



**ASSESSMENT OF FACTORS AFFECTING THE PERFORMANCE OF  
INTEGRATED LOGISTICS SYSTEM OF ARMAUER HANSEN RESEARCH  
INSTITUTE (AHRI)**

**By**

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A THESIS SUBMITTED TO THE ADDIS ABABA UNIVERSITY SCHOOL OF  
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## DECLARATION

I the under signee, hereby declare that the work which is presented in this thesis entitled “ASSESSMENT of FACTORS AFFECTING THE PERFORMANCE OF INTEGRATED LOGISTICS SYSTEM OF ARMAUER HANSEN RESEARCH INSTITUTE (AHRI)” is the original work of my own effort and done under the guidance of Shiferaw Mitiku (PhD), and that all the sources of materials used for the study have been duly acknowledged. I further confirm that the thesis has not been submitted either in part or in full to any other university for the purpose of earning any degree.

Declared by: Habtamu Mekonen    Signature ----- Date -----

## STATEMENT OF CERTIFICATION

Statement of Certification this is to certify that the thesis carried out by Habtamu Mekonnen on the topic entitled: “Assessment of Factors Affecting The Performance Of Integrated Logistics System of Armauer Hansen Research Institute” is his original work and is suitable for submission for the award of Masters of Art Degree in Logistics and Supply Chain Management.

Advisor: Shiferaw Mitiku (PhD) \_\_\_\_\_

Date & Signature \_\_\_\_\_


ADDIS ABABA UNIVERSITY COLLEGE OF BUSINESS AND ECONOMICS SCHOOL  
OF COMMERSE DEPARTMENT OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT

This is to certify that the thesis carried out by Habtamu Mekonnen, entitled: “Assessment of Factors Affecting The Performance Of Integrated Logistics System of Armauer Hansen Research Institute” and submitted in partial fulfillment of the requirements of the Degree of Master of Art in Logistics and Supply Chain Management complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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## ABSTRACT

*If supply chain management system to be successful, it must fulfill all the six rights of supply chain management which are right type of item, of the right quality, in the right quantity, at the right place, at the right time and with the right cost. The lengthy procurement process, specification problem, inadequate number of procurement staff, poor information technology infrastructure, lack of transportation and inventory management problems are internal bottlenecks and besides, custom, bank and pre import permit processes and suppliers incomplete import documentation are also another challenges that hinder the timely delivery of items. The objectives of the study is to assess the Integrated Logistics System practice of Armauer Hannson Research Institute, to identify internal and external factors affecting Integrated Logistics System performance and to measure the performance of Integrated Logistics System of Armauer Hannson Research Institute. This research is used explanatory research design and mixed approach. The sources of data were employees of Armauer Hannson Research Institute. The data were passed through validity and reliability test. The data is analyzed by using descriptive and statistics and further correlational tests were conducted to know the association of dependent and independent variables. Data analysis was done using SPSS version 25. The practices of Inventory management, information technology integration and transportation management in Armauer Hannson Research Institute were not in a position to support the Integrated Logistics System performance. Inventory management, information technology integration, transportation management, procurement management process, Custom procedure and Food, Medicine & Health Care Administration and Control Authority's pre-import permit approval were the factors which were significantly affecting the Integrated Logistics System performance of the organization. From the efficiency perspective, the performance of the integrated Logistics System of the organization is weak due to low practicability the integrated logistics system of the organization. Top management of the Armauer Hannson Research Institute should address the internal factors and take corrective measures to improve the ILS performance of the organization. Besides, the management also has to work on aligning its documentation with the country's custom procedure documentation requirements so as to enhance responsiveness and quality of ILS performance the Food, Medicine & Health Care Administration and Control Authority's pre-import permit approval must be improved.*

**Key Words: inventory management, transportation management, Information technology, integrated logistics system, transportation management**

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## **ACRONYMS AND ABBREVIATIONS**

