ADDIS ABABA UNIVERSITY

SCHOOL OF COMMERCE

DEPARTMENT OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT

THE EFFECT OF ENTERPRISE RESOURCE PLANNING IMPLEMENTATION ON INTERNAL SUPPLY CHAIN PERFORMANCE: THE CASE OF ETHIO TELECOM

BY

ADANE AYALEW

ADVISOR:

MATIWOS ENSERMU (Ph.D.)

A THESIS SUBMITTED TO ADDIS ABABA UNIVERSITY SCHOOL OF COMMERCE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN LOGISTICS AND SUPPLY CHAIN MANAGEMENT

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ADDIS ABABA, ETHIOPIA

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APPROVED BY BOARD OF EXAMINERS

Advisor	**Signature & Date**
Internal Examiner	**Signature & Date**
External Examiner	**Signature & Date**

Declaration

I declare that this thesis is the result of my independent research work on the topic entitled "The Effect of ERP Implementation on Internal Supply Chain Performance the case of Ethio telecom" in partial fulfillment 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.

Adane Ayalew _____

Name **Signature & Date**

Dedication

This thesis is dedicated to the memory of my mother Belaynesh Simeneh, who would have been happy to see her seedlings grown well.

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List of Abbreviations and Acronyms

ERP	Enterprise resource planning
IT	Information Technology
ISCP	Internal Supply chain performance
MR	Material Requisition
POR	Purchase Order requisition
RFQ	Request for quotation
SCM	Supply chain Management
SCOR	Supply chain operation reference
SCP	Supply chain Performance
SPSS	Statistical package for social science
TOT	Training of trainers

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Abstract

The main objective of this study is to examine the effect of ERP implementation on the internal supply chain performance of ethio telecom with respect to ERP implementation factors of project plan & vision, top management support, project management, project champion, user training, IT infrastructure, Vendor support and communication. Both quantitative and qualitative research approaches were used in the study. Explanatory research design was used to identify ERP implementation factors and to examine the effect of ERP implementation on the internal supply chain performance of the case company. Simple random sampling was used to select the appropriate samples of the study. All of the implementation factors were found to have positive and significant correlation with the dependent variable which is internal supply chain performance. The ANOVA test result showed that, the value of R and R^2 obtained under the model summary was statistically significant. The multiple linear regression analysis revealed that, 6 of the 8 independent variables (top management support, project management, user training, IT infrastructure, vendor support and communication) have a statistically significant relationship to predict internal supply chain performance. The other 2 variables (project plan & vision and project champion) are not statistically significant to predict internal supply chain performance. User training and IT infrastructure accounts the largest share to explain the variation of internal supply chain performance.

Key Words: User training, vendor support, communication, top management support, IT infrastructure, project management, project champion, project plan & vision

CHAPTER ONE: INTRODUCTION

1.1. Background of the Study

Today, many organizations face continuous demands from rapidly changing and increasingly competitive global markets. They also must serve customers who want innovative, high quality products that feature special options. Additionally, further pressures are created by technology developments that shorten many product life cycles, and by intensified international competition which drives cooperation to reduce costs and improve production efficiencies. To increase their competitive advantage, companies must have flexible business information systems that adapt to rapid changes. To address these needs, enterprise business applications are providing solutions that concentrate on the customer by integrating the supply chain (Kumar, 2004).

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).

Shatat and Udin (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.

Rashid, Hossain and Patrick (2002) give the following as some of the core ERP modules that are found in the successful ERP systems: accounting, financial, manufacturing, production, transportation, sales and distribution, human resources, customer relationship 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. 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 enables approval through hierarchical workflow and creates enhanced and paperless work environment. However, Implementation of ERP systems is not an easy task. While successful ERP systems can boost a company's performance, failed systems can be disastrous on the other hand.

The use of ERP system in Ethiopia is a new phenomenon and ethio telecom has implemented it since December, 2010 to replace the old legacy system and integrate its functional departments. The system is being applied in finance, human resource and supply chain functions of the company.

This study has assessed the implementation process and find out the effects ERP implementation on the internal supply chain performance of the company based on selected performance indicators of the SCOR model.

The SCOR model is a well-known supply chain performance metrics model developed by supply chain council which focuses on five supply chain activities of plan, source, make, deliver, and return (Reza, Nasrin and Hoda, 2009).

1.2. Statement of the Problem

Ethio Telecom is the sole telecom operator in Ethiopia which is engaged in the provision of telecom services to its customers throughout the country. Telecom network Infrastructure deployment, product development & configuration, marketing, sales and different internal

operations are among the major activities being performed by the company in order to serve its customers.

These functions are being performed by different functional departments of the company and supply chain operations play a pivotal role by supplying different resources for the departments through proper planning, sourcing and delivery of network, IS, commercial and facility related materials.

In order to better streamline these operations and to provide better customer service, effective and efficient supply chain is required.

With the vision of becoming world class telecom operator & for the effective management of its resources, the company has invested & implemented an IT solution named ERP (enterprise resource planning) for the business functions of supply chain, finance and human resource since December 2010.

In order to improve its internal supply chain performance, the company has implemented five ERP modules; Oracle inventory, Oracle order management, Oracle purchasing, Oracle Sourcing & Oracle iprocurment.

The company has invested more for the purchase of the solution, for the implementation of the project and for the training of the staffs in order to replace the desperate legacy system to integrated and automated business process.

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).

Henk (2003), pointed out that implementation of ERP does not necessarily guarantee success in organizations. Its effectiveness depends on success on the implementation process and organizational set up. The implementation process is explained by ERP implementation factors (Syeda, Muhammad and Saddam, 2013).

On the other hand the company has a plan to go for further phase implementation of the system in related business functions. It is necessary to check the implementation process and effect of

the implemented ERP system on performance so that lessons can be taken for further phase implementations.

However, no formal research has been undertaken on the implementation process of the system and its effect on the internal supply chain performance of ethio telecom.

The effects of ERP modules implementation on the internal supply chain needs to be known, categorized, and measured so that appropriate & timely interventions can be undertaken for improvement.

This study was conducted to fill this gap and has examined the implementation process. Accordingly, it found out ERP implementation factors and its effect on the internal supply chain performance of ethio telecom with respect to the well-known supply chain performance metrics model called the SCOR model.

1.3. Basic Research Questions

The basic research questions to be addressed in the study are:

1. What are the factors that affect the implementation of ERP?
2. Which ERP implementation factors have significant effect on internal supply chain performance?
3. What are the effects of ERP implementation on internal supply chain performance?

1.4. Objective of the study

The general objective of the study is to identify the effects of ERP implementation process on the internal supply chain performance of ethio telecom.

The specific objectives of the study are;

I. To identify factors that affect ERP implementation.
II. To identify ERP implementation factors which have significant effect on internal supply chain performance
III. To examine the effect of ERP implementation on internal supply chain performance.

1.5. Significance of the study

The study will provide information to the management of the company to focus & work on those ERP implementation factors that has direct effect on internal supply chain performance. It will also enable decision makers to know the real contributions of the system for the performance of the internal supply chain.

The study will also use as reference for future researchers who will be interested to study topics related with ERP implementation and its impact on organizational performance.

For organizations which have a plan to deploy the system, the study will enable to take decisions by looking at the effects of the system for internal supply chain application in Ethiopian context.

1.6. Scope of the study

The study mainly focuses on the assessment of the effect of ERP implementation process on the internal supply chain performance of Ethio Telecom and only supply chain ERP modules implemented in ethio telecom were the concern of the study. Only eight ERP implementation factors extracted from literature were considered in this study even though, there are many implementations factors to be considered in the process of ERP implementation.

1.7. Limitation of the Study

Unavailability of secondary data and related research work on the current topic are the limitations of this study. Response bias from respondents was another limitation of the study since the information provided by the respondents is from their stored memory. However, the researcher has tried to minimize this bias by undertaking in-depth interview with ERP super users and system support providers who have direct involvement in the implementation project.

1.8. Organization of the Study

The study is categorized in five chapters. The first chapter shows the general background of the study, definition of the research problem, objective, significance, and scope of the study. The second chapter deals with reviews of literature. The third chapter presents the research methodology used in the study. Data analysis and findings are presented in chapter four. Conclusions and possible recommendation are given in the final chapter which is chapter five.

CHAPTER TWO: LITERATURE REVIEW

2.1. Theoretical Review

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 Merkuryev, 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 provides the database and the transaction capability to initiate, track, monitor, and report on customer and replenishment orders. ERP systems provide firms with information consistency, economies of scale, and integration. ERP system design includes the central database and application modules to facilitate supply chain, financial and human resource management (Donald, David and Bixby, 2002).

ERP has its roots in manufacturing, although it has evolved in a remarkably short time to address many other functions and sectors. The ERP system can simply described as an integrated information system servicing all aspects of the business. It handles transactions, maintains records, provides real time information and facilitates planning and controls (Stephen, 2003).

ERP is used to support existing business strategies and provides the company with the flexibility required to improve customer responsiveness (the demand-side) and to better manage production needs, inventory and the procurement of inputs (the supply-side). It is also the ultimate tool for allocating scarce resources. Using ERP, a company can create a new information foundation (that is organized, consistent, codified and standardized) by replacing the existing diverse legacy systems (Chris et al., 2003).

Kumar (2004), summarized the benefits of ERP as better customer satisfaction, improved vender performance, increased flexibility, reduced quality cost, improved information accuracy & integrity, improved decision making capability, better solution in terms of business process.

The rational for implementation of ERP varies between companies and provides an indication of the type of implementation envisaged. There are six main reasons for implementing ERP. The chief reason is the need for a common IT platform. Other reasons include a desire for process improvement, data visibility, operating cost reductions, increased responsiveness to customers and improvements in strategic decision making. ERP is certainly acting as an impetus for the replacement of a mix of aging legacy systems with a common platform (Altekar, 2007).

