, and storage capacity, where system and hardware management are highly transparent to the users. The motivation for organizations to adopt an ERP system is typically to reduce costs, improve decision making through better reporting capabilities, improve customer relationships, meet market and legal requirements, and to increase process efficiency (*Elise Bjelland and Moutaz Haddara, 2018*)

According to Mendelson (2000), ERP is a software architecture that designed in order to expedite the information flow as well as the information sharing between various departments in a company, and also to provide to decision-makers an enterprise-wide view of all information that they may need to assist them in decision-making. The primary objective of ERP systems is to find a solution for information fragmentation and to integrate the flow of information inside the company (*McAdam & Galloway, 2005*).

Enterprise Resource Planning (ERP) is an enterprise-wide software solution that integrates and automates business functions of an organization. Real-time information integration across the organizations functional areas increases operational efficiencies and helps managers to arrive at better decisions making. Today having an ERP system is not a luxury, but a necessity. A robust ERP system along with a fully trained workforce is a must for an organization's survival (*Alexis, 2008*).

2.2. Benefits of ERP System

In today's dynamic and unpredictable business environment, companies face the tremendous challenge of expanding markets and rising customer expectations. This compels them to lower total costs in the entire supply chain, shorten throughput times, reduce inventories, expand product choice, provide more reliable delivery dates and better customer service, improve quality, and efficiently coordinate demand, supply and production (*Tambovcevs and Merkurjev, 2009*). Most companies are using enterprise resource planning (ERP) to produce efficiencies by

integrating different functions of an organization which includes information, flow of material, resources and financial output of a company (*Hammer, 2006*)

ERP can help companies in automating and integrating corporate cross-functions and also in organizing and standardizing data and business processes. ERP systems also facilitate information sharing whereby supply chain management can make closer cooperation among supply chain partners in order to reduce the cost of transactions (*Tarn et al., 2002*).

A well-designed, properly setup and correctly implemented ERP solution can provide tremendous benefits to any company no matter their size or scope. It enables the company to instantly run real time report without manual data entry and it also enable employees not to waste their time re-entering the same data into multiple systems. Companies that have deemed to be successful attribute their success to their ERP solution. Forward looking firms are also considering the ERP system as a key element of their overall business investment strategy.

Shang and Seddon (2000) defined list of ERP benefits from a review of 233 cases published in ERP vendors' stories. They also classified the benefits into five benefit categories: operational, managerial, organizational, IT infrastructure, and strategic.

Operational Benefits

Cost reduction: ERP systems can remove redundant processes which results in cost reduction.

Cycle time reduction: ERP systems can facilitate employee support, customer support, and supplier support that leads to measurable cycle time reductions.

Productivity improvement: ERP systems can improve employees' productivity. This improvement can be measured by different metrics such as the number of customer served by employee or the number of products produced per employee.

Quality improvement: Accuracy and reliability can be improved. In other words, reductions in error rates and duplication errors can be achieved

Customer service improvement: The customer data is handled centrally in a unified manner regardless of the amount of data which makes it easier to deal with customer inquiries.

Managerial Benefits

Better resource management: an ERP system improves supply chain management which can lead to improved inventory management, reduced stock, and increased turnover. It can also help to better manage and utilize human resources based on their skills and experiences.

Better decision making: Due to the integrated nature of an ERP system it is possible to generate improved operative data that can be used by business managers to make better informed decisions about strategic planning and market responses.

Better performance control: Financial performance can be measured and controlled in different ways, either by customer, business, product, geography, or a combination of them which leads to an overall increase in operational management efficiency and effectiveness.

Strategic Benefits

Support business alliances: Alliances can be efficiently and effectively amalgamated with the organization's standard business practices.

Build cost leadership: ERP streamlines processes and shared services which makes it easier to achieve economies of scale.

Build external linkage: The system can easily be integrated with the systems of external parties such as business partners, suppliers, and distributors which improves business performance.

Enable worldwide expansion: A centralized world operation can be facilitated by the system that can handle global resource management and market penetration, allows operating in multi-currency, and the ability to provide solutions globally that are efficiently and cost effectively.

Customer service improvement: An ERP system can make it easier to deal with customer inquiries based on the centralized customer data available in the system.

Infrastructure Benefits

Increased business flexibility: The IT infrastructure that hosts ERP system supports stable and flexible business changes for the current and future expansions as well. This enables organizations to respond quicker, at a lower cost, and provide a range of options

to internal as well as external changes. IT cost reductions: ERP systems can lower costs by consolidating dispersed legacy systems since maintenance and integration of multiple legacy is costly.

Increased IT infrastructure capability: stable and flexible for the current and future business changes - ERP systems are stable; they are built on streamlined and standardized platforms. They promote continuous improvements and have global support. They bring flexibility with them since they are built on modern technologies. Finally, they are extendable to other parties and expandable to a range of applications; and they are also customizable and configurable.

Organizational Benefits

Facilitate business learning and broaden employee skills: ERP systems can broaden employee's skills and facilitate shortened learning times.

Empowerment: ERP systems can facilitate providing value-added responsibilities to employees so that they can work autonomously. Moreover, it can be used to track accountability of employees based on their defined roles in the system.

Change culture with common vision – ERP systems are process based that promotes employees cross-functional and interdepartmental communication between employees. It also enables the vision to be consistent across different levels of the organization so that coordination and harmonization can be boosted.

Better employee morale and satisfaction: ERP systems' decision-making tools boost employees' problem solving capability which increases employee satisfaction and moral.

2.3. Benefits of ERP on Supply chain management

An ERP system can offer high value to any organization whose aim is smooth planning and execution of related operations to achieve long term profitability and maintain a solid competitive edge. This is the main reason more and more companies are attracted towards purchasing and implementation of the information technologies like ERPs. What does an ERP has to offer an organization?

1. Improved Supply Chain Network: ERP provides complete visibility across the supply chain network which is highly impossible in the manual process. With the implementation of ERP an organization can monitor all the status and activities of all suppliers, plants, storage facilities and all the members of the supply chain which makes it easy for communication throughout the network. This in turn helps in effective tracking and management of all processes, right from ordering, through manufacturing and shipping of finished goods to the customers (*Wei, C.C. and Wang, M.J.J. (2004)*). The status of all the operations can be monitored at any time and corrected anytime in case of problems.
2. Minimized delays: Many supply chains which are not configured with the ERP systems have already placed complaints over poor business relationships and as well as loss in business. Some of the general complaints are late shipments from vendors, slow down or crashes on production lines, logistical errors in distribution channels. These all have negative impacts on organization and therefore results in negative impact with the customers who are the main force of attraction for a supply chain. With the implementation of ERP all the activities can be co-ordinated and executed ensuring higher levels of on time delivery across the chain.
3. Enhanced Collaboration: ERP helps organization to have a control over all the suppliers and distributors. This creates the ability to know what they are doing all the times. ERP bridges the gap between supply chain partners. With ERP all the members across the network can share vital information like demand, forecasting reports, inventory levels,

status of production, transportation plans and many more in real time. This type of available real time information makes the supply chain process to run flawlessly (Stevenson, 2007).

4. **Reduced Costs:** An ERP can help to reduce expenses in many ways. It can help improve inventory management facilitating just in time model or quick response models which eliminates the strain about the availability of raw materials and therefore the need for storing the raw goods can be eliminated.

It enables more effective demand planning so that the production levels can be set to address customer requirements without the shortages (Mabert et. al. 2003). It can also help to improve relationship with vendors and distributors, so decision makers can identify cost cutting opportunities such as volume discounts.

2.4. ERP system modules

ERP is known by its modular nature to manage diverse business processes across the organization under a unified database which facilitates integration and seamless information flow among the modules. ERP system consists of many standard enterprise software modules that can be individually purchased, based on what best meets the specific needs and technical capabilities of the organization.

An ERP module focuses on one area of business processes, such as HCM, FI/CO, logistics and sales & marketing. Even though the types and contents of ERP modules are different (from vendor to vendor) with some degree of specialty, the core modules remain the same across vendors (Gundogar et al., 2010). These core ERP modules are also comprised of different sub- modules depending on their functionality and specialty. In order to further elaborate ERP components, the modules of SAP ERP, which are incorporated under SAP R/3 package, is discussed since SAP is the leading ERP vendor in the world-wide market. Moreover, SAP/R3 is the ERP system implemented by the organization under this case study. Currently, SAP has 12 main modules that are fully integrated as can be seen below in figure 2.1.



Figure 1: Standard SAP ERP Modules (Source: <http://www.saperp.com/general/sap-module-overview.html> (Accessed on January 29, 2019))

However due to the scope of the study, the explanation of the ERP modules are limited to supply chain modules which are described here below.

Material Management (MM): As the name implies this module is dedicated for procurement handling and inventory management. It is integrated with other modules such as PP (product planning), SD (sales and distribution), and QM (quality management).

Product Planning (PP): The purpose of PP is to ensure that manufacturing runs effectively and efficiently in order to produce products as per customers' demand. This module handles master data needed like bill of materials (BOM), routings and work centres.

Quality Management (QM): is dedicated for ensuring that all the necessary activities to design, develop and implement a product or service that are effective and efficient with respect to the system and its performance. It is the comprehensive solution that helps the company throughout the product life cycle and along the supply chain.

Plant Maintenance (PM): dedicated to cover the entire maintenance activities, supporting the Planning, Programming and Implementation optimally, by focusing on the availability of equipment, staff costs and Assurance. SAP's PM comprises of activities such as inspection, preventive maintenance and repairs in order to measure and restore the ideal condition of a technical system.

Project System (PS): aimed to support the planning, controlling and monitoring of long-term, highly complex projects to achieve targeted project goals by balancing time, budget and scope.

Sales & Distribution (SD): is part of logistics module that support customers through the processes of quotations, sales order and all the way towards billing the customer. This module is highly integrated with the MM and PP functional modules and allows firms to manage customers' sales price, check for open orders and forecast sales related activities. SD includes order management, sales management, sales planning, pricing, and after-sales-service sub- modules.

2.5. ERP post implementation phase

The post-implementation phase starts from go-live of the ERP system where the system is in operational use and lasts until the system retires to be replaced by a new one (*Ruivo et al., 2012*). In this stage, the responsibilities of implementation project team shift to system users and the IT technical team. During post-implementation phase, normal business operations can be executed repeatedly without critical issues such as login issues, lacking performance, failing functionalities, etc. Hence, ERP post-implementation mainly focuses on utilizing, maintaining, and enhancing the implemented system to realize business benefits (*Willis & Willis, 2002; Ruivo, et al., 2012; Ononiwu, 2013*).

While ERP use refers to the daily usage of the system which is in production environment for the targeted business activities, ERP post-implementation success refers to the organization's ability to utilize ERP to create business results. In essence, ERP post-implementation success refers to the effective system utilization to enhance organizational goals (*Davenport, 1998; Ifinedo, 2008*). On the other hand, ERP implementation success refers to the

technical installation success of such systems wherein the measurement indicators mainly focuses on project management metrics, time estimate, cost overruns, scope etc.

According to *Jasperson, et al. (2005)*, utilization is defined as the extent to which the features and capabilities of the system are used by end-users to perform a business task. By the same token, when end-users fail to utilize the full features of the adopted system, then the system is considered as underutilized. Even though an ERP system is also an IS, the findings of other IS studies that have investigated the system utilization would not be considered sufficient for ERP systems. Several researches have shown equating an ERP system to other IS prohibits the clear understanding of ERP system (*Davenport, 2000; Yu, 2005; Ifinedo, 2008; Ononiwu, 2013*). *Ifinedo (2008)* stated that ERP systems are different from other IT systems as their implementation incorporates technological, organizational, operational, managerial, and strategic components.

The realization of business values has often been assumed to be achieved automatically once the success of an ERP system implementation is achieved. However, successful implementation of an ERP system is only the initial step accomplishment towards achieving ERP success towards realization of business results. In other words, ERP implementation is not the end of the journey, but rather, the beginning of the long road way towards innovation, improvement, and flexibility (*Smyth, 2001; Willis & Willis, 2002; Yu, 2005; Koouki et al., 2007; Peng & Nunes, 2009; Peng & Nunes, 2010; Ononiwu, 2013*). As with any IS, an ERP system should be exploited in order to realize the expected business values (*Jasperson, et al., 2005*).