<b>AHRI</b> -----	Armauer Hansen Research Institute
<b>ALERT</b> -----	Africa Leprosy Rehabilitation and Training hospital
<b>CLM</b> -----	Council of Logistics Management
<b>CSCMP</b> -----	Council of Supply Chain Management Professionals
<b>ERC</b> -----	Ethiopian Railways Corporation
<b>FMOH</b> -----	Federal Ministry of Health
<b>FMACA</b> -----	Food, Medicine & Health Care Administration and Control Authority
<b>HIV</b> .....	Human Immune Virus
<b>ICT</b> -----	Information Communication Technology
<b>IL</b> -----	Integrated Logistics
<b>ILS</b> -----	Integrated Logistic System
<b>ILSs</b> -----	Integrated Logistics Support
<b>LMIS</b> -----	Logistic Management Information System
<b>MOHSW</b> -----	Ministry of Health and Social Welfare
<b>PFSA</b> -----	Pharmaceutical Fund and Supply Agency
<b>RSDP</b> -----	Road Sector Development Program
<b>STI</b> .....	Sexual Transmitted Infection
<b>SIDA</b> .....	Sweden International Development Agency
<b>NORAD</b> .....	Norwegian Agency for development cooperation
<b>TB</b> .....	Tuberculosis

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## CHAPTER ONE

### INTRODUCTION

The study assessed the challenges affecting the performance of integrated logistics system at Aremauer Hanson Research Institute. This chapter described problem statements on the ground, which gives rise to the study objectives. In addition significance, scope of the study, definition of terms and organization of the study was described.

#### *1.1. Background of the study*

Logistics is seen as vital to success of businesses, and to a nation's prosperity and capacity to compete in globalized economy. Logistics is defined by council of logistics management as the process of planning, implementing and controlling the efficient, effective flow and storage of goods, services and related information from point of origin to point of consumption for the purpose of conforming to customer requirements. The integration of two or more logistics within a network to create value, enhance efficiency and satisfy customers is called integrated logistics management. Analyzing and assessing logistics and supply chain practices will help discern important issues such as emerging trends and areas of concern (Srivastava, 2006), which will help in taking remedial measures.

Cilliers and Nagel (1994) made assessment of status of logistics in South Africa using individual company's logistics excellence and how companies integrate into and the excellence of a supply chain they are part of. They used data gathered by questionnaire survey from key people in logistics industry. The elements of business logistics are treated well but many important factors such as infrastructure, availability of human resource in the market, customs, etc are not considered in the assessment. They considered external factors such as the effects of infrastructure, macroeconomic and human resource scarcity as challenges to integrated logistics development. Studies on health research institutes focused on a) partnership b) transport c) forecasting and demand management and d) use of ICT to facilitate supply chain integration and performance elements have countable task in the implementation of integrated logistics. If it is not integrated, it will be a challenge (Srivastava, 2006).

Integrated logistics hence, affects the procurement performance of a biomedical research in terms of several parameters like cost, time, information, transport, warehouse and inventory (Arvis,*et.al*; 2007).

As AHRI is the institution that has been reestablished as one organ of FMOH's biomedical research agency with the mandates of developing research agenda on biomedical technology and

medical biotechnology, it needs research inputs like chemicals, reagents, laboratory supplies and equipment. To avail such crucial inputs, the logistics system of AHRI needs internal integration with finance, inventory, transportation & procurement departments and besides, external integration with banks (commercial and national bank), insurance, custom and Food, Medicine & Health Care Administration and Control Authority of Ethiopia (FMHACA) is also very crucial.

And hence, this study assessed factors affecting the performance of the integration of the above elements in AHRI and forward some suggestions to solve the problem at hand.

### ***1.2. Statement of the problem***

The research activities of AHRI are dependent on the availability of reagents, chemicals and laboratory supplies with the required quality and quantity, at the right time.

The AHARI receives reagents, chemicals, Lab supplies and equipment from international and local suppliers and then store in warehouse and finally distribute to the departments (working units) for their research activities. This integration needs the skill of human resource, transportation, information system, and inventory and procurement managements.

I have interviewed some senior experts about the practice and performance of integrated logistics system of AHRI. Experts said that AHRI imports reagents, chemicals and laboratory supplies from abroad however, the lengthy procurement process, specification problem, inadequate number of procurement staff, poor information technology infrastructure, lack of transportation and inventory management problems are internal bottlenecks and besides, custom, bank and pre import permit processes and suppliers incomplete import documentation are also another challenges that hinder the timely receipt of items. Furthermore, experts informed me that integrated logistics system of AHRI has not been performing its activity as planned and its performance is low. The performance of the organization (AHRI) was 65% green, 12% yellow, and 23% red.