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).

A well-designed, properly setup and correctly implemented ERP solution can provide tremendous benefits to any company no matter their size or scope. The ability to instantly run status reports with no manual data entry in spreadsheets can provide companies with invaluable information on business operations and allow for more timely reactions to changing business environments. Companies that have been deemed successful with above average or high profit levels in relation to their industry frequently attribute their success, at least partially, to their ERP solution. Forward looking firms have begun to look at their business systems as a key element of their overall business investment strategy and apply the same financial metrics to business software that are used when acquiring a new plant or new equipment.

In the fast changing world of business, an advanced, modern ERP system is no longer just a key to business success, but a core element of survival. If a firm has difficulty running reports in real-time, if employees waste time re-entering the same data into multiple systems, or key

business metrics are calculated by hand on spreadsheets, the firm could benefit from a modern ERP business package.

Supply chain, finance, human resource, service and reporting are the major ERP application areas of companies.

The ERP supply chain applications include the modules labeled inventory and supply applications, manufacturing applications, and sales and delivery. These three modules support supply chain activity, including raw materials acquisition, production, and customer order fulfillment. These modules incorporate the transactions and processes that initiate the entire range of supply chain activities. The financial module incorporates the transactions necessary to maintain the firm's financial and accounting records. Specifically, the module maintains the contents and references to the firm's general ledger and tracks payables and receivables. The module also facilitates the development of standardized income statements and balance sheets for divisions, geographic regions, or for the entire global operation. The typical transactions include accounts receivable and payable, invoicing, financial accounting, and management reporting. The human resource module tracks employee records, assignments, and performance. This information is used to support payroll, tax, and work history documentation. In addition to the typical human resource applications, this module aids in costing supply chain activities by tracking time individuals spend on an order, an activity, or a process. Detailed activity tracking allows supply chain managers to determine the relative expense associated with customized or specialized cost of manufacturing and service.

The service module supports post sales product service and warranty support. Customers of expensive capital equipment such as manufacturing, medical, communication, or transportation equipment require strong after-sales support for maintenance and repair. The system has to track equipment types and versions to ensure that the correct repair parts are available and can be dispatched to the required location quickly. The service module can also track usage and repair records to anticipate potential problems with preventative maintenance or equipment adjustment.

The reporting module generates the standard and customized management reports for monitoring, performance measurement, and decision support. Using the central data warehouse,

these report applications provide management with the capability to monitor activity levels and identify performance deficiencies and issues (Donald, David and Bixby, 2002).

Supply chain design is becoming a core competency, and the enterprise resource planning (ERP) system is expected to be an integral component of supply chain management (SCM). Installing an ERP system is, however, expensive and risky. IT managers must decide how to use their limited resources and invest in the right product (Su and Yang, 2010).

2.1.1. Factors affecting ERP implementation

Implementation factors are defined as areas where things must go right for a business to flourish (Rockart, 1979).

According to Leidecker and Bruno (1984), implementation factors are "those characteristics, conditions or variables that, when properly sustained, maintained, or managed, can have a significant impact on the success of a firm competing in particular industry"

Different studies are conducted to identify ERP implementation factors. Hussien, (2010) summarized and defined the implementation factors.

Project Plan and Vision: One of the problems faced in ERP projects is justification of the huge resources required to implement it. Nah (2003), stated that one of the biggest problems ERP project leaders face comes not from the implementation itself, but from the expectations of board members, senior staff and other key stakeholders. Thus, a business plan that outlines proposed strategic and tangible benefits, resources, costs, risks and timeline is critical to clearly define where the resources are going to be allocated and what are the reasonable returns from it (Wee, 2000).

An ERP plan should decide in advance what to do, how to do it, when to do it and who is to do it. These may include the establishment of an intentional structure of roles though determination of the activities required to achieve goals of an enterprise and each part of it, the grouping of these activities, the assignment of such groups of activities to a manager, the delegation of authority to carry them out, and provision for coordination of authority and informational relationships horizontally and vertically in the organization structure (Koontz, 1980).

Top management Support: Top management role in following-up and controlling the ERP project implementation is as important as its role in launching and facilitating it. Al-Mashari et al. (2003) stated that top management support does not end with initiation and facilitation, but must extend to the full implementation of the ERP system. Koontz (1980) defines controlling as a "managerial function of measuring and correcting performance of activities of subordinates in order to assure that enterprise objectives and plans are being accomplished". Thus, top management should be kept updated about the project progress so they can maintain, control and correct the implementation process if needed.

Project Management: ERP systems are organization-wide projects that deal with many aspects and often require genuine changes; hence a powerful and qualified management that is able to manage, steer and control it is essential for the success of implementation. ERP project managers should enjoy a good technical experience, business knowledge and interpersonal skills.

Al-Mashari et al., (2003) stated that "the success of projects is related to the knowledge, skills, abilities and experiences of the project manager as well as the selection of the right team members". Manager therefore should be able to properly manage the project, set the required and suitable strategies and continuously follow, direct, control and maintain implementation process. According to Dennis Lock (1996), "project management has evolved in order to plan, coordinate and control the complex and diverse activities of modern industrial and commercial projects". Project management should there for set effective strategies.

Project champion: Some studies showed that the presence of project champion is found to have a good impact on ERP implementation. Project Champion refers to the existence of high level executive sponsor with power to set goals and control changes and continually strive to resolve conflicts and manage resistance (Nah, Lau and Kuang, 2001).

User Training: Users have to be intensively trained to avoid any error or confusion during when implementing and using it. Sufficient training can increase success for ERP systems. Management should focus in training courses and willing to allocate all resources needed. The quality of training is very important for a good understanding and proper utilization of the

system. Consultants play a key role by transferring their knowledge to the end users either through training program or interaction during implementation (Nah et al., 2003).

Vendor Support: ERP system differs not only from other information systems but also from one ERP system to another which requires a depth and expert knowledge in the selected system particularly to implement it. Vendors and their trained consultants are usually the only parties who have acquired such knowledge. Therefore, vendors play a substantial role prior, during and after the implementation. Vendor should participate in the implementation plan architecting; provide well designed training programs for the organization staff and dedicate specialized consultants with good experience in the system as well as business process to assist the organization throughout implementation phases (Holland et al., 1999).

Communication: Communicating ERP project with employees is essential to build awareness about the importance of these projects to the organization. This will enhance them to cooperate with the implementation team and participate in change. Another important point that should be communicated with the employees is how the system will impact their jobs. Managers need to communicate the importance of the project, and the employees should be informed in advance about the scope, objectives and the changes that will occur (Sumner, 1999).

IT infrastructure: The IT staff's quality (i.e., knowledge of technological changes and up-to-date skills) is cited among the important factors required for IT systems success in general and for ERP implementation success in particular (Essex et al., 1998).

Empirical evidence suggests that IT systems are more likely to succeed in organizations where general IT skills and relevant in-house IT expertise exist (Igbaria, 1990).

2.1.2. Supply chain performance Measurements

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).

SCOR combines elements of business process engineering, metrics, benchmarking, leading practices, and people skills into a single framework. Under SCOR, supply chain management is defined as the integrated processes of plan, source, make, deliver, and return. Each element is explained below.

Plan: Assess supply resources; aggregate and prioritize demand requirements; plan inventory for distribution, production, and material requirements; and plan rough-cut capacity for all products and all channels.

Source: Obtain, receive, inspect, hold, issue, and authorize payment for raw materials and purchased finished goods.

Make: Request and receive material; manufacture and test product; package, hold, and/or release product.

Deliver: Execute order management processes; generate quotations; configure product; create and maintain customer database; maintain product/price database; manage accounts receivable, credits, collections, and invoicing; execute warehouse processes including pick, pack, and configure; create customer-specific packaging/labeling; consolidate orders; ship products; manage transportation processes and import/export; and verify performance.

Return: Defective, warranty, and excess return processing, including authorization, scheduling, inspection, transfer, warranty administration, receiving and verifying defective products, disposition, and replacement (Bolstorff and Rosenbaum, 2011).

2.2. Empirical Review

Very little academic research has 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.

Successful implementation and the effective usage of ERP system can contribute toward enhancing supply chain management 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).

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.

The focus of ERP is optimization of resources within the business, whereas the focus of supply chain management is optimization of resources within the supply chain. ERP integrates all the business processes in order to improve efficiency of the organization (Koh et al., 2014).

The authors studied the impact of ERP implementation on supply chain performance based on five benefit categories of ERP (managerial, operational, strategic IT infrastructural and organizational benefits) and concluded that supply chain performance is enhanced and improved with the implementation of ERP.

Jacquiline (2013), find out that top management support, end user ta training and effective project management had positively contributed for the success of ERP implementation.

Albert (2013), identified end user training, communication, involvement of top management and organizational culture as important factors that determine the implementation of ERP.

As per the findings of Somsit (2013), user education & training, Business process reengineering and top management support is the major factors determining the success of ERP implementation.

Ten critical success factors should be considered during the ERP implementation as the most important factors. These factors are Top Management Support, User Involvement, Clear Goals & Objectives, Strategic IT Planning, User Training & Education, Vendor Support, Teamwork & Composition, Project Champion, Monitoring & Evaluation of Performance, and Education on new Business Processes. These top 10 critical factors can help companies to achieve successful implementation of ERP system (Ahmad, 2015).

In special view of implementing ERP for Supply Chain management (SCM), the application of ERP increases the efficiency of SCM. Shatat and Udin (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).