According to *Peng and Nunes, (2009)*, organizations often encounters a wide range of risks during an ERP system post-implementation phase which incorporates using, maintaining, and enhancing ERP systems after the go-live stage. These issues are not only the technical aspects, but are also, and more importantly can be found in diverse operational, strategic, and organizational areas (*Peng and Nunes, 2010*). Some organizations that have implemented ERP have failed to achieve the expected business values due to underutilization; while others have abandoned using the system even though the initial implementation was successful (*Smyth, 2001; Willis & Willis, 2002, Peng & Nunes, 2009*). Hence, ERP post-implementation emerges to be an interesting research topic and it is also being considered as the direction of the second

wave ERP researched by IS researchers (*e.g. Willis & Wills, 2002; Yu, 2005; Kiriwandeniya et al., 2013; Pan et al., 2009*).

Kouki et al. (2007) have studied ERP assimilation determinants during post-implementation stage by conducting a cross-case study analysis in three large scale Canadian manufacturing firms. In this study, assimilation is defined as the magnitude to which the ERP system is used in a comprehensive and integrated way and becomes routinized and embedded in the firm's work process and value chain activities. Accordingly, his findings have shown different constructs that determine ERP utilization. These constructs are categorized as technological, organizational and environmental factors.

The technological context refers to the ERP systems' attributes that might influence the acceptance rate of the system by its users and also the IT expertise which indicates the IT people competence in maintaining, updating and supporting the ERP system. The organizational context refers to the top management championship, the knowledge side of the system and user involvement. Environmental context refers to consultants' effectiveness and vendor's support. In the post-implementation stage, consultant's effectiveness describes the external consultants' role during the system's upgrades. Vendor's support refers to the strategic relationship and the close fit between the system's vendor and the user organization that could be established between the vendor and the ERP adopting firm. Different studies are conducted to identify ERP post implementation factors. Kouki et al. (2007) summarized and defined the post implementation Assimilation factors.

Top Management Championship: refers to the extent that top management supports and commits to the continuous ERP system utilization, upgrade and progress of the system in a direct or indirect way (*Kouki et al., 2007; Jones et al., 2008*). Top management championship is a critical recurrent factor which affects not only the implementation but also the post- implementation phase of an ERP system life cycle (*Kiriwandeniya et al., 2013*). Similarly, *Kouki et al. (2007)* indicated the demand of sustainable top management support as long as the system is operating, considering the continuous technological development of ERP systems and their endless requirements.

Training: training during post-implementation phase of an ERP system, ensures that users quickly become familiar with the system and business processes. Training allows users to take better advantage of the various functionalities and features included in the system continually (*Kiriwandeniya et al., 2013; Ononiwu, 2013*).

User Involvement: in the context of ERP post-implementation phase, user involvement refers to the extent to which users understand how to perform their own business activities in the ERP system. Moreover, it refers to the users' understanding about how their own business activities fit into other department's business processes (*Jones, et al., 2008*).

Productivity improvement: refers to the contribution of an ERP system to improve employees' productivity to produce better outcome. This productivity improvement can be measured by the quality improvement of employees' output, the efficiency of employees' decision making using the output of the system, and also the quality of the decisions they make in their work. Ahmed Shatat(2012).

IT Expertise & User Support Level Quality: describes the IT people competence and expertise in supporting, maintaining and updating the system to best align with the business. Moreover, it refers to the quality of the user support provided by the IT team that ensures effective system utilization (*Kouki et al., 2007; Ononiwu, 2013*).

ERP ATTRIBUTE: describes ERP system's technical characteristics or attributes that might influence the effective utilization of the system by its users (*Kouki et al., 2007*). It has been argued that ERP attributes affect the users' satisfaction and hence the effective utilization of the system.

According to *Wu and Wang (2006)*, there are eleven ERP systems characteristic that have significant impact on effective system utilization. These are: Relevancy of the information executed by the system, integrated nature of the system, ERP system timeliness, information accuracy, reliability, response time, flexibility, completeness, output requirement, ease of use, usefulness of the system to the users. The questionnaire items were drawn from *Hakkinen and Himola (2008)* to measure the role of ERP attributes on ERP post-implementation success.

2.6. Supply chain performance measurement

SCM can be perceived through managing upstream and downstream operations, which resulted in reducing the operational costs in order to improve the profit margin, and in delivering the products to the market in order to reach the customer on time (*Sundaram and Mehta, 2002*). The goals of SCM are to reduce uncertainty and risks related to the supply chain, and this can contribute in decreasing inventory levels and cycle time, improving business processes, and enhancing customer service, and finally increase profitability and enhance competitiveness of the company (*Turban et al., 2008*).

The overall supply chain performance could be improved through the channel coordination, information sharing, operational efficiency, and integrated communication within the supply chain. ERP system provides integration for better communication and coordination within the company and its supply chain. The success of ERP system and the supply chain highly depends on the process of integration achieved in the company and this could be achieved smoothly with the core functionality of ERP system which provides web linkage, facilitates electronic data interchange, and integrates the entire supply chain in order to support effectively the company's supply chain activities (*Ahemed Shatat & Udin, 2012*).

As supply chains continue to replace individual firms as the economic engine for creating value during the twenty-first century, understanding the relationship between supply chain management (SCM) practices and supply chain performance (SCP) becomes increasingly important. Performance measurement is the process of quantifying the effectiveness and efficiency of an action. Effectiveness is the extent to which a customer's requirements are met and efficiency measures how economically a firm's resources are utilized when providing a pre specified level of customer satisfaction. Performance measurement systems are described as the overall set of metrics used to quantify both the efficiency and effectiveness of action (*Farahani, Asgari, and Davarzani, 2009*). The supply chain operations reference model (SCOR), developed by the Supply Chain Council, provides a useful framework that considers the performance requirements of member firms in a supply chain. The SCOR model is a process reference model, which contains a standard description of management processes, a framework of relationships among the standard processes, standard metrics to measure process performance, management

practices that produce best-in-class performance, and a standard alignment to software features and functionality. The SCOR model views activities in the supply chain as a series of interlocking inter organizational processes with each individual organization consisting of five components: plan, source, make, deliver, and return.

Each of these components is considered as a critical intra-organizational process in the supply chain with five measurement criteria: (1) supply chain reliability, (2) responsiveness, (3) flexibility, (4) costs, and (5) assets (*Farahani, Asgari, and Davarzani, 2009*).

The **SCOR** reference model consists of four major sections; Performance, Processes, Practices and People (*SCC, 2012, i.3*). In this study the performance section of SCOR Metrics is considered as the main aim of the study which is to measure the performance of the internal supply chain based on the following three performance attributes:

Reliability

The Reliability attribute addresses the ability to perform tasks as required. Reliability focuses on the predictability of the outcome of a process. Typical metrics for the reliability attribute include: On-time, the right quantity, the right quality. The SCOR key performance indicator (level-1 metric) is Perfect Order Fulfillment. Reliability is a customer focused attribute.

Responsiveness

The Responsiveness attribute describes the speed at which tasks are performed. Responsiveness addresses repeated speed of doing business. Ex-ample Responsiveness metrics are cycle time metrics. The SCOR key performance indicator for Responsiveness is Order Fulfillment Cycle Time. Responsiveness is a customer focused attribute.

Agility

The Agility attribute describes the ability to respond to external influences; the ability to and speed of change. External influences include: Non-forecastable increases or decreases in demand, suppliers or partners going out of business, natural disasters, acts of (cyber) terrorism,

availability of financial resources (the economy), labor issues. The SCOR key performance indicators include Flexibility, Adaptability and Value-at-Risk. Agility is a customer focused attribute.

2.7. Related literature

Few academic researchers have been done on ERP except for research on reasons for implementation and on the challenges of implementation projects (*Henk, 2003*).

Su and Yang, (2010), examined the benefits of the ERP for supply chain management through in-depth literature review and concluded that ERP has operational, managerial, and strategic benefits for SCM.

Mahmud, (2014) used four independent variables (ERP integration, ERP implementation cost, staff training and management support) to study the relationship between ERP and supply chain management in manufacturing company and concluded that investment in ICT can make a statistically significant positive contribution to business performance as it enhances information exchange, accuracy, documentation and monitoring. However, Mahmud didn't address the utilization level and the satisfaction level of the ERP users.

Successful implementation and the effective usage of ERP system can contribute toward enhancing supply chain performance in many ways such as, integration of internal business processes, enhancement of information flow among different departments inside the company, improvement of the company's relationships and collaboration with outsourcing suppliers, customers, and supply chain partners (*Shatat and Udin, 2012*).even though the study clearly shows the positive relationship the ERP has with the supply chain, Shasta didn't address the business result that ERP has contributed.

In special view of implementing ERP for Supply Chain management (SCM), the application of ERP increases the efficiency of SCM. *Shatat and Uddin (2012)* illustrates the relationship between ERP and SCM that there is a significant positive relationship between ERP system and performance of SCM as ERP integrates the internal business process, flow of information and collaboration with the suppliers as well as customers. The use of ERP as a supply chain

management system can elaborate success for entire supply chain and for the organization as a whole (*Syeda, Muhammad and Saddam, 2013*).

There are few literature and research related to ERP systems implementation in Ethiopian context. One of the studies related to ERP system from Ethiopian perspective is the work of *Abiot and Gomez, (2012)*. This study has discussed about a successful ERP Implementation in an Ethiopian private limited engineering company. The ERP system mentioned by the authors is Microsoft Dynamics which is not well known ERP application. The study didn't identify post implementation factors and the impact on performance. It simply identified and classified problems related with the implementation of the system as cultural, business and technical.

Sintayehu (2014) studied on the success factors for implementation of Enterprise Resource Planning system at Ethiopian Airlines. The objective of the study was to investigate CSFs and sharing experiences to other Ethiopian organizations with similar context and environment. The researcher has used a qualitative case study strategy like interviews, observations and an online survey questionnaire (supplementary) as main data collection techniques. Finally, the researcher identified twenty factors that can be critical for the success of ERP system implementation in the context of Ethiopia. These factors are project planning, top management support, project management and leadership, capability of consultants, change management and communication, organizational readiness and overall knowledge transfer. The researcher also recommended to use his study for post project lessons assessment.

Elsa (2015) carried research on ERP post-implementation management framework on Ethiopian Airlines. The main objective of this study was to investigate technical, organizational, and operational issues of ERP post-implementation success in the context of Ethiopian airlines and design a solution framework to address those issues. The researcher has employed both quantitative and qualitative research approach. Therefore, survey questionnaire and interview contents were prepared based on the defined research model by partially adapting from existing literature and developed her own. Finally, the researcher has developed a high-level ERP post implementation management framework. The researcher recommended impact assessment on the proposed framework in order to assess the consequences of its contribution on the overall business improvement and success of ERP post-implementation

Adane (2017) studied on effect of ERP implementation on internal supply chain performance in Ethio-Telecom. In his research he studied the effect of ERP implementation on the three supply chain processes or functions. However, he hasn't assess the performance of the supply chain in terms of its reliability, responsiveness and flexibility. As *Van Hoek (2001)* emphasizes that to assess the supply chain performance, supply chain metrics must centre on the customer satisfaction.

Thus the aim of this study was to assess the effect of ERP post implementation issues/factors on the supply chain performance with in Ethiopian airlines.

2.8 Conceptual framework

Based on the literature review, research model is defined as depicted in figure 2. The model illustrates the six determinant factors that influence the ERP post-implementation utilization. Accordingly, the case company's effective utilization of the ERP system was evaluated based on the research model.

The model mainly adapted from two research studies. According to Kouki et al. (2007), six independent variables were identified that have an influence on ERP utilization; the top management champion ship; training, user involvement, ERP attribute and IT & user support quality and the six independent variable namely improved productivity was adopted from Ahmed Shatat & udin (2012) as an important factor that influences ERP utilization. Accordingly, figure 2 illustrates the research model of this study which depicts the six enablers of ERP system utilization.