AHRI has 16 working groups; Knowledge management directorate, Mycobacterial disease research directorate, Bacterial and viral Diseases Research directorate, Malaria and Neglected Tropical Disease (NTD) Research directorate, Bioinformatics and Biotechnology Research directorate, the clinical trial directorate, Non-Communicable Disease directorate, HRM directorate, Finance and Procurement directorate, General Service directorate, Public Relation and communication directorate, Women and Youth Affairs directorate , Ethics and Anti-

Corruption directorate, Reform and good governance directorate, Research training directorate and Audit Directorate

The report identified procurement related problems (i.e. specification, repeated bid failures), shortage of human resource and quality of network were the challenges in ILS of AHRI (annual report of AHRI, 2018/19).

To be successful, the Integrated Logistics System (named here after as ILS) ought to fulfill the six rights of supply chain management<sup>1</sup>. Ciuriak and Preville, (2010).

Integrated logistics system (ILS) implementation requires the collaborative efforts of internal and external stockholders.

The major factors affecting the performance of integrated logistics system of AHRI was identified. Correspondingly, this research is aimed at the assessment of factors affecting the performance of ILS of AHRI.

### ***1.3. Research Question***

Congruent upon the stated objectives, the proposed study has tried to answer the following research Questions;

- ❖ How ILS is being practiced at Armauer Hansen Research Institute?
- ❖ What are the internal factors affecting the performance of integrated logistics system of Armauer Hansen Research Institute?
- ❖ What are the external factors affecting the performance of integrated logistics system of Armauer Hansen Research Institute?
- ❖ What is the performance of Integrated Logistics System at Armauer Hansen Research Institute?

### ***1.4. Objectives of the study***

The principal objective of this study is to assess the major factors affecting the performance of integrated logistics system of Armauer Hansen Research Institute (AHRI). In line with this general objective, the proposed study specifically attempts

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<sup>1</sup> The six rights of supply chain management<sup>t2</sup> are right quality, right price, right time, right place, right product and right quantity

- ❖ To assess the Integrated Logistics System practices of Armauer Hansen Research Institute.
- ❖ To identify the internal factors affecting the performance of Integrated Logistics System of Armauer Hansen Research Institute.
- ❖ To identify the external factors affecting the performance of Integrated Logistics System of Armauer Hansen Research Institute
- ❖ To measure the performance of Integrated Logistics System of Armauer Hansen Research Institute in terms of efficiency and effectiveness.

### ***1.5. Significance of the Study***

Although, the importance of integrated logistics system is vital for any organization, many studies did not undertake in the area. This is also true for AHRI. As adequate studies were not being conducted on the subject under study, this study is useful for academicians and concerned organizations to precede further studies on it. It is hoped that this study will contribute to fill the literature gap. The study provide information for AHRI to tackle challenges in implementations. The result of the study is helpful for FMHACA and other stakeholders to reconsider their service delivery performance. Yet it give a clue on the subject under investigation and can also be used as a bench mark for further study.

### ***1.6. Scope of the study***

This study focused on the factors affecting the performance of integrated logistics system of AHARI located in Addis Ababa, Ethiopia. Those variables (internal factors affecting the performance of ILS) will be evaluated from procurement, inventory, transportation, and information technology perspectives and (external factors) from custom, banks, suppliers' documentation and FMACA's pre import permit approval perspectives respectively.

### ***1.7. Limitation of the Study***

As the study is limited to only one organization, it is less likely to represent and reflect the actual circumstance in other similar organizations. Some perspectives and practices were not be included in this paper. Perspectives of integrated logistics such as economic, financial and legal are excluded. Practices such as security analysis and Warehouse areas were not included because they are very bulky to analyze and constraint of time also matters to comprise them in the study. Besides, none of the studies had been conducted in the integrated logistics system of AHRI to identify literature gaps.

Although, it was proposed to collect data from 105 employees and seven directors for interview, it became impossible to collect the required number of data from the proposed target population due to COVID-19. Most of the target population stay at home with inaccessibility of Internet even to collect the data electronically.

### ***1.8. Definition of Terms***

**Inventory Management:** It is the process of consistently having the optimal amount of raw materials for transformation and finished products available in order to deliver them rapidly to meet a customer's inventory requirement in a competitive manner (Bowersox, *et al.*, 2010).