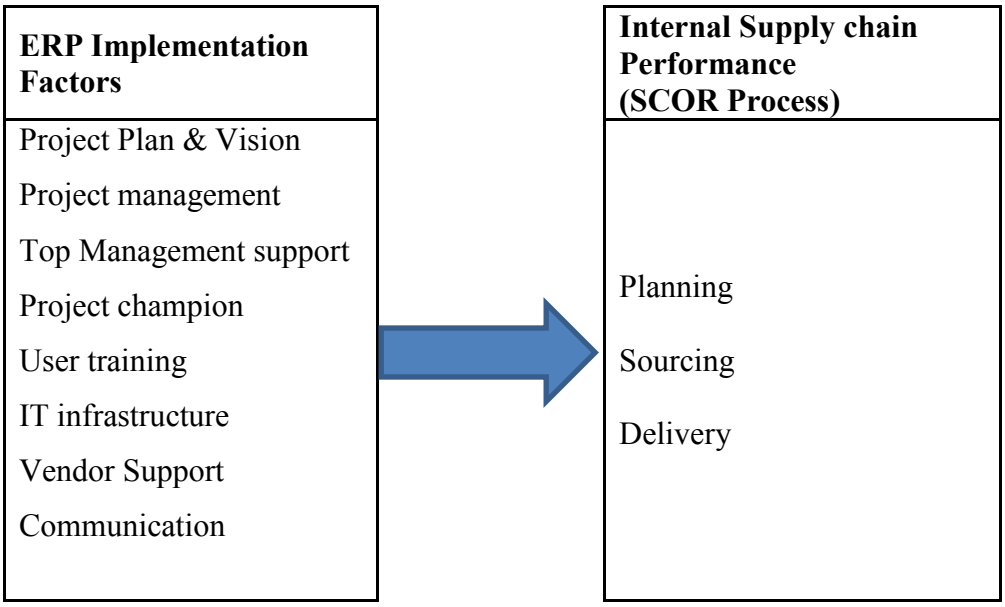
There are very limited literature and research about ERP systems implementation in Ethiopian context. One of the studies related to ERP system from Ethiopian perspective is the work of Abiot and Gomez, (2012). This study has discussed about a successful ERP Implementation in an Ethiopian private limited engineering company. The ERP system mentioned by the authors is Microsoft Dynamics which is not well known ERP application. The study didn't identify 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) conducted a research on success factors on enterprise resource planning in Ethiopian Airlines. He identified eight important factors for successful ERP implementation. These are project planning and strategy, top management support and commitment, project management and leadership, training, documentation and knowledge transfer, clear user requirement and need assessment, capability of consultants and implementers, change management and communication, team composition and retention and organizational culture and readiness.

However both of the studies focused on identification of the success factors and challenges of ERP implementation. The effect of the implementation on business performance is not studied.

So, this study has tried to work on this gap by identifying ERP implementation factors and the effect of the implementation on internal supply chain performance.

Conceptual Framework

ERP implementation factors found from literature and applicable performance metrics of the SCOR model are considered in the framework below. Make and Return performance metrics of the SCOR model are not included in the framework since it is not applied in the context of ethio telecom due to the nature of the business.



Source: Syeda, Muhammad and Saddam, 2013

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Research Design

Explanatory research design is used to identify ERP implementation factors and to analyze the effect of ERP implementation on the internal supply chain performance of ethio telecom. Close ended questionnaires together with semi-structured interview was employed to get the required information.

3.2. Research Study Area

The study is conducted in ethio telecom, specifically on sourcing and facility division of the company which is responsible for managing the supply chain activities of the company. More specifically, the study is conducted at corporate level of ethio telecom and the offices are located in Addis Ababa.

3.3. Sample size and Sampling techniques

The total population of the study is 217 working under sourcing and supply chain departments in sourcing and facility division. Since the study population is homogeneous in dealing with supply chain ERP modules, simple random sampling technique was used to select the representative sample. The number of the sample is determined by using sample size determination formula developed by Yamane(1967).

$$n = \frac{N}{1 + Ne^2}$$

Where n=sample size, N=population size, e=the error of sampling.

$n=217/1+217(0.05)^2=140$

Accordingly, out of the 217 employees, questionnaire was distributed to 140 employees. A total of 121 responses were received of which 115 were complete, which represents a response rate of 82.1 percent. In addition to the questioner, 6 managers and 5 super users who participated in ERP implementation project were interviewed.

3.4. Method of data collection: Data Source and Instrument

Primary data was used in this study and source of the data was from the users of Oracle ERP supply chain module in ethio telecom. Close ended questionnaires and semi-structured interviews were employed to collect the data. Respondents were contacted personally to collect the required information via questionnaire. Similarly, the interview with mangers and ERP super-users was conducted in person.

3.5. Method of Data Analysis

Once the data was collected, verification was conducted and complete questionnaires were identified. Then the data is coded in to SPSS (statistical package for social science) according to the variables selected and the questions asked.

The data analysis was performed using descriptive and inferential statistics. IBM SPSS statistics (statistical Package for social scientists) software version 20 is used to process the data.

3.5.1. Descriptive statistical Analysis

The final report of the relevant demographic variables was produced through central tendency measurements (frequency and frequency distribution, valid & cumulative percentage and comparison of mean). In addition, tabular explanations are used to present the result with the help of SPSS.

3.5.2. Inferential statistical Analysis

In inferential statistical analysis, correlation and multiple linear regression methods were utilized using statistical package for social sciences (SPSS) software. The use of these statistical tools and methods of presentation are described below.

a) Correlation

Correlation (r) is used to describe the strength and direction of relationship between two variables. Since all variables are measured as an interval level, Pearson product moment correlation was used. Correlation “r” output always lies between -1.0 and +1.0 and if “r” is positive, there exists a positive relationship between the variables. If it's negative, the

relationship between the variables is negative. While computing a correlation, the significance level shall be set at 95% with alpha value of 0.05 or a chance of occurrence of odd correlation is 5 out of 100 observations.

b) 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 eight ERP implementation factors or predictors which have influences on internal supply chain performance.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots + \beta_n X_n + \varepsilon$$

Where Y is the dependent variable and the independent variables are those which explain the response ranges from X_1 to X_8

Table 3. 1 Model Specification of Variables.

S.№	Predictor Variable (X)	Beta Coefficient (β)	Predictor X-Value Assigned
1	Project plan and vision	β_1	X_1
2	Top management support	β_2	X_2
3	Project Management	β_3	X_3
4	Project Champion	β_4	X_4
5	User Training	β_5	X_5
6	IT infrastructure	β_6	X_6
7	Vendor Support	β_7	X_7
8	Communication	β_8	X_8
9	Internal Supply Chain Performance	Constant	Y

3.6. Measurement Instruments

The employed questionnaire contains the general information of the respondents and Likert scale measurements of the variables. The general information includes gender, educational level, job position in the company, years of company experience and years of experience in using ERP.

Five point Likert scale was used to rate the independent and dependent variables, which ranges from Strongly-disagree (1) to Strongly-agree (5) level of agreement. These five point Likert scale are adapted from different literatures of scholars. The independent variables or implementation factors of ERP questions were adapted from the studies of (Karim et al., 2007; Olivier et al., 2009; Yousef, 2010) whereas the internal supply chain performance measurement questions were adopted from (Afra, 2014, Giorgise, 2015) research studies.

3.7. Ethical consideration

The source of data for the study was questionnaire and interview from users of oracle ERP modules in ethio telecom. 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.

3.8. Validity and Reliability Test

3.8.1. Validity Test

The scientific soundness of a research finding is determined by the validity of the instruments used. 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 individuals who have knowledge of the area by allowing them to read and comment on it. Constructive comments were collected from the individuals and the

questionnaire was adjusted accordingly. Then, validation of the instrument was given by academic advisor prior to the data collection.

3.8.2. Reliability Test

Reliability is essentially the dependability of an instrument to test what it was designed to test. The appropriate test for reliability is inter-item consistency reliability which is popularly known as the Cronbach's coefficient alpha.

According to Joseph and Rosemary (2003), Cronbach's alpha reliability coefficient (α) normally ranges between 0 and 1. According to these authors, there is a greater internal consistency of the items if the Cronbach's alpha coefficient closes to 1.0.

Based on the following rule of thumb of (George and Mallery, 2003, p. 231), if "α > 0.9 – 'Excellent', α >0.8 – 'Good', α >0.7 – 'Acceptable', α >0.6 – 'Questionable', α >0.5 – 'Poor', and α <0.5 – 'Unacceptable'."

Table 3.1 below shows that there is "*acceptable*" and "*good*" internal consistency of each independent variable's parameters used. And the study has the sum of the independent variables average Cronbach's alpha value of (α = **0.904**) and the reliability test of the study is located on "*excellent*" range.

Table 3.2 Reliability Test of Variable's Using Cronbach's Alpha

	Reliability Statistics				
S.№	Variable Name	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	№ of Items	(α) reliability ranges
1	Project Plan and Vision	.790	.799	4	*Acceptable*
2	Top management Support	.844	.848	4	*Good*
3	Project Management	.746	.751	4	*Acceptable*
4	Project Champion	.871	.872	4	*Good*
5	User Training	.788	.794	4	*Acceptable*
6	IT Infrastructure	.792	.792	4	*Acceptable*
7	Vendor Support	.700	.714	4	*Acceptable*
8	Communication	.700	.709	4	*Acceptable*
9	Planning Performance	.796	.800	4	*Good*
10	Sourcing Performance	.730	.732	4	*Acceptable*
11	Delivery Performance	.746	.741	4	*Acceptable*
Overall		**.904**		**46**	*Excellent*

Source: Respondents Survey Test Result, 2017.