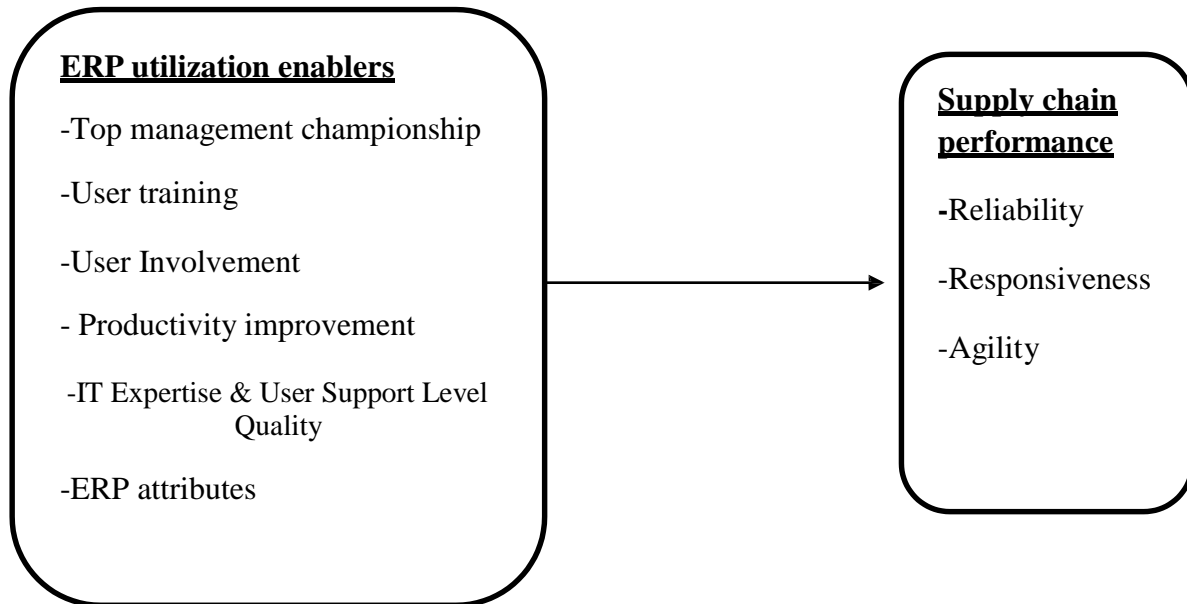


Figure 2; Source: Research Model (adapted from: Kouki et al., 2007 & Ahemed Shatat & Udin (2012))

The success of ERP implementations is often measured at implementation time, leaving post-implementation completely out of the equation. However, post-implementation is a critical phase that should be taken into consideration in order to fully evaluate the success of an ERP installation (Fryling, 2010).

As Su & Yang concluded ERP has operational, managerial, and strategic benefit to SCM. Using ERP integration, ERP implementation cost, Staff training and management support as an independent variable Mahmud (2014) concluded that investment in ICT can make a significant positive contribution to business performance. According to Ahmed Shatat & Udin (2012) there is a positive relationship b/n ERP implementation and supply chain performance. However, both researchers haven't assessed the post implementation utilization effect on the supply chain performance.

There are very few similar studies available on ERP post implementation lifecycle and its effect on supply chain performance in Ethiopia. However, there is no research made from the Ethiopian Airlines context.

Thus, First, none of the studies have shown how exactly the ERP utilization affect the supply chain performance in terms of responsiveness towards customer request, in terms of flexibility in order to meet a changing customer demand and in terms of ensuring the reliability of the supply chain deliverable.

Second, most of the studies focus on the time during or before the implementation of the ERP system.

Third, *Adane Yalew (2017)* has concluded the positive relation between ERP implementation and the Plan, Source and Deliver process of the supply chain management. However, he hasn't studied from the dimension of the performance of the supply chain. Thus the intention of the researcher is trying to fill the gap and recommend further study area.

CHAPTER THREE

Research Methodology

This study has attempted to assess the effect of ERP system utilization enablers on the supply chain performance of Ethiopian airlines based on post implementation utilization enablers and supply chain performance model so as to determine the outcome and define roadmap for improvement based on identified improvement areas. Moreover, this study investigates how ERP implementation contributed to the success of the supply chain performance with in the context of Ethiopian airlines.

This chapter presents the methodology that is used to achieve the objective of the study. First, the general research approach is described. Second, population of the study, sampling techniques, sample size, data collection instrument and data collection procedure are discussed, then, pilot study are discussed. Finally, data analysis and presentation method is presented along with quality of the research.

3.1. Research Approach

In this research, Ethiopian Airlines is considered as a case company to study ERP system utilization enablers effect on internal supply chain performance, which basically concentrates on measuring the contribution of post implementation utilization enablers towards the performance of the supply chain.

Ethiopian Airlines is selected for the case study since the company has a huge IT investment every year in order to stay in business and further win the stiff competition of an airline industry. In line with this, assessing the effective utilization of the IT systems across the company mainly, in the supply chain division of the company helps to ensure the continuity of customer satisfaction and the findings of this research help management to know the focus area for further improvement. The other reason is, as Ethiopian Airlines is a global organization with a flavour of both international and local organizational cultures with an intensive use of IT other Ethiopian firms can learn a lot from the output of this study. Moreover, the researcher works for about 15+

years in the organization with Supply chain management and SAP functional support since the implementation which can positively contribute to the success of the research. The main reason that the study focused on ERP and supply chain performance is due to the number of incidents reported from supply chain users is not decreasing as it had been anticipated during the implementation and functional support teams are still working for the past six years on fixing the routine issues coming from users rather than focusing on system enhancement and upgrade.

In this study, both quantitative and qualitative data collection and analysis approaches are employed. The quantitative approach provides leverage to reach more people with optimized time than qualitative approach. Hence, it provides the potential to mine large amounts of information from large populations with adequate level of accuracy.

3.2. Study Design

In this study Descriptive and Explanatory research design was used to analyse the effect of ERP utilization on the supply chain performance of Ethiopian Airlines. Close ended questionnaires together with semi-structured interview will be employed to collect the required data.

3.2.1. Research Population

Ethiopian Airlines has around 16,000 employees including staffs working in different countries (international locations). This study has taken employees at head quarter by focusing on Purchasing and Supply chain management division employees as a target population not only for a reason of manageability but also for supply chain processes are especially performed in the section and ERP Logistics supply chain modules are majorly practiced in this division. Therefore, according to SAP license data of Ethiopian Airlines the number of employees who have access on SAP LOG module are 450. Thus the target population of the study embraces 450 Management and non-Management employees (N=450).

3.2.2. Sampling Techniques and Sample Size

The researcher intends to use simple random sampling for quantitative analysis. Since the study population is similar in using supply chain ERP module. And for qualitative data analysis Purposive sampling is used to identify the interviewee. The sample size for the quantitative survey (questionnaire) is determined to be 207 (n=207) applying the sampling formula shown below (*Chohran, 1977*) with confidence level of 95% and 5% confidence interval.

The

calculation to determine this sample size is demonstrated in appendix D.

$$n_0 = \frac{(Z_{\alpha/2})^2 pq}{e^2}$$

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{N}}$$

Where, N = Target Population

n_0 = Sample size

n = Calculated/Actual sample size

e = the desired level of precision, (taken confidence level = 95% where by $\alpha = 0.05$)

P = is estimated proportion of an attribute in the population (taken as 0.5 and q = 1-P = 0.5; for conservative estimate)

Z = normal curve that cuts an area α (the value read from statistical table)

3.2.3. Data Collection Instrument

For the purpose of quantitative analysis, this study employed survey which is conducted through Five point Likert scale questionnaire where 1= Strongly Disagree, 2=Disagree, 3=

Neutral

4=Agree and 5= Strongly agree. The independent variables are mainly adopted from the study of Kouki (2007) and question 2 & 3 are adopted from *ArunKumar Madapus (2008)*. Whereas, the supply chain performance measurement constructs were primarily adopted from (*Ahemed Shatat (2012)*). However, the constructs are developed based on other related literature review.

3.2.3.1. Data Collection Procedure

The researcher conducted trend analysis of questionnaire response rate of Ethiopian Airline's Employees. In Ethiopian Airlines, market feedback analysis (MFA) which is one of the tools used to conduct a survey to improve internal services and achieve competitive excellence (ACE). In due course, business units/sections disseminate online survey to other internal business units/sections to measure the customer satisfaction and identify improvement opportunities.

According to the discussion held with few managers, the response rate of the online MFA is only 20%. This might be associated with the tight work load of the employees, time constraints and the attitude of giving genuine feedbacks in online surveys. They were also requested about the survey success of the online versus the hard copy, and they replied that the hard copy survey response rate is better than online surveys. Hence, the survey was implemented using a paper-based questionnaire to obtain a better response rate. The initial communication to the respondents include clear instructions of the questionnaire, promises of anonymity, and explaining how the output of the research can contribute to the improvement of Supply chain performance.

Accordingly, the questionnaire was hand delivered to 207 selected respondents physically by the researcher. Subsequently, follow-ups conducted through phone & short message service such as Skype for business. Moreover, the researcher also approached the respondents physically to encourage them to finalize the questionnaires timely with their genuine feedbacks. Additionally, employees were nominated from each and every of the departments/ sections, so that they can encourage, assist and facilitate the data collection process in their respective working area. The filled questionnaires were collected on the target date given to the respondents. Out of the total number of distributed questionnaires, 11 of the respondents couldn't return the questionnaire due to different reasons and 196 were collected. This indicates the achievement of

94.68 % response rate. Data cleaning was conducted for possible omissions, missing items and errors. Accordingly, of the total 196 responses collected, all of them found to be complete. This indicates of the total 196 collected responses, 100% found to be complete and valid to be used for the analysis of the study.

The data collected using the questionnaire were then logged and tracked on excel sheet. Next, the questionnaire items were coded as can be seen in appendix A and then the data imported to Statistical Package for Social Science (SPSS) version 24 software tool. Eventually, SPSS Software used to analyse all the data based on the objective of the study.

3.3. Data Analysis and Presentation Method

The quantitative data is collected from the identified areas of data sources, edited, organized, and analysed using SPSS version 24 based on appropriate statistical methods and tools. Descriptive statistics methods such as frequency distribution, mean calculation, and graphical representations are used to summarize the collected data. Descriptive statistical analysis is used for the final report of the relevant demographic variables which was produced through central tendency measurements (frequency and frequency distribution, valid & cumulative percentage and comparison of mean). In addition, tabular and pie chart explanations are used to present the result with the help of SPSS.

In inferential statistical analysis, multiple linear regression method was utilized using statistical package for social sciences (SPSS) software. The use of the statistical tool and method of presentation is described below.

Multiple Regression Analysis

Multiple regression analysis is a major statistical tool for predicting the unknown value of a variable from the known value of variables. And it is about finding a relationship between variables and forming a model. The Model for this study was developed using six ERP post implementation factors or predictors which have influences on internal supply chain performance. $= \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_n X_n + \varepsilon$

Where Y is the dependent variable and the independent variables are those which explain the response ranges from X1 to X6

3.4. Quality of Research

The quality of a research can be evaluated using its reliability and validity. The reliability and validity of the study is further discussed below.

3.4.1 Reliability of study

To measure the internal consistency of the questionnaire, reliability test was conducted. Accordingly, cronbach's coefficient alpha was used as a reliability criterion with the help of SPSS. Accordingly, Cronbach's Alpha is the most common measures of the reliability of the internal consistency. As per Norman (2003, p.219), this coefficient ranges between 0 and 1, with a high value indicating a high level of consistency among the items. In view of that, the result obtained is greater than 0.70 which is the minimal alpha value to prove the internal consistency and reliability. Hence, the Cronbach's alpha test is an indication that the survey questionnaire's reliability and internal consistency to use for the study

Pilot study is useful to ensure the validity of the instrument if it is a new measurement tool or consists of newly developed questions. A pilot study was conducted with a sample of 10 purposively selected ERP support section manager, Sr. ICT Quality Assurance Officer Supply chain managers and Sr. Procurement employees to test reliability of the questionnaire. Moreover, it helps to ensure whether the instruments are free of ambiguity and irrelevant items. Pilot study is also valuable for controlling bias in data interpretation prior to distributing the survey questionnaire to the actual full-scale group. The survey participants were selected from SAP ERP support section, IT quality assurance and from the supply chain units by considering their expertise and knowledge in relation to ERP system utilization and supply chain processes. One to one discussion was held with the pilot study respondents prior to distributing the questionnaires. All of the participants filled the questionnaire same day, which indicated 100% response rate of the pilot study. Once the questioner was filled, the feedbacks were collected

from the participants. Finally, in accordance with the pilot test feedbacks, the questionnaire was amended to improve the clarity of the questions, minimize data interpretation bias and increase the likelihood of success. Accordingly, the reliability test result of the pilot study, the full scale data and each independent and dependent variable are shown the below consecutive tables.