**Logistics:** Logistics encompasses all the information and material flows throughout an organization, it is the process of strategically managing the parts and finished inventory (and related information flow) through the organization at cost effective fulfillment of orders (Christopher, 2010)

### ***1.9. Organization of the study***

Including the introductory Chapter, the study organized into five chapters. In chapter two, Review of the Related Literature both theoretical and empirical was discussed. Data sources and methodological issues was treated in chapter three of the study. This include research design and approach, data collection instruments, methods of data analysis, research approaches, and ethical considerations. Chapter four presented results and discuss the findings of the study. Chapter five described the Summary, Conclusion and Recommendation.

## CHAPTER TWO

### 2. Related Literature Review

#### *Introduction*

This chapter gives a clue for about the content of the title. Literature review is a description of the related literature of integrated logistics system practice, performance and challenges of implementation. It gives an overview of what has been said and who are the key writers. The first part has helped in framing the study in terms of the already existing theories. Whereas, the second part summarizes findings of related studies conducted having consistent and contradictory findings. Finally, identified literature gaps were described.

#### **2.1. Theoretical Literature Review**

AHRI was established as a biomedical research institute located next to Africa Leprosy Rehabilitation and Training Hospital (ALERT). The Institute joined the Ethiopian Ministry of Health in 2004.

AHRI receives core support for its research activities from SIDA and NORAD. Postgraduate (MSc and some PhD) students' research is funded from the core budget of the Institute. Most of other research is funded by competitive grants. AHRI's research activities cover basic (immunology and molecular biology), epidemiological and translational research. AHRI has published more than 380 papers in peer reviewed journals so far. It has also produced several thesis and dissertations from Ethiopian and international scholars in biomedical research. The Institute has a network of national and international collaborators in peer reviewed grant projects, clinical trial partnerships, capacity building activities and in training of MSc and PhD students. There are 165 female and 173 male employees (HR document, 2019).

##### **2.1.1. Integrated logistics concept**

In real world, every market has diverse customer needs and market characteristics, but currently the import needs flexibility and the real time response to the changes in the market and a closer position to the quality preferences (Uckelmann, 2008).

The word logistics was found first in military. In 1898, logistics was discussed as, "Strategy is art of control of troops and tactics in war". Again at the third process the French discussed, logistics is moving and quartering troops in war..." (Lummus, Krumwiede, & Vokurka, 2001).

Logistics integrates all activities of internal and external company activities is integrated by logistics into one activity or process, brings the service of customer at minimum cost.

Management of Integrated logistics includes (forecasting, planning, organizing, operational management, control) flows of information and financial to life cycle of product, from product development to delivery, production and distribution to final consumers to maximize customer satisfaction and to minimize cost. The vital effect is to raise productivity. Implementing integrated logistic may take several years because it is difficult. At the making stage, Logistics is integrated and needs a support. This support needs administrator who manage the elements of logistics and this support has an acronym ILSs (Integrated Logistics Support) (John Snow, Inc., 2017).

Currently, logistics is the handling the management and controlling of flows of goods, energy, information and other resources as facilities, services and people. The integration of information, transportation, and inventory, warehousing, cost and time were included in Integrated Logistics (IL). The word IL is appeared from the textile industry and grocery industry. This IL is defined in terms of integrating inbound logistics with unbound logistics to link corresponding departments and stakeholders in the chain (Gen, Cheng, & Lin, 2008).

In many literature, Integrated logistics is defined as "the process of prediction of customer needs", where the interests of company leads to raising capital, high-quality raw materials, plenty of experienced people, using of latest technologies and precise information are necessary to fulfill the needs and wishes, requirements of customers. The management of integrated logistics chain is called the integrated logistics management. IL in a health facility is a network of interconnected concerned organizations, supplier, customers, manufacturers and transporters that ensures the availability of health commodities to the people who need them (John Snow, Inc., 2017).

### **2.1.2. Integrated logistics system practice**

First the item should be ordered and then received. After received, the item has to be stored properly until distributed. A country's inventory control strategy specifies how much stock to store and where to store it. Adequate stock should be available until a new order is received to meet customer needs; but stocks expire or are wasted or that you exceed storage capacity must be avoided. Storage has two purposes for products: (1) to ensure the quality or condition, and (2) to make them available for distribution (Desalegn, 2015).