CHAPTER FOUR: DATA ANALYSIS AND DISCUSSION

4.1. Data Analysis

In this chapter, the data collected using questioner and interview was analyzed and presented based on the objectives of the study set above. The data was found to be important to explain the effect of ERP implementation factors on internal supply chain performance of ethio telecom. Descriptive and inferential statistics were used to analyze 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. Hence it is possible to conduct Pearson correlation and linear multiple regression (Creech, 2011).

Pearson correlation (r) is used to describe the strength and direction of relationship between the dependent variable which is internal supply chain performance and the eight independent variables. Multiple regression analysis is used to predict the value of internal supply chain performance from the value of the independent variables.

4.1.1. General information of respondents

Gender of the Respondents

As depicted in table 4.1 below, out of 115 respondents, 60.9 % of them were male and the remaining 39.1% were female respondents.

Table 4.1 Gender of the Respondents

Gender				
		Frequency	Valid Percent	Cumulative Percent
Valid	F	45	39.1	39.1
	M	70	60.9	100.0
	Total	115	100.0	

Source: SPSS output of the survey, 2017.

Education Level of the Respondents

Table 4.2 shows that few respondents (2.6%) have educational level of Diploma while the majority of the respondents (81.7%) have acquired their first degree. 15.7% 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 Level					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Degree	94	81.7	81.7	81.7
	Diploma	3	2.6	2.6	84.3
	Masters	18	15.7	15.7	100.0
	Total	115	100.0	100.0	

Position of the Respondents

As it can be seen from the table below majority of the respondents (88.7%) are Professionals and specialists based on the company's job classification. 11.3 % of the respondents are supervisors managing different staffs under them. The remaining 7 % of the respondents are managers.

Table 4.3 Job Position of the Respondents

Job Position					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Manager	8	7.0	7.0	7.0
	Professional	45	39.1	39.1	46.1
	Specialist	49	42.6	42.6	88.7
	Supervisor	13	11.3	11.3	100.0
	Total	115	100.0	100.0	

Source: SPSS output of the survey, 2017.

Company Experience of the Respondents

As it can be seen from table 4.4, more than 78 % of the respondents have experience of 6 years and above. 44.3 % of the respondents have worked 6 to 10 years in Ethio telecom while 17.4% of the respondents have served the company from 11 to 15 years. 7.8% of the respondents served the company for more than 21 years.

Table 4.4 Company Experience of the Respondents

Company Experience					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	11 to 15	20	17.4	17.4	17.4
	16 to 20	10	8.7	8.7	26.1
	21 & above	9	7.8	7.8	33.9
	6 to 10	51	44.3	44.3	78.3
	Below 5	25	21.7	21.7	100.0
	Total	115	100.0	100.0	

Source: SPSS output of the survey, 2017.

ERP Usage Experience of the Respondents

As stated above, it is around six years since ethio telecom has implemented ERP. More than 97 % of the respondents have experience of working with ERP for more than 2 years. 53.1% of the respondents have ERP usage experience of more than four years. Only 2.7% 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 ERP Usage Experience of the Respondents

ERP Experience					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 to 3	51	44.3	44.3	44.3
	4 to 5	47	40.9	40.9	85.2
	above 5	14	12.2	12.2	97.4
	Below 1	3	2.6	2.6	100.0
	Total	115	100.0	100.0	

Source: SPSS output of the survey, 2017.

4.1.2. Result of Survey data

In this part, the data collected using Likert scale is presented for the both the dependent and independent variables.

Table 4.6 Summery of Survey result for the independent variables

Project plan and Vision					
Measurements	Strongly disagree	Disagree	Neutral	Agree	Strongly disagree
The Company has a clear vision about the ERP project and how it will impact its performance	0.0%	15.7%	46.1%	34.8%	3.5%
The company has determined the budget it's willing to allocate for ERP project.	0.0%	16.5%	49.6%	33.9%	0.0%
The company has addressed the possible risks associated with ERP project	0.0%	14.8%	63.5%	20.9%	0.9%
The company has identified the desired and expected benefits from ERP business.	0.0%	21.7%	20.9%	56.5%	0.9%
Top Management Support					
Top management has allocated all the required resources for ERP implementation	0.0%	14.8%	29.6%	53.9%	1.7%
Top management has delegated implementation authority for project Managers	0.0%	15.7%	31.3%	53.0%	0.0%
Top management was regularly updated with the implementation process progress	0.0%	18.3%	39.1%	41.7%	.9%
Top management interferes and corrects the implementation process when needed	0.0%	23.5%	10.4%	66.1%	0.0%
Project Management					
Project managers had good technical experience	0.0%	2.6%	33.0%	53.9%	10.4%
Project managers had a good knowledge in business processes	0.0%	5.2%	33.9%	55.7%	5.2%
Project managers communicated the project strategies with employees in a friendly way	0.0%	13.9%	40.9%	38.3%	7.0%
Project managers have set good strategies for ERP implementation	0.0%	21.7%	21.7%	50.4%	6.1%
Project Champion					
ERP project was led by a high level executive	0.0%	17.4%	29.6%	46.1%	7.0%
Project manager promoted the project to top management and get their support	0.0%	20.0%	30.4%	47.0%	2.6%
Project manager was capable to motivate employees and enhance them to change	0.0%	24.3%	36.5%	34.8%	4.3%
Project leader strives to solve problems faced during implementation	0.0%	33.9%	18.3%	44.3%	3.5%

User Training					
The company has provided all resources required for training	0.0%	2.6%	24.3%	38.3%	34.8%
Internal staff has been intensively trained on the system	0.0%	4.3%	25.2%	67.8%	2.6%
The training program was handled by highly qualified consultants and trainers	0.0%	7.8%	30.4%	58.3%	3.5%
The training programs where properly and well designed for end-users.	0.0%	18.3%	12.2%	67.0%	2.6%
IT infrastructure					
The company has availed computer for all users of ERP	0.0%	6.1%	33.9%	42.6%	17.4%
There is reliable intranet connection to use ERP system	0.0%	16.5%	34.8%	46.1%	2.6%
System interruptions are fixed instantly without affecting performance	0.0%	9.6%	39.1%	47.0%	4.3%
It is possible to get instant support from system administrators when problem occurs in using ERP system	0.0%	29.6%	16.5%	50.4%	3.5%
Vendor support					
Vendor consultants have offered well designed and intensive training programs for end users.	0.0%	19.1%	28.7%	43.5%	8.7%
Vendor was ready to solve and troubleshooting any technical or procedural problem during the implementation	0.0%	21.7%	26.1%	48.7%	3.5%
Vendor has a quick response to company needs.	0.0%	35.7%	30.4%	33.9%	0.0%
Vendor's support has continued even after implementing the system in terms of maintenance and upgrading the system	1.7%	33.9%	33.0%	21.7%	9.6%
Communication					
Employees were aware about the resources the company has been allocated in ERP system	0.0%	7.0%	30.4%	58.3%	4.3%
Employees have been educated about the system benefits in business	0.0%	9.6%	35.7%	54.8%	0.0%
Employees were aware about the importance of the system for the company.	0.0%	6.1%	48.7%	43.5%	1.7%
The company has communicated the systems objectives with the employees and its impact on their jobs.	0.0%	17.4%	7.0%	75.7%	0.0%

Source: SPSS output of the survey, 2017.

Table 4.6 shows the detailed survey result from respondents and the mean value of each independent variable is shown below in table 4.7.

Table 4.7 Mean value of independent variables

S.№	Variables	N	Mean	Std. Deviation
1	User Training	115	3.71	0.58042
2	Project Management	115	3.53	0.58128
3	Communication	115	3.51	0.50152
4	IT Infrastructure	115	3.45	0.64397
5	Top management Support	115	3.37	0.64324
6	Project Champion	115	3.28	0.741
7	Project Plan and Vision	115	3.22	0.57272
8	Vendor Support	115	3.19	0.65482

Source: SPSS output of the survey, 2017.

Based on the mean comparison of the independent variables shown in table 4.7, it can be seen that user training is ranked first followed by project management. Communication, IT infrastructure, Top management support, project champion, project plan & vision and vendor support hold ranks from 3 to 8 respectively.

Table 4.8 Summery of Survey result for dependent variable

Planning Performance					
Measurements	Strongly disagree	Disagree	Neutral	Agree	Strongly disagree
Demand forecast accuracy	0.0%	6.1%	28.7%	40.0%	25.2%
Adherence to plans	0.0%	7.8%	29.6%	60.0%	2.6%
Planning cycle time	0.0%	10.4%	35.7%	50.4%	3.5%
Inventory planning	0.0%	18.3%	12.2%	67.0%	2.6%
Sourcing performance					
Quantity and Timely Delivery	0.0%	4.3%	24.3%	51.3%	20.0%
Procurement Cost	0.0%	13.0%	27.0%	57.4%	2.6%
Material Inventory Level	0.0%	5.2%	47.8%	43.5%	3.5%
Defect rate	0.0%	16.5%	11.3%	69.6%	2.6%
Delivery performance					
Defect rate	2.6%	13.9%	6.1%	67.8%	9.6%
Order Fulfillment	0.0%	40.9%	3.5%	48.7%	7.0%
Number of delivery faults	2.6%	6.1%	5.2%	82.6%	3.5%
Transit time	0.0%	67.0%	2.6%	24.3%	6.1%

Source: SPSS output of the survey, 2017.

As it is indicated above, internal supply chain performance is the dependent variable which is measured by planning, sourcing and delivery performances. Table 4.8 shows that majority of the respondents have rated most of the constructs as agree level of the five point Likers scale.

4.1.3. Summary of interview Result

Six managers and five ERP super users were involved in the interview. They were asked about the implementation process and the effect of ERP on internal supply chain performance. The result is summarized below based on the questions asked.