Table 3.1: Reliability Statistics based on the Pilot test data

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.897	.894	41

Source: Own survey, 2019

Table 3.2: Reliability Statistics based on the full scale data

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.911	.917	41

Table 3.3: Reliability test for each independent and dependent variable

component	Cornbach's Alpha	N. of item
Top Management championship	0.717	4
End User Training	0.796	4
User involvement	0.906	4
Productivity improvement	0.856	4
IT & User support quality	0.797	4
ERP attribute	0.856	4
Supply chain performance	0.931	12

3.4.2. Validity of the research

According to *Kerlinger and Lee (2000)*, validity can be measured in the form of content and construct. Content validity assesses how well the survey instrument items address the problem being investigated. All possible efforts were exerted to make the data collection instruments easily understandable by the respondents so that the intended information can be collected thereby increasing trustworthiness of the ultimate findings. After the questionnaire was constructed, pre-testing was done with senior expert (IT quality and assurance), Logistics, HCM & FICO modules functional consultants, who have knowledge of both the system and the business process by allowing them to read and comment on it. Constructive comments were collected from them. Accordingly, questionnaire was adjusted. Then, validation of the instrument was given by academic advisor prior to the data collection.

3.4.3. Ethical consideration

The source of data for the study was questionnaire and interview from users of SAP ERP Logistics modules in Ethiopian Airlines. The respondents were assured that the information provided by them is confidential and used exclusively for academic purpose. In addition, respondents were informed not to include any identity detail and personal reference in the questionnaire. This minimized the biasedness of the response collected from the respondents. In addition, the different research studies, articles and text books used as a reference in the study are exhaustively cited.

Generally, the whole process of the research was controlled to be within acceptable professional ethics.

CHAPTER FOUR

Data Presentation, Analysis and Discussion

In this chapter, the data collected using questioner and interview were analysed and presented based on the objectives of the study set above. Out of the total 207 distributed questionnaires, 11 of the respondents couldn't return the questionnaire due to different reasons and 196 were collected. This indicates the achievement of 94.68 % response rate. The data was also found to be important to explain the effect of ERP system utilization enablers on supply chain performance of Ethiopian airlines. Descriptive and inferential statistics were used to analyse and interpret the results of the study.

The descriptive analysis consists of central tendency measurements (frequency and frequency distribution, percentage, valid & cumulative percentages). In addition, tabular explanations are used with the help of SPSS. ANNOVA, Correlation and multiple linear regression analysis with the help of statistical package for social sciences (SPSS) software were also used to present the findings of the study.

The data collected using five point Likert scale which is non-parametric in nature was converted in to parametric one by computing the sum and taking the average of each variable.

Multiple regression analysis is used to predict the value of internal supply chain performance from the value of the independent variables.

4.1. Data Presentation, Analysis and Discussion

4.1.1 Characteristics of the respondents

The survey questionnaire collected demographic data that may have some implication on ERP system utilization. Hence, the characteristics of the respondents are discussed in this section of the current chapter.

4.1.2 Gender of the respondents

As depicted in table 4.1 below, out of 196 respondents, 60.2 % of them were male and the remaining 39.8% were female respondents. Thus it can be concluded that more men are manipulating the system than that of the women.

Table 4.1 Gender of the Respondents

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	118	60.2	60.2	60.2
	Female	78	39.8	39.8	100.0
	Total	196	100.0	100.0	

Source: Own survey (2019)

4.1.3. Educational background

Table 4.2 shows that few respondents (16.3%) have educational level of Diploma while the majority of the respondents (74.5%) have acquired their first degree. 9.2% of the respondents have second degree from the total sample. Based on their educational status, it can be said that the respondents have the ability to understand the language of ERP system.

Table 4.2. Educational level of the Respondents

Educational Background					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	DIPLOMA	32	16.3	16.3	16.3
	Bachelors Degree	146	74.5	74.5	90.8
	Masters Degree	18	9.2	9.2	100.0
	Total	196	100.0	100.0	

Source: Own survey (2019)

4.1.4. Job positions of the respondent

As it can be seen from the table below, majority of the respondents (78.6%) are non-management based on the company's job classification. 11.3 % of the respondents are Team leaders who are

managing different staffs under them. 6.1 % of the respondents are managers and the remaining 1% are senior managers. This indicates that the survey incorporates employees with different levels of positions to ensure the representation of the sample and also to investigate the impact of the position of an employee on ERP post-implementation success.

Table 4.3 Job Position of the Respondents

Position in Ethiopian Airlines					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Non-Management	154	78.6	78.6	78.6
	Team Lead	28	14.3	14.3	92.9
	Manager	12	6.1	6.1	99.0
	Senior Management	2	1.0	1.0	100.0
	Total	196	100.0	100.0	

Source: Own survey (2019).

Figure 5: Job position of the respondents (Source: Own survey, 2019)

4.1.5. Year of experience in Ethiopian Airlines

Year of experience is an important determinant factor in explaining how well the employee performs in an organization. Accordingly, the service year related data of the respondents is captured by the questionnaire. This helps, to investigate whether ERP post-implementation success can potentially be affected by the experience of the employees in the organization. The work experience of the respondents in the organization is summarized in table 4.4 as can be seen below.

As indicated in the table, more than 48 % of the respondents have experience of less than 5 years. 23.5 % of the respondents have worked 6 to 10 years of experience in Ethiopian Airlines while 12.2 % of the respondents have served the company from 11 to 15 years. 8.2 % of the respondents served the company from 16 to 20 years and 8.2% of the respondents have experience of more than 21 years. This implies the survey incorporated respondents with

sufficient experience in the organization to understand supply chain process and experience both on legacy systems and in SAP ERP system; and also respondents with little or no experience on the legacy systems. This indicates the representativeness of the sample considered in this study. Moreover, it helps to analyse the impact of employees' service year on ERP post-implementation success.

Table 4.4 Year of experience of the Respondents

Year of Experience in Ethiopian Airlines					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	< 5 years	94	48.0	48.0	48.0
	6-10 years	46	23.5	23.5	71.4
	11-15 years	24	12.2	12.2	83.7
	16-20 years	16	8.2	8.2	91.8
	> 21 years	16	8.2	8.2	100.0
	Total	196	100.0	100.0	

Source: Own survey (2019).

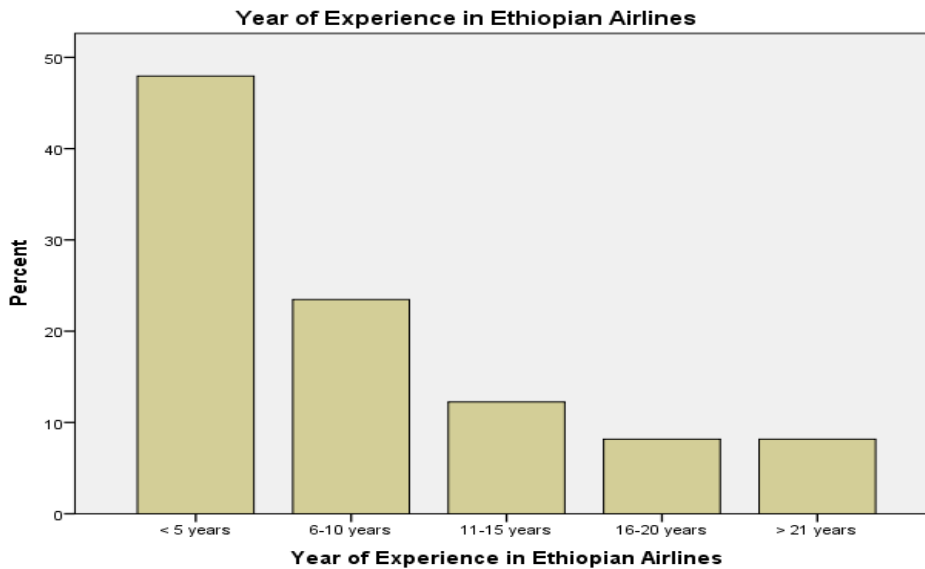


Figure 6: Year of experience in Ethiopian Airlines (Source: Own survey, 2019).

4.1.6. Year of experience in using ERP system in Ethiopian Airlines

It has been six years since Ethiopian Airlines has implemented ERP system. As depicted below, more than 83 % of the respondents have experience of working with SAP ERP for more than 2 years. 52.2% of the respondents have ERP usage experience of more than four years and 16.3% of the respondents have ERP usage experience of less than one year. So, it is possible to conclude that majority of the respondents have enough exposure for ERP.

Table 4.5 Year of experience in using ERP system

Year of Experience in using ERP System					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	< 1 year	32	16.3	16.3	16.3
	2-3 years	62	31.6	31.6	48.0
	4-5 years	46	23.5	23.5	71.4
	> 5 years	56	28.6	28.6	100.0
	Total	196	100.0	100.0	

Source: Own survey (2019)

4.2. ERP Implementation utilization Enablers

4.2.1 Top Management Championship

ERP system passes through continuous technological developments and endless requirements due to dynamic business changes and demands. Thus, top management championship should be sustained not only in the implementation (project) phase but also while the system is operating. In order to evaluate the top management championship, this study used two different approaches. The first approach was through the survey questionnaire in which; respondents were requested about the commitment of their immediate supervisors in allowing them to attend training. The second approach was evaluating the commitment of top management members who participated on the interview. The percentage distribution and the mean result of top management construct components is presented below in table 4.6 based on the questionnaire ratings.

Table 4.6 Top management championship (Percentage distribution and Mean)

Top Management Championship attributes associated with SAP syst	Strongly Disagre	Disagree	Undecided	Agree	Strongly	Mean
My immediate supervisor allows me the time to attend SAP related training sessions.	15.3	14.3	20.4	42.9	7.1	3.12
Management has continued to work on strenghenining internal Support team	6.1	21.4	30.6	35.7	6.1	3.14
Management has continued Long term relationship with ERP vendor.	4.1	17.3	39.8	29.6	9.2	3.22
Top Managment shares any business process change.	6.1	15.3	39.8	32.7	6.1	3.17

The respondents were asked regarding their immediate supervisor’s willingness in allowing them to attend SAP related training; in which only 49% of the respondents agreed the commitment of their supervisors. While 51% of the respondents disagreed the willingness of the supervisors. The mean value of the willingness of the supervisors is 3.12 as depicted in table 4.6. Which is the lowest mean value among the top management championship constructs.

This indicates that supervisors needs further awareness to realize the impact of training on their subordinate’s knowledge regarding the system; which ultimately affects the utilization of the system and also supply chain performance.

On the other hand, respondentS were asked regarding the top management commitment in strengthening the internal support team in which 58% of the respondent including employees who are un clear disagreed about the top management commitment. While, 42% agreed that the top management commit to strengthen the internal support team. More over respondents were asked regarding long term vendor relationship and about sharing business process changes in which 40% of the respondents are unclear about it and 40 % of the respondents are to the agree side of the five point likert scale questioner while 20% of them disagreed. Regarding long term relationship with ERP vendor, the interviewees were also asked about their views, accordingly

Unlike the respondents of the questionnaire, the interviewee replied, that “We have a good relationship with SAP Company, the vendor of SAP ERP system, so this helps to get the vendor’s support in the form of technical assistance, software updates, emergency maintenance and other support services”. It was also mentioned by the interviewee that Ethiopian airlines already has maintenance agreement with SAP to get upgrades, patches and expert support on major SAP ERP system related issues. However, both interviewees asserted that unlike the

positive relationship established with the vendor, Ethiopian Airlines hasn't utilized all the available opportunities from the vendor since the go-live stage. SAP service market place utilization could be one example that is not utilized by Ethiopian Airlines even if it is part of the agreement. It has been argued by several scholars that top management championship is the most crucial factor affecting the success of not only ERP implementation but also post-implementation utilization (Jones et al., 2008; Kouki et al., 2007; Peng & Nunes, 2009; Kiriwandeniya et al., 2013). This indicate the top management should start to revisit and work on the existing agreement with SAP system provider in order to insure effective utilization of the implemented ERP system. Furthermore, the Top management should communicate any result achieved to its employee so that they could feel the contribution of their management towards SAP system utilization which in turn result in improving the supply chain performance of the company.

4.2.2 Training

Several researchers, including Jones et al. (2008), Hakkinen and Himola (2008), Ruivo et al, (2012), Kiriwandeniya (2013) and Ononiwu (2013) assert training of the users is considered as one of the main determinants for successfully adopting, using and realizing benefits from ERP systems. Jones et al. (2008) further explained that, it looks reasonable to expect that users who had received insufficient training would be less likely to explore the functionality of the system for a broader and deeper usage. Accordingly, respondents were asked about SAP system training with respect to its quality, duration, and material sufficiency. In addition to the formal training, the survey attempted to investigate whether users take initiative by themselves to explore the system and improve their understanding. They were also requested the knowledge dissemination methods effectiveness for adopting new functionalities and changes. Moreover, the survey attempted to evaluate the users' understanding of the system's advantages and capabilities. The questionnaire rating of the components of the training construct is summarized in table 4.7 and also further discussed in the subsequent paragraphs.

Table 4.7 Training (Percentage distribution and Mean)

Training attributes associated with SAP system	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Mean
The quality of SAP training has been sufficient to use the system effectively.	8.2	28.6	21.4	24.5	17.3	3.14
The duration of SAP training has been sufficient to use the system effectively.	14.3	36.7	22.4	19.4	7.1	2.68
I am satisfied with the training material regarding SAP system use.	8.2	17.3	26.5	34.7	13.3	3.28
When new system functionality is added, proper circulars are disseminated so that I can adopt the change without any difficulty.	6.1	20.4	32.7	27.6	12.2	3.41

According to the survey, training is one of the low rated from all organizational theme constructs. The quality and duration of SAP system training was not accepted by most of the respondents (37% & 50%). As the training material is also related with the quality of the training, almost half of the respondents (47%) agreed to the sufficiency of training material. Training can help users to be aware of the system’s functionality, advantages and capability. If the training is aligned with the system and the supply chain process, users can utilize the system fully in their day to day business activities. The type, content and, duration of the training should be defined by considering the end user’s IT knowledge and capability. Moreover, the training materials should still be upgraded to best fit with end user’s unique business environment and context and be customized to the organization’s requirements and needs.

Training related finding of this study is also consistent with other scholars (Hakkinen & Himola, 2008; Ononiwu, 2013; Kiriwandeniya et al., 2013) that the end users should be properly trained to utilize the system and ensure ERP post-implementation success which has a significant effect on the supply chain performance. Hence, the survey feedbacks mainly indicate training is one of the improvement areas for ERP system utilization.

Even though aggregate mean (mean of the mean) result for the training construct is found to be 3.12 which is rated in the ‘agreement’ category. The management still needs to revisit the content, duration and, material of SAP system training. In addition to this, training roadmap should be planned to clearly address the training requirements for new entrants and also existing end users recurrent and refresher trainings. The feedback obtained from the interviewees also asserted that, revisiting the training strategy and its implementation can improve training related gaps so that employees can be equipped with the required knowledge before they get onboard to the actual job. Moreover, recurrent training roadmap should be defined in order to train already

existing employees to refresh their knowledge and also provide new functionalities of the system. It was also recommended to analyse and define training requirements for different levels of users along with the content, duration and mode of training.

4.2.3 User Involvement

User involvement is another critical element that determines post-implementation utilization (Kouki et al., 2007; Jones et al., 2008). The survey questionnaire attempted to examine the level of user involvement in relation with SAP system. Accordingly, the percentage distribution and mean value are summarized in table 4.8 below.

Table 4.8 User involvement (Percentage distribution and Mean)

User involvement attributes associated with	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Mean
I understand how the task(s) I perform can be an input into the next task(s) in cross-functional work process.	0.0	15.3	15.3	56.5	15.3	3.76
I understand how the task(s) I perform fit into the overall work process.	1.0	8.9	15.7	61.3	13.7	3.78
I understand the task(s) of other departments that are an input to the activities I carry out.	0.0	15.3	18.4	48.0	16.3	3.61
I understand the overall work process that my task(s) is part of.	1.0	11.2	17.3	51.0	19.4	3.77

The user involvement is examined through the level of their understanding about the cross-functional work process of SAP system. Most of the respondents (72%) agreed that they understand the cross-functional nature of SAP system. Furthermore, the aggregate mean (mean of the mean) result for the user involvement construct is found to be 3.67, which is rated in the agreement category. Though the data shows a positive result, user involvement considered as one of the improvement areas to enhance organizational data quality. In other words, SAP system users should know the input-output relationship of various business sections across the business value chain. This demands to have process oriented mentality rather than silo thinking so that users can be aligned with ERP, a process based system. According to Jones et al. (2008), user involvement in understanding cross-functional business relationship determines the level of the system utilization. In other words, users should know how their own business activities fit into other department's business processes. Hence, organizational change management (OCM) needs to be structurally in place to manage

organizational changes and learning in coordination with centre of excellence (COE) team. In due course, super users can be nominated from different units of the organization and train them to boost employees' engagement on the system. The super users of each section can be the leaders to facilitate SAP related organizational learning and utilization by facilitating the engagement of end-users.

4.2.4 Productivity improvement

Responses were received from respondents regarding the contribution of an ERP system in improving productivity and producing better outcome. They were also asked regarding data accuracy and integrity improved by sing ERP system. Based on the survey, more than 80% of the respondents agreed to the quality improvement of their output through SAP system. Moreover, the respondents were asked regarding the efficiency and quality of decision making they achieved through SAP ERP system; in which only 72% of the respondents agreed to it. 78% of the respondents also agreed that SAP ERP has improved their quality of work.

Productivity improvement is also one of the operational benefits argued to be achieved at the early stage of an ERP system post-implementation phase (Hawking, et al., 2004; Hakkinen & Himola, 2008; Peng & Nunes, 2009). As a result, users can utilize the system effectively which leads to post-implementation success. Thus, as empirically investigated, the productivity improvement is the area that shows the efficient utilization of the system. Even though the study finding shows the majority agreed on the productivity improvement, further ways needs to be studied to increase the overall quality of work and decision making capabilities which eventually insures the improvement of supply chain performance.

Table 4.9 Productivity improvement (Percentage distribution and Mean)

Productivity improvement attributes of the system	Strongly Disagre	Disagree	Undecide d	Agree	Strongly Agree	Mean
sap has enaled me improve the efficiency of my work	3.1	4.1	10.2	52.0	30.6	4.0
sap has enabled me improve the quality of my work	2.0	8.2	12.2	50.0	27.6	3.9286
Data accuracy and integrity is improved by using the SAP system	1	6.1	11.2	50	31.6	4.051
sap improved the quality of decision i make in my work	1	9.2	18.4	48	23.5	3.837

In line with the above findings, the interviewee feedback also asserted that the system creates paperless environment through workflow process of SAP which ensures productivity improvement and cost reduction. This has improved the previous process that involved paper based approval in different supply chain functions. The integration of the system has also improved the real time information sharing among supply chain functions, even though it needs further improvement on the quality of the data. Thus, they recommend that, continuous improvement in the dimension of people, process and technology can improve the business value realization. Additionally, Interviewees were also requested for their opinion regarding continuous improvement initiatives that are undertaken so far to ensure continuous ERP system utilization, upgrade and progress of the system. Continuous improvement is critical in order to address users' complexity issues, performance issues, improve the system's flexibility and its business process adaptability. Moreover, it consists of business processes and people side continuous improvements as well. Moreover, one of the interviewee replied that there are initiatives made to ensure continuous improvement of ERP system. The major initiative is the establishment of Center of Excellence (COE) team (under business transformation & continuity department) to work on the continuous improvement of the organization through automation and utilization of already existing systems

4.2.5 IT Expertise & Users' Support Level Quality

IT team expertise and users' support level quality is one of the important factors to the effective utilization of the system. This is due to the fact that the system needs continuous support, maintenance and upgrading to align the system with the business needs and changes (Hakkinen & Himola, 2008). In line with this, the questionnaire rating of the components of the IT expertise and user support level quality construct is summarized in table 4.10 and also further discussed in the subsequent paragraphs.

Table 4.10 IT expertise and user support level quality (Percentage distribution and Mean)

IT & User support attributes associated with SAP system	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Mean
sap support is organized in a good and efficient way to solve SAP problems	2	9.2	23.5	41.8	23.5	3.7551
I am able to receive user support regarding sap system use promptly in satisfactory manner.	1.0	17.3	21.4	39.8	20.4	3.6122
I am satisfied with the training material regarding SAP system use.	2.0	12.2	26.5	39.8	15.3	4.8776
The support team have insured full utilization of the ERP system	0	15.3	28.6	36.7	19.4	3.6020

Several scholars asserted that the level of IT expertise required by ERP systems is higher than the expertise required supporting in-house developed legacy systems (Kouki, 2007; Hakkinen & Himola, 2008; Ononiwu, 2013). This change demands a highly educated, skilled and trained IT team. Even if there are initiatives undertaken by the organization to train the IT team, it still needs additional efforts to improve the support service quality and enhance the IT team's expertise. Even though the research finding shows that most of the respondents agreed increased level of user support quality, the mean value of the utilization level of the system and the user satisfaction level in use of the system is lower than the other constructs. This indicates that the, generous functionality of the system is not realized. Thus, apart from focusing on routine system issues the support team should revisit the proper functioning of each sub modules of the SCM. Ononiwu (2013) empirically asserted that inadequate ERP expertise is one of the inhibitors of the effective use of ERP systems. Similarly, Peng & Nunes (2010) identified lack of well-trained in-house IT specialists to be one of the ERP exploitation barriers; that prevents firms from effectively monitoring, maintaining and improving the system in the long term.

4.2.6 ERP attributes:

According to Wu and Wang (2006), there are eleven ERP systems characteristic that have significant impact on effective system utilization. These are: ERP system timeliness, information accuracy, reliability, response time, flexibility, completeness, output requirement, ease of use, usefulness of the system to the users, relevancy of the information executed by the system and integrated nature of the system.

Table 4.11 ERP attributes (Percentage distribution and Mean

ERP attributes associated with SAP system	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree	Mean
SAP implementation has increased the integration of the information system in EAL.	1.0	2.0	9.2	56.1	31.6	4.15
SAP system is flexible enough to be modified to meet new business requirement.	1.0	11.2	23.5	45.9	18.4	3.69
the information and related report that SAP provides are useful and relevant to my work.	2.0	2.0	17.3	56.1	22.4	3.95
SAP provide accurate and reliable information	2.0	6.1	18.4	44.9	28.6	3.92

The system's technical characteristics significantly impacts the end user's satisfaction and, by the same token, the effective utilization of the system and its post implementation success (Moore & Benbasat, 1991; Wu & Wang, 2006; Kouki et al., 2007). The quality of ERP attributes is examined through the technical characteristics of the system mentioned above. The aggregate mean (mean of the mean) result for the ERP attribute construct is found to be 3.92, which is rated in the agreement category. This implies that the flexibility, responsiveness, data quality and accuracy of the system are positively recognized by the users of the system. However further effort required to improve the quality of data, the responsiveness and the flexibility of the system. In line with this finding the interview feedback also asserted that the system fulfills the required ERP attributes or characteristics in a general context. Majority of the interviewees emphasized that as long as the system is being used worldwide by big organizations successfully, it can be easily inferred that Ethiopian Airlines has also benefited from the attributes of successfully implemented system. However, three of the participants replied that information accuracy and completeness characteristics of the system is impacted not only in using SAP system itself but also by the data received from other systems through interface. One of the participants explained "In order to bring integrity of the systems, users should be aware on how to handle data in their day to day business activities. This will help to improve the data accuracy, completeness and timeliness.