The first question was about whether the company has clear project plan and vision for ERP implementation. Most of them responded that the company knows the benefit and performance outcomes of the system prior to implementation. But, the possible risks and mitigation mechanisms were not clearly identified & documented. Regarding the support from top management, all of the interviewees confirmed that there was an independent steering committee and regular project progress follow up. The other question presented to the interviewees was to explain how the project management was. Most of them responded that there was good project management and the assigned project manager has good technical knowhow and knows the company's business process very well.

With regard to the existence and role of project champion, all of them confirmed that there was no dedicatedly assigned high level executive for the project except the involvement of top level mangers via the steering committee. The other question presented to the respondents was to explain how the training was. They classified the training in to two. The first one is the training provided to super users by the integrator company. This training was adequate and the time given for it was enough to understand the system. The second type of training was end user training provided to users of the company. This training is provided by super users and there were adequate training manual and lab rooms for the training. However, majority of the interviewees complained that the time given for the training was very short (5 to 8 days) and it is very difficult for a user to understand the basic features of the system. In addition, they stated that there is no regular training time. Training was provided to end users massively at once. There was no formal training for new users instead they learn from their senior coworkers. The last problem raised by the interviewees was that there is time gap between provision of the training and systems go live.

The sixth question presented to the interviewees was how the company's IT infrastructure is for ERP implementation. They replied that there is reliable intranet connection. Even though, there were shortages, of computes and server capacity during the commencement of the system, the problem was gradually solved by the company.

The interviewees stated that two different vendors were involved in the implementation of the system. Oracle that provided the software and Soft pro that integrated the system with the company's business process. Customization was done in two ways i.e. customization of the business process to system needs and customization of the system in to business process needs. The vendor has also provided well organized training to super users of the system.

The last question presented to the interviewees was the role of communication in the implementation process. Most of them replied that there was no any formal communication prior to the implementation of the project. The communication was conducted during training before system goes live.

Finally, they were asked to explain the performance of internal supply chain performance after the company has implemented ERP system. The summarized response is that ERP has improved the internal supply chain performance of the company. Especially, it enabled to have optimal inventory level since online inventory tracking is possible. It has minimized the paper work communications with in the supply chain department. Purchase order requisitions (POR) and material requisitions (MR) are being managed by using Oracle Iprocurement. Sourcing performance is improved using Oracle sourcing and oracle purchasing ERP modules. Delivery performance is improved with the help of Oracle inventory and order management.

4.1.4. Correlation Analysis

Correlation shows the strength and direction of relationship between variables. The linear relationship between variables can be measured by correlation coefficient (r), which is commonly called *Pearson product moment correlation*. Person's "r" mainly measures the data from the interval or ratio level and used to measure based on the deviation from the mean (Yabebal, 2017). Table 4.9 shows the measures of association and descriptive adjectives between the predictor variables.

Table 4.9 Measures of Associations and Descriptive Adjectives

Measure of Association	Descriptive Adjective
> 0.00 to 0.20 ; < -0.00 to – 0.20	Very weak or very low
> 0.20 to 0.40; < -0.20 to – 0.40	Weak or low
> 0.40 to 0.60; < -0.40 to – 0.60	Moderate
> 0.60 to 0.80; < -0.60 to – 0.80	Strong or high
> 0.80 to 1.0; < -0.80 to – 1.0	Very high or very strong

Source: (MacEachron, 1982)

Hence, the correlation output of the dependent and independent variables is interpreted based on table 4.10

Table 4.10 Correlation Matrix between the dependent and the Independent Variables

	Correlations										
S.№			1	2	3	4	5	6	7	8	9
1	Internal Supply Chain performance	Pearson Correlation	1								
		Sig. (2-tailed)									
		N	115								
2	Project Plan and Vision	Pearson Correlation	.402**	1							
		Sig. (2-tailed)	.000								
		N	115	115							
3	Top management Support	Pearson Correlation	.497**	.053	1						
		Sig. (2-tailed)	.001	.573							
		N	115	115	115						
4	Project Management	Pearson Correlation	.699**	.228*	.360**	1					
		Sig. (2-tailed)	.000	.014	.000						
		N	115	115	115	115					
5	Project Champion	Pearson Correlation	.507**	.269**	.502**	.520**	1				
		Sig. (2-tailed)	.000	.004	.000	.000					
		N	115	115	115	115	115				
6	User Training	Pearson Correlation	.799**	.379**	.122	.692**	.226*	1			
		Sig. (2-tailed)	.000	.000	.194	.000	.015				
		N	115	115	115	115	115	115			
7	Vendor Support	Pearson Correlation	.194*	.140	-.338**	.022	-.133	.209*	1		
		Sig. (2-tailed)	.038	.135	.000	.817	.155	.025			
		N	115	115	115	115	115	115	115		
8	Communication	Pearson Correlation	.342**	.200*	.380**	.176	.496**	.080	-.175	1	
		Sig. (2-tailed)	.000	.032	.000	.060	.000	.392	.061		
		N	115	115	115	115	115	115	115	115	
9	IT Infrastructure	Pearson Correlation	.696**	.176	.275**	.720**	.656**	.560**	-.012	.362**	1
		Sig. (2-tailed)	.000	.060	.003	.000	.000	.000	.899	.000	
		N	115	115	115	115	115	115	115	115	115
	**. Correlation is significant at the 0.01 level (2-tailed).										
	*. Correlation is significant at the 0.05 level (2-tailed).										

Source: SPSS output of the survey, 2017.

Based on the survey result, the correlation between Project plan & vision and internal Supply Chain Performance is positive and they are significantly correlated at (R = .402**), (P< 0.01). According to MacEachron (1982) magnitude of correlation, the relationship between the two variables is moderate. Similarly, the correlation between top management support and internal supply chain performance is positive and they are significantly correlated at (R =.497**), (P< 0.01). Accordingly, the relationship between the two variables is moderate.

From the survey result, the correlation between project management and internal supply chain performance is positive and they are significantly correlated at (R =.699**), (P< 0.01) which reveals a strong relationship between the two variables. Project champion is found to be moderately correlated with internal supply chain performance with with R value of .507**, (P< 0.01).

Strong and statistically significant positive correlation is found between user training and internal supply chain performance with (R =.799**), (P< 0.01) as it is revealed by SPSS output of the survey data.

Based on the survey result, the correlation between internal Supply Chain Performance and vendor support is positive and they are significantly correlated at (R = .194*), (P< 0.05), which is a very weak relationship. In the same way, weak and statistically significant positive correlation is found between communication and internal Supply chain performance with (R =.342**), (P< 0.01).

SPSS statistical output also confirmed that strong positive correlation is observed between IT infrastructure and internal supply chain performance with a statistically significant output. (R = .696**), (P< 0.01).

In general, the correlation of eight ERP implementation factors with internal supply chain performance is analyzed with the help of SPSS. Project management, user training and IT infrastructure are found to have positive and strong correlation with internal supply chain performance. Project plan & vision, top management support and project champion has moderate and positive correlation with internal supply chain performance. Communication has weak relationship with the dependent variable internal supply chain performance. Very weak and positive relationship is observed between vendor support and internal supply chain performance.

4.1.5. 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 multicolliniearty tests. Each test is explained below.

Assumption 1 - Normality Distribution Test

Multiple regressions require the independent variables to be normally distributed. Skewness and kurtosis are statistical tools which can enable to check if the data is normally distributed or not. According to Smith and Wells (2006), kurtosis is defined as "property of a distribution that describes the thickness of the tails. The thickness of the tail comes from the amount of scores falling at the extremes relative to the Gaussian/normal distribution". Skewness is a measure of symmetry. A distribution or data set is symmetric if it looks the same to the left and right of the center point.

The skewness and kurtosis test results of the data is within the acceptable range (-1.0 to +1.0) and it can be concluded that the data is normally distributed. The kurtosis and skewness results are shown in annex 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 the below scatter the visual inspections of the scatter plot shows there exists a linear relationship between the *ERP i*mplementation factors and Internal Supply chain performance. The scatter plot is shoen 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, multicollinearity is not an issue. See appendix B.

Summary: The three assumptions of multiple regressions are met and the next step was processing the regression analysis to determine the values of the model summary (R and R^2), the model fit (ANOVA) and the beta coefficients.

With the help of multiple linear regression analysis, model summary, ANOVA and Beta coefficient were determined and the regression model was developed. Accordingly, the relative effect of ERP implementation factors for internal supply chain performance was identified.

4.1.5.1. Model Summary

In the model summary below (table 4.11), the multiple correlation coefficients R, indicates a very strong correlation of .893 between internal supply chain performance and the eight independent variables. $\mathbf{R^2}$ = .798 reveals that the model accounts for 79.8% of the variation in the internal supply chain performance and is explained by the linear combination of all the independent variables of ERP implementation.

Table – 4.11 Model Summary

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.893[a]	.798	.782	.18578	1.662
a. Predictors: (Constant), IT Infrastructure, Vendor Support, Project Plan and Vision, Communication, Top management Support, User Training, Project Champion, Project Management					
b. Dependent Variable: Internal Supply Chain performance					

4.1.5.2. ANOVA Model Fit

The regression model overall fit can be examined with the help of ANOVA. Accordingly, table 4.12 of this study shows that the value of R and R^2 found from the model summary is statistically

significant at (F=52.209), (P<0.001) and it can be said that there is a relationship between internal supply chain performance and the predictors (ERP implementation factors).

Table 4.12 ANOVA Model Fit

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.416	8	1.802	52.209	.000[b]
	Residual	3.659	106	.035		
	Total	18.074	114			
a. Dependent Variable: Internal Supply Chain performance						
b. Predictors: (Constant), IT Infrastructure, Vendor Support, Project Plan and Vision, Communication, Top management Support, User Training, Project Champion, Project Management						

Source: SPSS output of the survey, 2017.