Descriptive analysis (mean and standard deviation) was conducted on the factors of ERP post implementation.

Based on the mean comparison of the independent variables shown in table 4.12 below, it can be seen that IT & user support and increased productivity is ranked first followed by ERP attributes. User involvement, top management championship and user training ranks from 3 to 6 respectively.

Table 4.12 Descriptive analysis of independent variables

Descriptive Statistics			
	N	Mean	Std. Deviation
IT & User support	196	4.23	.79128
Increased Productivity	196	3.95	.83512
ERP attributes	196	3.92	.81397
User involvement	196	3.68	.64324
Top management Championship	196	3.26	.74196
Training	196	3.12	.57272
Valid N (list wise)	196		

Descriptive analysis (mean and standard deviation) was conducted on ERP utilization effect on supply chain performance in terms of Reliability, Responsiveness and Flexibility to meet customer demand. As depicted below in table 4.13. Based on the statistical result, the reliability, Responsiveness and Agility of the supply chain obtained score in the mean agreement rating by the respondents with mean of 3.90, 3.78 & 3.6 respectively and standard deviation of 0.79, 0.83 & 0.86 which implies employees generally have above mean expectation to agree on the increased supply chain performance during ERP post implementation life cycle.

Table 4.13 Descriptive analysis of dependent variables.

Descriptive Statistics (Dependent variable)					
	N	Minimum	Maximum	Mean	Std. Deviation
Reliability	196	1.75	5.00	3.9005	.79157
Responsiveness	196	1.50	5.00	3.7857	.83436
Agility	196	1.00	5.00	3.8888	.85639
Valid N (listwise)	196				

Source: Own survey (2019)

In line with the quantitative result, the interview result also asserted that ERP utilization enablers has improved the supply chain performance of the company. Especially, it enabled inventory level visibility and traceability, reduced processing time of procurement functions and it also enabled increased flexibility of the supply chain which is the result of the integrated nature of the system. Additionally, ERP minimized the paper work communication and improved the approval process of purchase order through its workflow attribute. The response time of the supply chain has also increased due to ERP implementation. As a result, user satisfaction is increased due to the overall supply chain performance improvement.

4.3. Multiple Linear Regression Analysis

Before running multiple linear regression analysis, the researcher has conducted basic assumption tests for the model. These are normality of the distribution, linearity of the relationship between the independent and dependent variables and multicollinearity tests. Each test is explained below.

Assumption 1 - Normality Distribution Test

Multiple regressions require the independent variables to be normally distributed. If the underlying distribution of the data is normal, the points will fall along a straight line. Deviations from this line correspond to various types of non-normality. Stragglers at either end of the normal probability plot indicate outliers. Curvature at both ends of the plot indicates long or short distribution tails. Convex, or concave, curvature indicates a lack of symmetry. Gaps, plateaus, or segmentation in the plot indicate certain phenomenon that needs closer scrutiny.

As depicted in appendix B Normal PP plot of regression standardized residual, there exists a linear relationship between the *ERP* utilization enablers and Supply chain performance. The PP plot is shown in appendix B.

Assumption 2 - Linearity of the Relationship Test

The second assumption for computing multiple regressions is test of the linearity of the relationships between dependent and the independent variables. As depicted in appendix B

scatter the visual inspections of the scatter plot shows there exists a linear relationship between the *ERP* utilization enablers and Supply chain performance even though some of the plots are a little scattered from the linear line. The scatter plot is shown in appendix B.

Assumption 3 - Multicollinearity Test

Multicollinearity refers to the situation in which the independent/predictor variables are highly correlated. When independent variables are multicollinear, there is “overlap” or sharing of predictive power. This may lead to the paradoxical effect, whereby the regression model fits the data well, but none of the predictor variables has a significant impact in predicting the dependent variable. This is because when the predictor variables are highly correlated, they share essentially the same information. Thus, together, they may explain a great deal of the dependent variable, but may not individually contribute significantly to the model. Existence of multicollinearity can be checked using “Tolerance” and “VIF” values for each predictor variables. Tolerance values less than 0.10 and VIF (variance inflation factor) greater than 10 indicates existence of multicollinearity (Robert, 2006). For the current data, as can be seen in appendix B the VIF value is less than 10 and greater than 0.10 thus this implies that multicollinearity is not an issue for this particular study. See appendix B.

4.3.1. Model Summary

In the model summary below (table 4.14), the multiple correlation coefficients R, indicates a strong correlation of .877 between supply chain performance and the six independent variables. Adjusted $R^2 = .764$ reveals that the model accounts for 76.4% of the variation in the supply chain performance and is explained by the linear combination of all the independent variables of ERP post implementation factors.

Table 4.14. Source Own survey 2019

Model Summary^b				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.877 ^a	.769	.764	.18578
a. Predictors: (Constant), Integration, User support, User involvement, Top Management Championship, Training, Productivity				
b. Dependent Variable: Supply Chain Performance				

4.3.2. ANOVA Model Fit

The regression model overall fit can be examined with the help of ANOVA. Accordingly, table 4.15 of this study shows that the value of R and R² found from the model summary is (F=31.43), (P<0.001). This indicates that over all, the regression model statistically significantly predicts the outcome variable that is the supply chain performance.

Table 4.15 ANOVA Model fit

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.62	6	1.824	51.429	.000 ^b
	Residual	3.45	189	.034		
	Total	19.56	195			
a. Dependent Variable: Supply Chain performance						
b. Predictors: (Constant), ERP attributes, User support, User involvement, Top Management championship, Training, Productivity						

Source; Own Survey 2019

4.3.3. Beta coefficient

4.3.3.1. Standard Beta Coefficient

Not all factors are retained in an analysis and only factors that are statistically important should be retained. The standardized coefficients are the coefficients which can explain the relative importance of explanatory variables. These coefficients are obtained from regression analysis after all the explanatory variables are standardized.

As it can be seen from table 4.16 below, the standardized coefficient of ERP attribute is the largest value followed by Productivity improvement, user involvement and training consecutively. Top management championship and user support assumes the fifth and the sixth

ranks respectively. The larger the standardized coefficient, the higher is the relative effect of the factors to the supply chain performances.

The significance tests of the 6 explanatory variables indicate that four of the explanatory variables are significant with p-value ($P < 0.05$) for predicting supply chain performance. The rest two factors have a p-value > 0.05 ($P > \delta$), and these factors are not statistically significant to predict supply chain performance.

Table 4.16 Beta Coefficient

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.932	.852		1.095	.275
	Training	.449	.126	.216	3.574	.000
	Top MGMT	-.222	.171	-.080	-1.299	.196
	User involvement	.085	.030	.140	2.884	.005
	Productivity	.544	.177	.192	3.079	.002
	User support	.053	.063	.045	.841	.401
	ERP attribute	1.808	.212	.504	8.526	.000

a. Dependent Variable: Supply Chain performance.

Source; Own Survey 2019.

Table 4.16 indicates that the top four ranked determinants of supply chain management performance. As per the output of the standard Beta coefficient, 50% of the total variation of supply chain management performance is explained by ERP attribute construct. This indicates that the technical context of the system that is the ERP attribute is a construct with high impact to the overall supply chain performance. It is also believed that the supply chain performance increased by 50%. In line with this, scholars have empirically asserted the impact of ERP attributes in the utilization of the system during the post-implementation phase and its positive contribution on supply chain performance (Wu & Wang, 2006; Kouki et al., 2007).

According to the finding, the next highest determinant factor of supply chain management performance is End user training. As shown in table 4.13, training makes contribution of 21.6% of the total variance of supply chain performance. Thus it can be believed that supply chain performance increased by 21.6% More over if users are familiar and knowledgeable about the

ERP system they are using, then they will be efficient enough to expedite the supply chain functions which ultimately improve the supply chain performance. According to (*Kiriwandeniya et al., 2013; Ononiwu, 2011*), Training allows users to take better advantage of the various functionalities and features included in the system continually (*Kiriwandeniya et al., 2013; Ononiwu, 2013*).

According to the standard beta coefficient finding, the third determinant construct of supply chain management performance is Productivity improvement. As shown in table 4.16, productivity improvement made contribution of 19.2 % of the total variance. This indicates that as the user's efficiency increased towards performing their task on time, they are able to make quality decisions and improved quality of their work, the supply chain performance is believed to improve by 14 %. Thus, productivity improvement is one of the main construct that can make a significant improvement on the supply chain performance.

According to the standard beta coefficient finding, the fourth determinant construct of supply chain management performance is user involvement. As shown in table 4.16, user involvement makes contribution of 14% of the total variance. This indicates that as the users' level of understanding regarding the process oriented nature of the SAP system increases, the supply chain performance is believed to get improved by 14 %. Thus, user involvement is important construct that can make a significant effect on the supply chain performance.

Based on standard beta coefficient finding Top management championship and IT & user support are not statistically significant to determine the supply chain management performance. This indicates that users are not clear about the top management champion ship in sharing and any business process changes and encouraging the employees to attend relevant SAP ERP training. Instead users are getting support from their senior and co-workers. The user support also considered insignificant determinant for supply chain management, as the case company is in the maturity level of the ERP system, most of the support and awareness is shared among employees and they are may not require much support from user support.

CHAPTER 5

Summary, conclusion and Recommendation

5.1. Summary

This chapter presents conclusions drawn from the study, some recommendations based on the evidences presented during the course of the study and also suggestions for future research.

The total sample size was 207 and questionnaires were distributed to the respondents out of which, 196 questionnaires were returned with a response rate of 94.68%. The sum of the independent variables average Cronbach's alpha value is ($\alpha = 0.911$) and the reliability test of the study is located on "*excellent*" range.

Out of 194 respondents, 60 % (116) of the respondents were male and the remaining 40% (78) were Female. 83.7% of the respondents have educational level of first and second degree. Close to 50% of the respondents have company experience of less than five years while 50% of them have more than five years of experience in Ethiopian Airlines. More than 83 % of the respondents have experience of working on SAP ERP for more than 2 years however 16.3% of the respondents have ERP usage experience of less than one year.

The first research question of the study was to identify ERP post implementation factors. Accordingly, Top management champion ship, user training, User involvement, Productivity improvement, IT and user support quality and ERP attributes are identified as post implementation factors. However, the output from regression analysis indicated that only four factors are the relevant post ERP implementation factors to explain variation in supply chain management performance. These are ERP attributes, user training, and productivity improvement and user involvement

The second research question of the study was to identify factors having significant effect on supply chain performance. Accordingly, based on the regression analysis result, it can be concluded that ERP attributes, productivity improvement and user training and user involvement accounts the largest share for the change in performance of supply chain management.

The third research question was to examine the effect of the ERP post implementation factors on supply chain performance and it is answered by the regression model summary, adjusted R = .764 which revealed that the model accounts for 76.4 % of the variation in the supply chain performance is explained by the linear combination of the independent variables of ERP post implementation. The ANOVA test result showed that R and R² found from the model summary was statistically significant at (F=51.429), P<0.001).

5.2. Conclusion

Many of internationally operating organizations consider ERP systems as an essential information systems solution to survive and prosper in today's competitive business environment. Ethiopian airlines, one of an international airline company, implemented ERP system in January, 2013; in order to adopt best practices imbedded on the system such as: streamline real-time process-integration, facilitate decision making by availing real-time information, and improve efficiency and effectiveness of the organization.

ERP adoption has three major phases: pre-implementation, implementation and post-implementation. The success of an ERP system is determined by the success of each of the phases including post-implementation phase. Even though ERP implementation success is a prerequisite for post-implementation success, it is not a sufficient condition for fully earning the possible benefits of the system. Rather, it demands continued efforts during the post-implementation phase of the system to achieve post-implementation success. Hence, examining and addressing ERP post-implementation issues is crucial.

In this study, Ethiopian Airlines is considered as a case organization to study the utilization of the implemented ERP system during post-implementation phase in terms of post implementation factors.

The main purpose of this study is to examine the effect of ERP post implementation utilization factors on the supply chain performance of Ethiopian Airlines. According to the findings presented in the previous section, the following conclusions are drawn.

Six ERP post implementation utilization factors are identified from previous literatures. These are top management championship, training, user involvement, productivity improvement, IT & user support quality and ERP attributes.

ERP attributes and productivity improvement are the most powerful factors for ERP post implementation utilization and powerful predictor for supply chain performance improvement. According to (Moore & Benbasat, 1991; Wu & Wang, 2006; Kouki et al., 2007), the system's technical characteristics significantly impacts the end user's satisfaction and, by the same token, the effective utilization of the system and its post implementation success, Furthermore, Productivity improvement is also one of the operational benefits claimed to be achieved at the early stage of an ERP system post-implementation phase (Hawking, et al., 2004; Hakkinen & Himola, 2008; Peng & Nunes, 2009).

User training is also the third most important factor without which post implementation success is almost impossible and it is identified as the most powerful predictor of supply chain performance. Qualified trainers well prepared training manual and sufficient training time per the level of user's IT experience, are essential for effective utilization of the ERP system. Several researchers, including Jones et al. (2008), Hakkinen and Himola (2008), Ruivo et al, (2012), Kiriwandeniya (2013) and Ononiwu (2013) asserted that training of the users is considered as one of the main determinants for successfully adopting, using and realizing benefits from ERP systems.

User involvement is the fourth determinant construct of supply chain management performance. User involvement makes significant contribution of the total variance. This indicates that as the users' level of understanding regarding the process oriented nature of the SAP system increases, the supply chain performance is also believed increase. According to wu and wang (2016) as users gradually learn the system by experiencing it (experimental learning), they start to understand the system functionalities and to explore its possibilities and limits. The more they are satisfied with the system, the more they are engaged with it and the higher their level of utilization is Wagner & Newell (2007)

This research can conclude that ERP post implementation utilization factors have positive and significant effect on supply chain performance. Ahemed Shatat (2014) also asserted that there is significant positive relationship between ERP system and SCM performance.

Despite literature has outlined top management championship and it & support as some of the important factors for ERP post implementation assimilation, this study indicated that they are not relevant predictor of supply chain performance which shows that most of the constructs of these factors are unclear in Ethiopian airlines.

In general the findings of this study implies that the effective usage of ERP system can contribute toward improving SCM performance in many ways such as, integration of supply chain processes, enhancement of information flow within the different departments inside the company, improvement of employees productivity, sharing, exchange and movement of information related to goods and services, improvement of product quality, flexibility and customer responsiveness, and finally reduction of inventory to the optimum level.

The finding of this study also implies that, Ethiopian Airlines is able to attain effective usage of ERP system that helped the company achieve high and effective SCM performance. In other words, the successfully implemented and efficiently used ERP system significantly improved and enhanced the performance of SCM. Hence, the company reaped many benefits such as, having an easy and reliable access to data and information; accordingly, the supply chain reliability is improved. Adaptability in any changing customer needs, improved scalability, improved efficiency, through which the supply chain flexibility is enhanced and reduced cycle time, reduced time of delivery, in which the responsiveness of the supply chain improved.

5.3. Recommendation

5.3.1 Recommendation for practitioners

The result of this study is believed to provide guidance to the management of Ethiopian Airlines, IT professionals and consultants concerning the core activities which can influence positively the utilization of ERP system and realize the intended business benefits.

Ethiopian airlines should improve the utilization of the system and attain the desired business result by focusing more on training as a priority goal.

Improving the training quality in terms of time, material and technology acceptance level of employees should get the required level of attention considering their contribution in the utilization of the system. Users of the system should get efficient training on the system and also more importantly on the business processes and input-output relationship. Ultimately, users can understand not only how to use the system but also the end to end business process interactions and realize the influence of their day to day activities on the entire supply chain performance. This helps to uplift the process-oriented thinking of the employees, increase data quality of the system and facilitate rational decision making. Similarly, internal ERP experts should get the advanced level of training in the dimensions of support, development and technical infrastructure area in order to improve IT expertise and user support level quality. Ongoing training programs, targeted at various organizational levels, are critical for ensuring effective system usage over a number of years and hence realization of the system's full potential benefits (Teltumbde et al.,2002; Kumar et al., 2003; Mabert et al., 2003a).

Once the organizational issues get the required attention and addressed as per the above recommendations, management, COE and IT team should work on improving technical attributes of the system and improve the user support level quality.

Data should be considered as corporate asset and data and information accuracy, completeness, and flexibility improvement should get utmost attention and appropriate actions. In line with this, management needs to establish data governance strategy and exercise accordingly in order to improve the data quality with in the supply chain by defining the required data model and also educate users on the impact of the input data quality on the output of the overall supply chain performance.

5.3.2 Recommendation for future academic research

For future researches, the following recommendations are presented by the researcher:

Future research could focus on other modules of ERP system which are not addressed in this study that are related to finance or human capital management or any other section in order to improve other parts of business performance such as the financial performance (return on investment and return on assets), and customer-based performance (customer satisfaction), and all these parts will finally provide a holistic view of the overall business performance of the organization.

This study focused on Ethiopian Airlines which is service oriented enterprise and it will be of added values if future researchers also examine ERP post implementation utilization from the perspective of manufacturing industries.

The future researchers are also recommended to study the maturity level of the ERP system and the needed preparation before the retirement life cycle of system.

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APPENDICES

Appendix A: Questionnaire Survey

QUESTIONNAIRE

ADDIS ABABA UNIVERSITY SCHOOL OF COMMERCE DEPARTMENT
OF LOGISTICS & SUPPLY CHAIN MANAGEMENT

Dear Respondent,

I am a Sr. Business process Expert in the SAP Business Analyst & Master Data department in the IT Division at Ethiopian Airlines. I have prepared this questionnaire in order to conduct a study on the effect of ERP Utilization on the performance of the supply chain management at Ethiopian Airlines. I am conducting the study in partial fulfilment of the requirements for the degree of Master of Arts in Logistics and Supply Chain Management, which I am pursuing at the Addis Ababa University, School of Commerce.

The objective of the study is to assess the effectiveness of the SAP ERP utilization based on the Organizational, Operational and Technological themes of post implementation lifecycle and to assess the actual impact that it has contributed to the supply chain management Reliability, Responsiveness and Flexibility and towards achieving the internal customer satisfaction. Based on the result, the researcher will attempt to identify improvement areas where further effort is required to ensure the full utilization of the ERP system and improve the performance of the supply chain management of Ethiopian airlines.

The questionnaire will require about 10 minutes completing. I kindly request your co-operation in responding to the questions. Please respond to the questions as honestly and as completely as possible and return the completed questionnaires as promptly as possible for the successful completion of the study (you may call me or drop me email for the collection of the completed questionnaires).

Please do not put your name on the questionnaire. The overall purpose of this questionnaire is exclusively academic. Your response will not be used for any other purpose; it is confidential.

Thank you very much for taking your time to complete this questionnaire.

If you have any questions or concerns you may contact me at **0115178996** or at hirutm@ethiopianairlines.com.

Sincerely,

Hirut Moreda
Sr. Business Process Expert

PART I: Demographic Information

1. Gender: M F
2. Educational Level?
Diploma Bachelor's Degree Master's Degree
Doctorate(PhD)
3. Position in the organization?
Non-management supervisor Manager Sr. Management
4. Year of experience in Ethiopian Airlines?
Below 5 6-10 11-15 16-20 21 and above
5. Year of experience in using ERP software: _____
Below 1 2-3 4-5 above 5

PART II: General Instructions

1. In this questionnaire, SAP refers to the ERP system and its modules that are already implemented and being used by Ethiopian Airlines. **For the purposes of this questionnaire, please consider the 'SAP LOGISTICS' sub-modules that you use frequently for your day to day activities/ tasks.**
2. Please answer this questionnaire consistently with respect to the SAP system modules/sub modules and the department which you are most familiar with and that you know the best. Kindly base your answers on the current SAP status and not on anticipated future results.
3. If you are using more than one sub-module, please consider the following. Either fill a separate questionnaire or provide average values.
4. Please indicate your level of agreement on the statements by circling the numbers in the column using the following rating scale,

Where: 1=Strongly Disagree 2=Disagree 3= Neutral 4=Agree 5=Strongly Agree

PART III: ERP Post Implementation Factors

Please indicate your level of agreement on the statements by circling the numbers in the column using the following rating scale.

Where: 1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

1.	Top management champion ship	1	2	3	4	5
1.1	Immediate supervisor allows time to attend SAP related training.	1	2	3	4	5
1.2	Management has continued to work on strengthening the internal capacity in order to meet system maintenance and upgrades.	1	2	3	4	5
1.3	The management has created long term relationship with the ERP vendor for any ERP related needs that requires vendor's intervention until the system retires.	1	2	3	4	5
1.4	Top management shares any business process changes to the support team for on time configuration on the system.	1	2	3	4	5
2.	Training	1	2	3	4	5
2.1.	The quality of SAP training has been sufficient to use the system effectively.	1	2	3	4	5
2.2.	The duration of SAP training has been sufficient to use the system effectively.	1	2	3	4	5
2.3.	The quality of training material has been sufficient to use the system effectively.	1	2	3	4	5
2.4.	EAL has a knowledge sharing system which continually gets updated for SAP related changes and new developments.	1	2	3	4	5
3.	User Involvement	1	2	3	4	5
3.1.	I understand how the task(s) I perform can be an input into the next task(s) in cross-functional work process.	1	2	3	4	5
3.2.	I understand how the task(s) I perform fit into the	1	2	3	4	5

	overall work process.					
3.3.	I understand the task(s) of other departments that are an input to the activities I carry out.	1	2	3	4	5
3.4.	I understand the overall work process that my task(s) is part of.	1	2	3	4	5
4	Increased Productivity	1	2	3	4	5
4.1	SAP has enabled me to improve the efficiency of my work (e.g. reduced time required for performing certain tasks, has made work easier, eliminated overlaps.	1	2	3	4	5
4.2	SAP has enabled me to improve the quality of my work (e.g. has improved the outcomes of my work, has enabled me to perform new tasks).	1	2	3	4	5
4.3	Data accuracy and integrity is improved by using the SAP system.	1	2	3	4	5
4.4	SAP improved the quality of decisions I make in my work.	1	2	3	4	5
5	IT and User support quality					
5.1	SAP support is organized in a good and efficient way to solve SAP system related problems quickly.	1	2	3	4	5
5.2	I am able to receive user support regarding SAP system use promptly in a satisfactory manner.	1	2	3	4	5
5.3	User authorization (Permission) request are responded promptly and satisfactorily.	1	2	3	4	5
5.4	The Support team have insured full utilization of the ERP system.	1	2	3	4	5
6	ERP attributes	1	2	3	4	5
6.1	SAP implementation has increased the integration of the information systems in EAL.	1	2	3	4	5
6.2	SAP has a quick response time (the system's	1	2	3	4	5
6.3	The information and related reports that SAP	1	2	3	4	5
6.4	SAP provide accurate and reliable information.	1	2	3	4	5

PART VI: SCOR Supply Chain Performance Metrics

Please indicate your level of agreement on the statements by circling the numbers in the column using the following rating scale.