4.1.5.3. Beta Coefficient

- **Standardized Beta Coefficient**

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 4.13 below, the standardized coefficient of user training is the largest *value followed by IT infrastructure. Communication, vendor support, project champion, top management support, project plan & vision, project management assumes ranks from three to eight respectively.* The larger the standardized coefficient, the higher is the relative effect of the factors to the internal supply chain performances.

The significance tests of the 8 explanatory variables indicate that 6 of the explanatory variables are significant with p-value (P<0.05) for predicting internal supply chain performance. The rest 2 factors have a p-value >0 .05 (P > ∂), and these factors are not statistically significant to predict internal supply chain performance.

Table 4.13 Beta Coefficient

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.387	.202		1.914	.058
	Project Plan and Vision	.041	.036	.059	1.151	.252
	Top management Support	.058	.035	.093	1.647	.013
	Project Management	.017	.054	.024	.307	.039
	Project Champion	.070	.039	.130	1.775	.079
	User Training	.394	.049	.574	8.005	.000
	Vendor Support	.085	.030	.140	2.884	.005
	Communication	.108	.042	.136	2.549	.012
	IT Infrastructure	.117	.049	.189	2.387	.019

a. Dependent Variable: Internal Supply Chain performance

Source: SPSS output of the survey, 2017.

- **Unstandardized Beta Coefficient ($\boldsymbol{\beta}$)**

As it is defined in chapter three, the unstandardized coefficients ($\boldsymbol{\beta}_{1 \text{ up to } 8}$) are the coefficients of the estimated regression model. Hence, by including the error term (ε), the model for internal supply chain performance can be written as;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots + \beta_8 X_8 + \varepsilon$$

$$Y = .387 + .041X_1 + .058X_2 + 0.017X_3 + .070X_4 + .394X_5 + .085X_6 + .108X_7 + .117X_8 + .18578$$

The intercept ($\boldsymbol{\beta}_0$) is the point on the vertical axis where the regression line crosses the Y axis. The value of $\boldsymbol{\beta}_0$ is 0.387 which means the expected value of internal supply chain performance is 0.387 when all the eight variables assume zero value.

Among the eight factors, 6 of them are found to be statistically significant ERP implementation factors and significant predictors of the dependent variable which is internal supply chain performance. These are top management support, project management, user training, IT infrastructure, vendor support and communication. The beta coefficients of these factors indicate that an increase in the implementation factors will result in the increase in the performance of internal supply chain performance.

Project plan & vision and project champion are not statistically significant predictors of internal supply chain performance.

4.2. Discussion of the Study

4.2.1. Project Plan and Vision

In this study, based on the mean comparison of the eight ERP implementation factors, project plan & vision is ranked seventh with mean value of 3.2196. 58.3 % of the respondents rated it as disagree and neutral as a factor of ERP implementation. This factor is positively & significantly correlated with internal supply chain performance with R=.402 (P<0.01). But, it is not statistically significant predictor of internal supply chain performance since its beta coefficient is .041 at significance level of .252. Wee (2000), stated that project plan and vision that outlines proposed strategic and tangible benefits, resources, costs, risks and timeline is critical to clearly define where the resources are going to be allocated and what are the reasonable returns from it. The result from the interview justifies this gap between the findings of the case company and previous empirical studies. It confirmed that even though the desired benefits were known prior to the implementation, the possible risks associated with the system and the possible mechanism of mitigation was not clearly identified.

Other studies have outlined project plan and vision as one of the important factors for ERP implementation (Francoise, 2009; Bloemen et al., 2009; Sanchez, 2007).

4.2.2. Top management Support

Based on the mean comparison of the eight ERP implementation factors, top management support is ranked fifth with mean value of 3.3696. 54 % of the respondents rated this factor as agree and strongly agree in the five point Likert scale measurement. It is also positively & significantly correlated with internal supply chain performance with R=.297 (P<0.01) and it is statistically significant predictor of internal supply chain performance with beta coefficient of .058 at significance level of .013.

Koontz (1980) asserted that top managers should be kept updated about the project progress so that they can maintain, control and correct the implementation process.

The interview result also confirmed that there was an independent steering committee established for this purpose and there was tight and close project progress follow up during the implementation of the project.

Other studies have also identified top management support as one of the important factors for ERP implementation. (Bloemen et al., 2009; Dezdar, 2012; Swaminathan, 2011; Sanchez, 2007; Li Fang, 2005; Plant & Willcocks, 2007).

4.2.3. Project Management

Project management ranked second from the eight factors for ERP implementation as it is revealed from the analysis of the data and its mean value is 3.5304. More than 60 % of the respondents rated it as agree and strongly agree in the five point Likert scale measurement. 65 % of the respondents believe that project managers had good technical knowledge and business process know how. The same percentage of respondents claimed that project managers have set good strategies for ERP implementation by involving external consultants and forming good implementation team. Project management is positively & significantly correlated with internal supply chain performance with R=.699 (P<0.01) and it is statistically significant predictor of internal supply chain performance with beta coefficient of .017 at significance level of .039. This finding from the survey is also confirmed by interview result that the assigned mangers have good technical knowhow with better business process knowledge and previous project experience.

According to Al_Mashari (2003), qualified management that is able to manage, steer and control is essential for the successful implementation of ERP project. Other studies have outlined project plan and vision as one of the important factors for ERP implementation. (Francoise, 2009; Bloemen et al., 2009; Dezdar, 2012; Sanchez, 2007; Plant & Willcocks, 2007).

4.2.4. Project Champion

Project champion is the sixth ranked ERP implementation factor according to the data analysis result from the current study and its mean value is 3.2783. 40 % of the respondents believe that there was involvement of the high level executive during the implementation while the rest 60% of the respondents believe that the involvement of higher executive was minimal. Project champion is positively & significantly correlated with internal supply chain performance with R=.507 (P<0.01). But, it is not statistically significant predictor of internal supply chain performance since its beta coefficient is .070 at significance level of .079. Nah (2001), identified that the existence of high level executive sponsor with power to set goals and control changes and continually strive to resolve conflicts is essential. The result from the interview seems possible justification for the variation of the finding with other empirical studies. According to

the finding from the interview, there was one executive level manager who directly involve and follow the progress of the project and motivates the project team. Still, the involvement was not adequate since the executive officer was tied up with other projects of the company. Project champion is mentioned as one of the important factors for ERP implementation by other studies (Francoise, 2009; Sanchez, 2007; Plant & Willcocks, 2007).

4.2.5. User Training

More than 60 % of the respondents believe that training was given so that users can work and be effective using the system. 40 % of the respondents have hesitation on the qualification of the trainers. User training is found to be positively & significantly correlated with internal supply chain performance with R=.799 (P<0.01) and it is one of the strong predictors of the dependent variable which is internal supply chain performance with beta coefficient of .394 at significance level .000.

According to the result found from interview, the training provided was of two types. The first one was the training provided to the project team and super users. This training was prepared and provided by the vendor/integrators and it was well organized and detail. This training is basically given for the trainees so that the can provide training to end-users and provide system support. The second type of training is the training provided by super users to end-users. For this training, even though, there was well organized training material, the allocated time (5 to 8 days) was not enough to thoroughly understand the system. In addition to the formal training provided at lab rooms, on the job training & support was provided to end-users so that they can work with the system.

One of the problems raised by the interviewees is that after the implementation project is completed, there was no any formal and organized platform to train new employees who join departments that intensively use ERP system for their operation.

User training is identified by previous studies as one of the important factors for ERP implementation (Sanchez, 2007; Plant & Willcocks, 2007; Francoise, 2009; Bloemen et al., 2009; Swaminathan, 2011; Dezdar, 2012).

4.2.6. IT infrastructure

IT infrastructure is the fourth ranked ERP implementation factor according to the data analysis result from the current study and its mean value is 3.45. IT infrastructure is explained by the availability of IT equipment to use ERP system such as computer, server, IT personnel, and system support and so on. 53 % of the respondents believe that ethio telecom has good IT infrastructure to support ERP system. . IT infrastructure is positively & significantly correlated with internal supply chain performance with R=.696 (P<0.01) and it is one of the strong predictors of the dependent variable which is internal supply chain performance with beta coefficient of .117 at significance level .019. This finding is with in line with the findings of previous studies. IT systems are more likely to succeed in organizations where general IT skills and relevant in-house IT expertise exist (Igbaria, 1990).

The quality of IT staff (i.e., knowledge of technological changes and up-to-date skills) is cited among the important factors required for IT systems success in general and for ERP implementation success in particular (Essex et al., 1998).

According to the result from the interview, at the initial stage of the implementation, there was limited number of computers to effectively use the system. Even those computers have low capacity to support all of the features of the system. The server had also limited capacity and system privilege was possible for only few staffs. However, both computer and server problems were fixed by the company and currently all concerned staffs have got the privilege and are using the system effectively.

4.2.7. Vendor Support

Two different vendors were involved during the implementation of the project. The first vendor is Oracle that provided the software of the system. Its activities are related to ERP software elements. The second vendor is the integrator called Softpro. Its functions are integration of ERP system with the company's business process, provision of training to ERP users of ethio telecom especially to ERP project team.

More than 55% of the respondents believe that vendors provided the expected level of support for ERP implementation. Vendor support is positively correlated with internal supply chain performance with R=.194 (P<0.05). Previous studies have similar argument regarding vendor support. Vendor should participate in the implementation plan architecting; provide well designed training programs for the organization staff and dedicate specialized consultants with good experience in the system as well as business process to assist the organization throughout implementation phases (Holland et al., 1999). Other studies have outlined vendor support as one of the important factors for ERP implementation (Plant & Willcocks, 2007; Dezdar, 2012).

The result from the interview also confirmed that the role of the vendors was important in aligning the company's business process with the system's requirement. Some of the business processes were customized in to the requirements of the system and some of the features of the system were customized so that existing processes can be maintained. The role of the vendor was indispensable in this regard. In addition, well organized training was provided to the project team by the vendor specifically by the integrator. The support from the vendor was continued even after the implementation based on support and maintenance agreement.

4.2.8. Communication

Only 35% of the respondents believe that there was effective communication during ERP implementation. Communication is positively correlated with internal supply chain performance with R=.352 (P<0.01).

The result from the interview confirmed that formal communication and awareness was started after the system is deployed and during the provision of training. There was no any formal communication to employees of the company about ERP system and its impact on organizational performance prior to the implementation. According to Sumner (1999), Communicating ERP project with employees is essential to build awareness about the importance of the system to the organization.

Similar studies have also identified effective communication as one of the important factors for ERP implementation (Sanchez, 2007; Plant & Willcocks, 2007; Francoise, 2009; Bloemen et al., 2009; Swaminathan, 2011; Dezdar, 2012).

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Under this chapter, summery of the findings, conclusions and recommendations are provided.

5.1. Summary of the Findings

The total sample size was 140 and 150 questionnaires were distributed to the respondents out of which, 115 questionnaire were returned with a response rate of 82.1%.

The sum of the independent variables average Cronbach's alpha value is ($\alpha = 0.773$) and the reliability test of the study is located on "*Acceptable*" range.

Out of 115 respondents, 60.9 % (70) of the respondents were male and the remaining 39.1% (45) were Female.

97.4% of the respondents have educational level of first and second degree. 78.3 % of the respondents have company experience of more than six years while 21.7% of them have less than six years of company experience. 53 % of the respondents have ERP experience of more than four years while 2.6% (3 respondents) have ERP experience of below one year.

The first research question of the study was to identify ERP implementation factors. The correlation analysis revealed that all of the eight factors have significant correlation with internal supply chain performance. However, the output from regression analysis indicated that only six factors are the relevant implementation ERP implementation factors. These are project management, user training, IT infrastructure, top management support, communication and vendor support.

The second research question of the study was to identify factors having significant effect on internal supply chain performance. Accordingly, from the regression analysis, it can be concluded that user training and IT infrastructure accounts the largest share for the change in performance of internal supply chain performance.

The third research question was to examine the effect of the implementation on internal supply chain performance and it is answered by the regression model summery, $R^2 = .798$ which revealed that the model accounts for 79.8% of the variation in the internal supply chain performance is explained by the linear combination of all the independent variables of ERP implementation.

The ANOVA test result showed that R and R^2 found from the model summary was statistically significant at ($F=52.209$), $P<0.001$)

5.2. Conclusions

The main purpose of this study is to analyze the effect of ERP implementation on the internal supply chain performance of ethio telecom with respect to ERP implementation factors. Based on the findings presented in the previous section, the following conclusions are drawn.

- Eight ERP implementation factors are identified from the correlation analysis. These are Project Plan & vision, top management support, project management, project champion, user training, IT infrastructure, top management support, vendor support and communication.
- User training and IT infrastructure are the most powerful factors for ERP implementation.
- ERP implementation has positive and significant effect on internal supply chain performance.
- Despite literature has outlined project plan and vision as one of the important factors for ERP implementation, the study indicated that it is not important predictor of internal supply chain performance which shows that most of the constructs of project plan & vision are not properly addressed in ethio telecom.
- The support from top management is one of the basic factors for ERP software adaptors to succeed in implementation of ERP and to bring the desired change in performance. Based on the findings of the study, top management support has significant effect on internal supply chain performance and it can be concluded that the constructs considered for this variable are well managed in ethio telecom during the implementation of the system.
- Project management is identified as an important ERP implementation factor having significant effect on internal supply chain performance. Effective project management is needed in terms of forming good implementation team, setting realistic project schedule, assigning the right project manage and setting good project implementation strategies.
- Most special projects need a project champion or high level executive to closely follow and promote projects so that the likelihood of project success can be increased. The finding from this study didn't identify project champion as significant

predictor of internal supply chain performance. There was no dedicated high level executive during the implementation of the project. It was the project manager who assumed the responsibility by communicating with the steering committee established for this purpose.

- User training is the most important factor without which implementation success is almost impossible and it is identified as the most powerful predictor of internal supply chain performance. Qualified trainers well prepared training manual and intensive user training are essential to succeed in ERP system implementation.
- IT infrastructure in terms of intranet connection, computer availability and instant system admin support has indispensable role to be successful in ERP implementation. The finding from this study has proved this constructs of IT infrastructure are vital and has effect on internal supply chain performance.
- Vendor support is another important factor identified having effect on internal supply chain performance. The vendor/integrator has provided well designed training, especially to the project team and was ready to provide quick support when problems occurred during and after implementation.
- Effective communication with employees is important to build awareness about the system and its effect on performance. Awareness was created to employees about the objectives of implementing the system and its impact on performance during training, before they start to use the system.

5.3. Recommendations

- The ERP experience of the respondents shows that 21.7 % of them have ERP experience below one year. The interview result revealed that, this is due to the movement of the experienced employees to other work units of the company. Therefore, there should be a mechanism to retain senior users of the system.
- Project plan & vision is found to be statistically insignificant ERP implementation factor in the case company. This finding was in line with the interview result that, the expected benefits and organizational impact was not clearly put and communicated to employees. However, literature tells us that project plan and vision is one of the most important ERP implementation factor by linking the ERP project to organizational strategy, and determine the goals to be met and its feasibility. Therefore, this factor should be considered in further phase ERP implementation processes.
- The regression analysis revealed that internal supply chain performance is impacted more by user training. Therefore, special emphasis should be given to training in order to improve the capacity of users. From ERP year of user experience, most of the respondents who have experience below 1 year rated user training at disagree category of the Likert scale. The interview result has justified the reason for this finding that after the system is fully deployed, providing formal training has been given less emphasis and recent users are working with the system by the knowledge they got from their coworkers who have previously got the training. Therefore, there should be a formal process to provide formal training of new employees. Another important finding from interview result was the fact that the time allocated to train end users was very short (5 to 8 days) to enable users exploit all of the features of the system. As a result of this, there is a tendency to go back to the manual system by some users. So, it is better to conduct competency assessment of the ERP system users and arrange training for those users where the gap is observed. Attention should also be given to the timing of the training. As per the findings of the result form interview, some employees totally forget what is given in the training due to two reasons. First, the go live of the module may not be immediately after the training. Second, the user may not get computer to use the system. Therefore, the date of training end users and the date of system go live should be

carefully planned. In addition, it is recommended to make sure that the trainee will immediately start to use the system.

- The second important predictor identified after the regression analysis is IT infrastructure. The result of the regression analysis indicated that working on this factor will enable to increase internal supply chain performance by greater magnitude than the other 6 factors except user training. So, it is recommended to give special emphasis to this factor. The findings of the study indicated that it is not possible to get instant support from system administrators when problem occurs related to the system. As per the findings of the interview result, sometimes it may take half a day to fix system problems which forces them to stop work. This has significant impact on supply chain performance. Therefore, the skills of system support providers should be upgraded via training.

5.4. Limitation and implication for further Research

This study was conducted based on eight ERP implementation factors and accounted for 79.8% of the variation of the dependent variable. Other researchers may consider other factors and study the reason for the remaining variation (20.2%). In addition, this study is conducted in only one case company. Research can be done by considering more than one case company to compare the power of the independent variables.

Internal supply chain performance is considered under this study. Other researchers may conduct the study in a fully pledged supply chain companies which have in-bound, internal and out-bound supply chain operations.

Under this study, only supply chain ERP modules were considered. Other researchers may include other modules of finance, human resource together with supply chain modules and can study the effect on organizational performance.

Unavailability of similar study in Ethiopian context was one of the challenges of the study. Due to this, the researcher relied on studies conducted in other countries and interview results to present the discussion of the study.

Finally, the time gap between the implementation of ERP project and the time the data is collected was assumed as a challenge for respondents to remember and provide the right information. However, the researcher has made effort to minimize the bias by comparing the results with the interview results obtained from ERP project manager, ERP project members and super-users.

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APPENDICES

Appendix A: Questionnaire

ADDIS ABABA UNIVERSTY

SCHOLL OF COMMERCE

DEPARTMNET OF LOGISTICS & SUPPLY CHAIN MANAGEMENT

Dear Respondents

The following questionnaire is developed by student Adane Ayalew from Addis Ababa university school of commerce to study the effect of ERP Implementation on internal supply chain performance of ethio telecom in fulfilling the requirement of Masters of Logistics and supply chain management. I kindly request your co-operation in responding the following questions for the successful completion of the study. 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.

Do not hesitate to contact me for any information with 0911510366 or adaneayalew@gmail.com.

PART I: **Demographic Information**

1. Gender: **M** ☐ **F** ☐
2. Educational level?

   Diploma ☐ Degree ☐ Masters ☐ PhD ☐

   If other specify_____
3. Position in the organization?

   Professional ☐ Specialist ☐ Supervisor ☐ Manager ☐ Officer ☐
4. Year of experience in ethio telecom?