Where: 1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

4.1 Effect of ERP utilization on the supply chain performance Reliability

No	RELIABILITY	Scale				
1.	SAP ERP enabled perfect order fulfilment in terms of quality and quantity.	1	2	3	4	5
2.	SAP ERP enabled on time delivery per customer commit date	1	2	3	4	5
3.	SAP ERP has improved the data quality with in the supply chain. .	1	2	3	4	5
4.	SAP has increased the satisfaction level of the internal customers of the supply chain.	1	2	3	4	5

4.2 Effect of ERP utilization on supply chain Responsiveness

No	RESPONSIVENESS	Scale				
1.	SAP expedited the time taken to transport materials from ware house to the user department.	1	2	3	4	5
2.	SAP enabled reduced Lead time.	1	2	3	4	5
3.	SAP enabled minimum processing time of material request.	1	2	3	4	5
4.	SAP has enabled the supply chain to share quick and accurate information to the internal customers.	1	2	3	4	5

4.3 Effect of ERP utilization on supply chain Flexibility (Agility)

No	FLEXIBILITY	Scale				
1.	SAP improved the Supply chain response time for un planned customer request.	1	2	3	4	5
2.	SAP enabled product flexibility to meet the changing customer demand.	1	2	3	4	5
3.	SAP enabled to take actions based on all the information consciously collected along company's supply chain.	1	2	3	4	5
4.	SAP has enabled to track inventory levels and	1	2	3	4	5

	contributed for purchase planning.					
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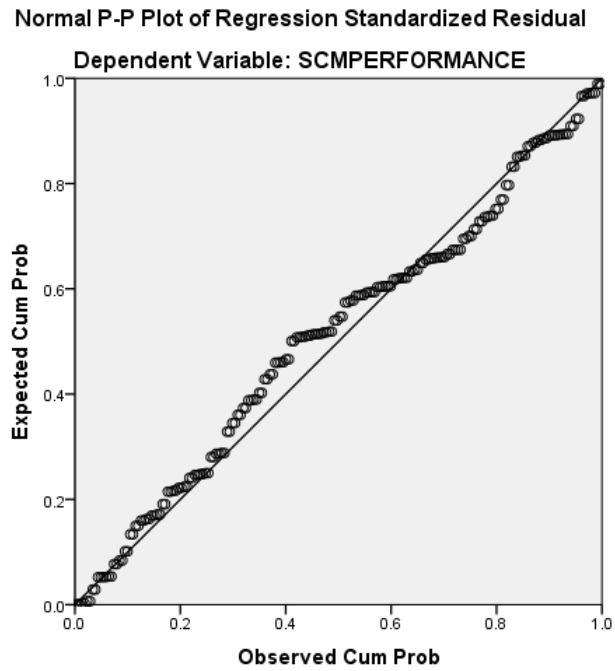
Thank You!

Appendix B: Interview Questions

1. How do you see the ERP attribute for the success of utilization?
2. How do you see the relationship with the ERP vendor?
3. How do you evaluate the SAP related training quality in terms quality, content and duration?
4. Comment on the operational contributions of ERP system in Ethiopian Airlines. It can be seen from the point of view of, Productivity Improvement and Internal Process Improvement
5. What kind of initiatives do you make to ensure continuous ERP system utilization and upgrade and progress of the system?
6. How do you rate the performance of the supply chain after the company implemented the ERP logistics module?

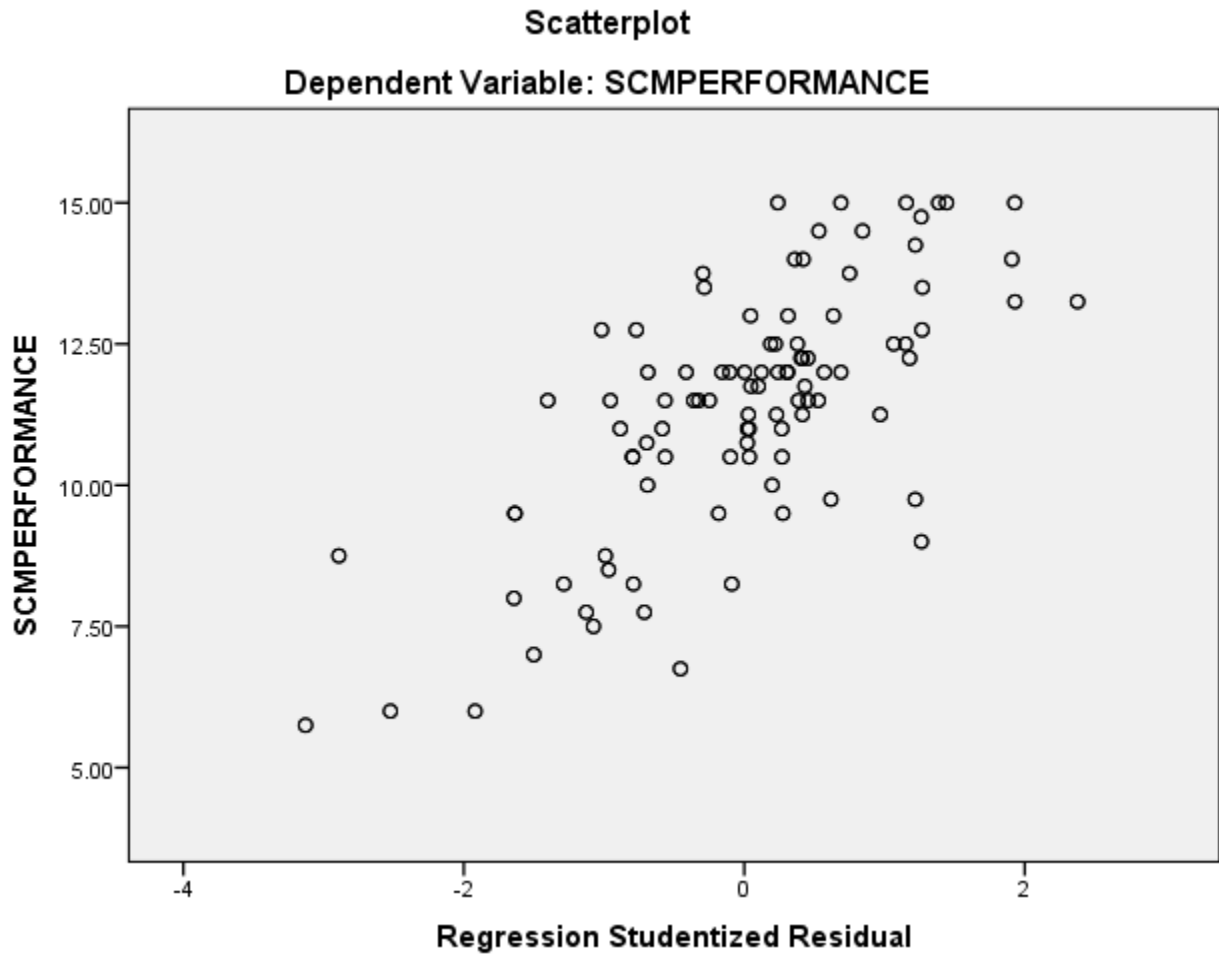
Appendix C: Regression Model assumption Tests

1. Normality Distribution Test



Source; Own Survey 2019

2. Linearity of the Relationship Test



3. Multicollinearity Test

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Training	.726	1.377
	Top MGMT	.702	1.424
	User involvement	.736	1.358
	Productivity	.682	1.467
	User support	.936	1.068
	Integration	.759	1.317

Appendix D: Sample Size Calculation

$$n_0 = \frac{(Z_{\alpha/2})^2 pq}{e^2}$$

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{N}}$$

Where, N = Target Population

n_0 = Sample size

n = Calculated/Actual sample size

e = the desired level of precision, (taken confidence level = 95% where by $\alpha = 0.05$)

P = is estimated proportion of an attribute in the population (taken as 0.5 and q = 1-P = 0.5; for conservative estimate)

Z = normal curve that cuts an area α (the value read from statistical table) = 1.96

N = 450

$\alpha = 0.05$ $Z_{\alpha/2} = 1.96$

$e^2 = 0.0025$

$n_0 = 384.16$

$$n = \frac{384.16}{1 + \frac{384.16-1}{450}}$$

n = 207.44

n = 207

Appendix E. Preliminary questions and answers

Preliminary Questions and Answers				
No.	Preliminary question	Respondent 1	Respondent 2	Respondent 3
1	Do you think the implementation of SAP ERP was successful?	Do you think the implementation of SAP was successful?	Yes, but the awareness through users are not adequate rather through experience / try and error	Yes about 85%. (15% is for the failures on MRP which may be due to lack of data on the system).
2	What benefits do you think your section earned with the implementation of the system?	<ul style="list-style-type: none"> • Minimized operational errors (discrepancy & PO errors), Increased speed, efficiency and customer satisfaction and on time performance. • Reduced operational and other related costs • Smooth and streamline our purchasing process • We can check PO status, payment and stock items movement. • PO approval has been made on time via workflow. • Reduced waste, increased productivity and eliminated operational inefficiency 	As purchasing department this system make easy of our transaction process for goods and service purchase	I believe it has many advantage especially in terms of technology. It minimize time, avoid paper work which result in swift approval of orders, enable efficient utilization of space in the company (no need of file room same as before), easy control over stock and it provide accurate information on purchase orders.

3	How do you express the effect of SAP ERP on the supply chain performance? In terms of employee satisfaction, process improvement and time	<ul style="list-style-type: none"> • It has a significant impact on employees' productivity, service quality and innovation. • It has a potential effect to manage and stream line overall business by integrated various system and process. • Automate workflow and speed transaction • Improve customer service and customer retention. • It is actually intended to standardize the process. 	The system has a good effect on ERP as a system but due to the understanding and knowledge on using the system SAP is not effectively used	
4	Is SAP ERP system performing as per your expectation if yes why? If no why?	Yes, because the system is user friendly, flexible and vital for the company's strategy growth. It is customized per ET requirement. The system is built on fixed transaction codes with minimum mandatory requirements. SAP ERP system training is also accessible on YouTube & internet. The system enhances employee's productivity.	Yes the system is doing fine as expected to do but the company needs to work on training users	No, may be because accurate and timely data is not feed in to the system which is affecting quality of MRP result.
5	What challenges are you facing while carrying out your routine activity on the system?	<ul style="list-style-type: none"> • Limited access granted • frequent system termination. (Several login and exit). • Data redundancy • MRP (Material requirement planning doesn't run properly. • lack of confidence on the system inventory balance • system restriction due to company financial policy • Release strategy problem 	There was a knowledge gap on using the system, it was self-learning most of the time, there was no respective training to each users	Intermittent approval workflow which is disappointing and requires the support team intervention every time.it also affected our on time performance.

6	Do you think SAP functionalities are utilized fully as much as it has been told since the implementation? If your answer is no. what are the gaps or not utilized	I think, the SAP system is not fully utilized. We have noticed some of the gaps like pretty cash PR, Automatic MRP, automatic email notification on employee's feedback (EPDMS) and vender's notification are not working yet. Miscommunication of new processes, SAP support team turnover and users took long period of time to cope with the new systems and processes. SAP ERP Modules are not fully utilized.	NO, i think SAP is not utilized fully there are many function which it can do but we are not using them.	
7	How do you see the support office assistance in addressing issues raised from your section (the quality of support and timeliness)?	The SAP team assistance is improved from time to time and we are now getting on time response for our requests. However, the solution is not long lasting as the result it creates a back and further communications.	Even the utilization level of the ERP system is less, the support we get from the experts is very nice with good quality	
8	Do you think the training that had been given during the implementation was satisfactory for end users? If your answer is NO, please explain	Yes, the given training was satisfactory	The training was given to few selected employees but it was not good enough to use the system effectively. Continuous training should be given to each users.	NO, On the implementation stage it was good but as there are many new employees joined the company after that the knowledge they have on this is not enough due to luck of recurrent training.
9	What do you suggest on the ability and the knowledge of the SAP support team?	The company needs an SAP support team with a deep understanding of both technical and strategic side of SAP system and business, along with the ability to coordinate with different IT departments . The company should be recruited the employee's in IT related fields instead of other fields as Senior employees are resigns from	The ability and knowledge of the SAP support team was very nice and good but need improvement	It is good and fast in solving issue but I have doubt on giving permanent solutions on repetitive problems to avoid repetitive requests for similar problem (it can be on the system or lack of training to users).

<p>10</p>	<p>What are the improvement areas that you suggest on SAP ERP system</p>	<ul style="list-style-type: none"> • The ERP system needs to be evaluated for full utilization of the existing functionalities. • Long lasting solution for frequent problems. • Top management should consider acquiring additional modules like vendor management system and Contract administration. 	<p>There is very high knowledge gap between users and system which the company really need to work on so that system utilization can be efficient.</p>	<p>The company should work on feeding proper and quality data on the system especially in materials management (MM) area so that the supply chain management can benefit more from the system.</p>
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