   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 Questions

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

№	Effect of ERP Implementation	Scale				
1	ERP supply chain modules are successfully implemented in ethio telecom	1	2	3	4	5
2	Implementation of ERP has improved the internal supply chain planning performance of ethio telecom.	1	2	3	4	5
3	Implementation of ERP has improved the sourcing performance of ethio telecom.	1	2	3	4	5
4	Implementation of ERP has improved the delivery performance of ethio telecom.	1	2	3	4	5

Part III: ERP 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

№	ERP implementation factors	Scale				
1	**Project plan & vision**					
1.1	The Company has a clear vision about the ERP project and how it will impact its performance	1	2	3	4	5
1.2	The company has determined the budget it's willing to allocate for ERP project.	1	2	3	4	5
1.3	The company has addressed the possible risks associated with ERP project	1	2	3	4	5
1.4	The company has identified the desired and expected benefits from ERP business.	1	2	3	4	5
2	**Top management support**					
2.1	Top management has allocated all the required resources for ERP implementation	1	2	3	4	5

2.2	Top management has delegated implementation authority for project managers	1	2	3	4	5
2.3	Top management was regularly updated with the implementation process progress	1	2	3	4	5
2.4	Top management interferes and corrects the implementation process when needed	1	2	3	4	5
3	**Project Management**					
3.1	Project managers had good technical experience	1	2	3	4	5
3.2	Project managers had a good knowledge in business processes	1	2	3	4	5
3.3	Project managers communicated the project strategies with employees in a friendly way	1	2	3	4	5
3.4	Project managers have set good strategies for ERP implementation	1	2	3	4	5
4	**Project Champion**					
4.1	ERP project was led by a high level executive	1	2	3	4	5
4.2	Project manager promoted the project to top management and get their support	1	2	3	4	5
4.3	Project manager was capable to motivate employees and enhance them to change	1	2	3	4	5
4.4	Project leader strives to solve problems faced during implementation	1	2	3	4	5
5	**User Training**					
5.1	The company has provided all resources required for training	1	2	3	4	5
5.2	Internal staff has been intensively trained on the system	1	2	3	4	5
5.3	The training program was handled by highly qualified consultants and trainers	1	2	3	4	5
5.4	The training programs where properly and well designed for end-users.	1	2	3	4	5
6	**IT infrastructure**					
6.1	The company has availed computer for all users of ERP	1	2	3	4	5
6.2	There is reliable intranet connection to use ERP system	1	2	3	4	5
6.3	System interruptions are fixed instantly without affecting performance	1	2	3	4	5
6.4	It is possible to get instant support from system administrators when problem occurs in using ERP system	1	2	3	4	5
7	**Vendor Support**					
7.1	Vendor consultants have offered well designed and intensive training programs for end users.	1	2	3	4	5
7.2	Vendor was ready to solve and troubleshooting any technical or procedural problem during the implementation.	1	2	3	4	5
7.3	Vendor has a quick response to company needs.	1	2	3	4	5

7.4	Vendor's support has continued even after implementing the system in terms of maintenance and upgrading the system	1	2	3	4	5
8	**Communication**					
8.1	Employees were aware about the resources the company has been allocated in ERP system	1	2	3	4	5
8.2	Employees have been educated about the system benefits in business	1	2	3	4	5
8.3	Employees were aware about the importance of the system for the company.	1	2	3	4	5
8.4	The company has communicated the systems objectives with the employees and its impact on their jobs.	1	2	3	4	5

PART IV: SCOR process 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 implementation on planning process

№	Metrics or Key performance indicators	Definition	Scale				
1	Demand forecast accuracy	Implementation of ERP has improved the accuracy of demand forecasting in the company	1	2	3	4	5
2	Adherence to plans	Implementation of ERP has improved adherence to demand plans by user divisions	1	2	3	4	5
3	Planning cycle time	Implementation of ERP has reduced the time needed to collect, aggregate and prioritize demand.	1	2	3	4	5
4	Inventory planning	Implementation of ERP has enabled to track inventory levels and contributed for purchase planning.	1	2	3	4	5

4.2.Effect of ERP implementation on sourcing process

№	Metrics or Key performance indicators	Definition	Scale				
1	Quantity and Timely Delivery	Implementation of ERP enabled to deliver quantity ordered on time.	1	2	3	4	5
2	Procurement Cost	Procurement cost is reduced due to ERP implementation	1	2	3	4	5
3	Material Inventory Level	Implementation of ERP enabled to have optimal inventory level	1	2	3	4	5
4	Defect rate	Implementation of ERP enabled to minimize the rates of defect items from suppliers	1	2	3	4	5

4.3.Effect of ERP implementation on delivery process

№	Metrics or Key performance indicators	Definition	Scale				
1	On Time Shipment	Implementation of ERP enabled to ship materials to the user on time.	1	2	3	4	5
2	Order Fulfillment	Implementation of ERP enabled to meet orders from different user departments on time & without error.	1	2	3	4	5
3	Number of delivery faults	Implementation of ERP enabled to minimize material delivery faults.	1	2	3	4	5
4	Transit time	Implementation of ERP optimized the time taken to transport materials to their destination	1	2	3	4	5
5	Effectiveness of delivery invoicing method	Implementation of ERP enabled the invoicing method to be effective and clear to understand	1	2	3	4	5
6	Total distribution cost	Implementation of ERP reduced material distribution cost	1	2	3	4	5

Thank You!

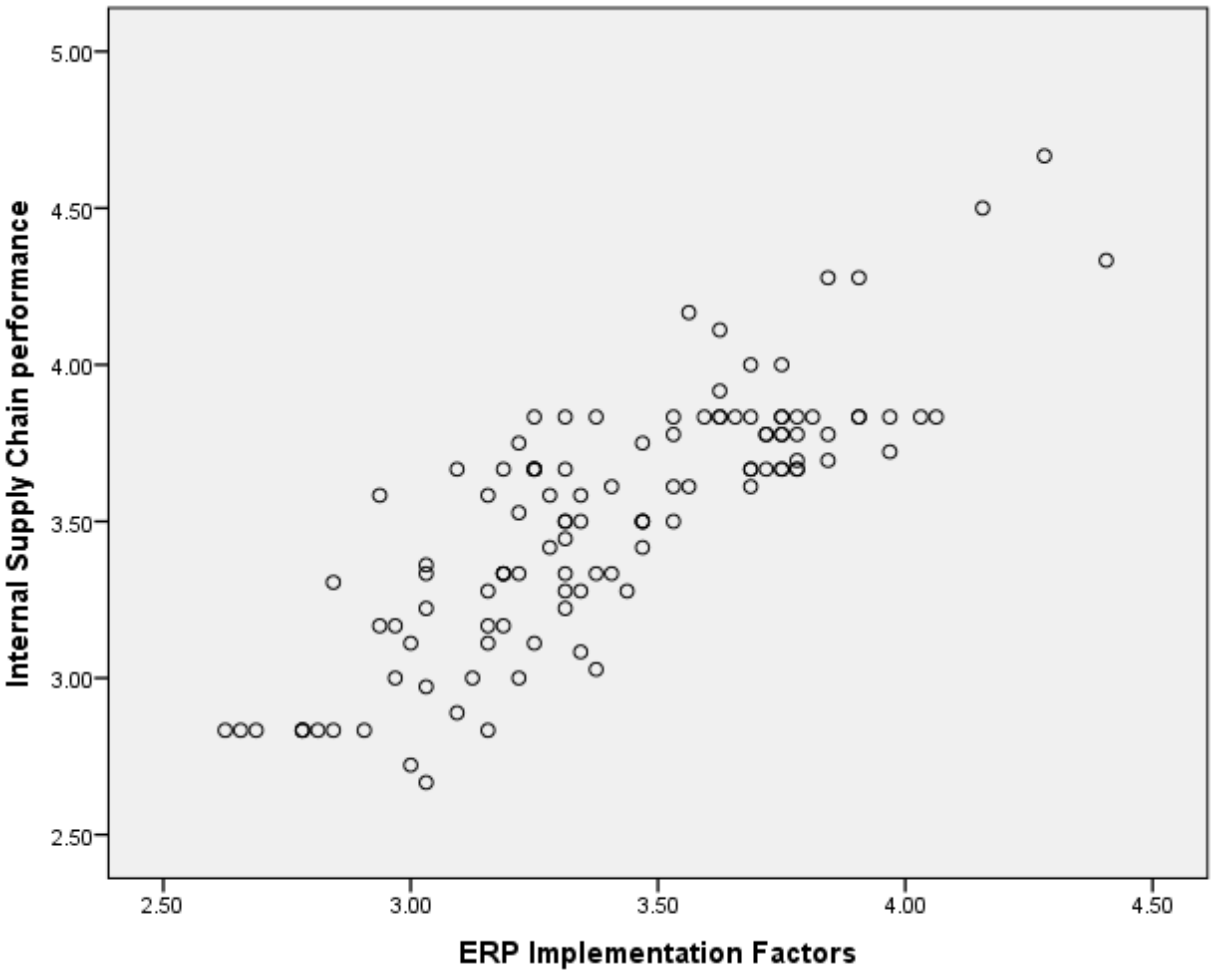
Appendix B: Regression Model assumption Tests

1. Normality Distribution Test

Descriptive Statistics					
	N	**Skewness**		**Kurtosis**	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
Internal Supply Chain performance	115	-.050	.226	-.028	.447
Project Plan and Vision	115	-.503	.226	-.482	.447
Top management Support	115	-.636	.226	-.714	.447
Project Management	115	.481	.226	-.349	.447
Project Champion	115	-.200	.226	-.593	.447
User Training	115	-.348	.226	-.978	.447
Vendor Support	115	-.464	.226	-.645	.447
Communication	115	-.618	.226	-.381	.447
IT Infrastructure	115	.125	.226	-.776	.447

Source: SPSS output of the survey, 2017.

2. Linearity of the Relationship Test



Source: SPSS output of the survey, 2017.

3. Multicollinearity Test

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	Project Plan and Vision	.732	1.366
	Top management Support	.592	1.688
	Project Management	.306	3.269
	Project Champion	.358	2.796
	User Training	.372	2.689
	Vendor Support	.809	1.236
	Communication	.672	1.489
	IT Infrastructure	.306	3.271

a. Dependent Variable: Internal Supply Chain performance

Source: SPSS output of the survey, 2017.