The recording and reporting of ILS practice is enhanced by LMIS. It helps supply chain employees and managers in collecting, organizing, present and use of logistics data across all levels of the system by physical and technological recording system. The right combination of people, processes, and technology is the determinant of effective LMIS. Recording, analyzing,

managing, and use of supply chain data at every level must be handled by skilled and professional people. Use of different health information technologies, designed to digitize key supply chain business processes to improve quality of care and efficiency, is expanding in developing and developed countries. Specifically; Dispensing or point-of-service (POS) systems, electronic LMIS (eLMIS) solutions, Warehouse management systems (WMS), Fleet management systems, Distribution planning systems, Enterprise resource planning (ERP) Barcode technology, and remote temperature monitoring devices are mostly implemented (John Snow, Inc., 2017).

According to the Council of Supply Chain Management Professionals (CSCMP), IL includes the planning and management of all activities involved in sourcing and procurement, and all logistics management activities and coordination of channel partners (supplier, transporter, custom facilitators, forwarders, agents, customers and third party logistics providers). So, In essence, IL integrates supply and demand management within and across companies (CSCMP, 2016).

The arrangement of the members of the supply chain and their relations are determined by network structure. The closeness of the relationship of members of the supply chain in the network structure differs at different points of the supply chain based on the level appropriateness for particular supply chain links (Lambert *et al.*, 1996). The network structure dimensions include the length of the supply chain and the number of suppliers and customers at each level, where the supply chain looks less like a pipeline or chain than an uprooted tree of an extensive network of customers and suppliers (Lambert *et al.*, 1998). Lambert and Cooper (2000), to construct the supply chain network structure, they recommend three primary aspects of a company's network structure: these are the members of the supply chain, the structural dimensions of the network and the different types of process links across the supply chain. Distinguishing primary and supporting members is essential for managing more complex networks. Primary members are "all those autonomous companies and strategic business units who carry out value-adding activities (operational and/or managerial) in the business processes designed to produce a specific output for a particular customer or market." On the other hand, supporting members are "companies that simply provide resources, knowledge utilities, or assets for the primary members of the logistics chain" (Porter, 1984; Davenport, 1993; Lambert and Cooper, 2000). According to Lambert and Cooper (2000), network structure is supposed to answer the question: Who are the key supply chain members with whom to link processes?

Transportation is the process of moving products from the source of supply or manufacturing companies to the place of consumption or destination. It is the art of getting the right type and amounts of commodities to the right places at the right time to the right facility. It involves transportation, delivery, and receiving of commodities, proper storage, and inventory control for receipt and disbursement and information systems (Mulken,L. 2015).

ILS typically includes a number of activities such as selection of suppliers, forecasting demand, transportation of items, warehouse management, procurement and inventory management (John Snow /DELIVER, 2004).

AHRI's procurement department is responsible for the procurement of reagents, chemicals, laboratory supplies and equipment from international and domestic suppliers. To maintain adequate stock levels, the maximum months of stock, minimum months of stock and an emergency order point have been established for dispensing unit in the system. Besides, it is an effective way to measure and supervise the efficiency of purchasing processes so that it minimizes the total cost of purchasing. With economic globalization, the competition among companies is becoming more and more fierce, which requires all the business to enhance the level of T, Q, C, S (Time of research and development, Quality of products; Cost control; satisfaction with Service), so that they can operate their business successfully in the market. In contrast to domestic purchasing, the international purchasing mode has the following characteristics (Fan, 2007): the system requires the basic logistics data about the reliability of suppliers, legal issue of the country, culture, custom law and other relevant issues that accompanied by data source to make comprehensive logistics decisions. The Standard operating manual is intended to simplify and standardize the work required for the logistics management of items used in AHRI. The manual guides the staff in the completion of the following tasks: ordering, receiving and storing.

### **2.1.3. Integrated logistics system challenges**

The interaction of a number of critical factors to ensure smooth design and implementation affects the success of an integrated logistics system (ILS). The critical factors comprises; contextual factors, technical factors, organizational factors, customization and adaptation, and implementation related factors. The contextual factors are mostly about political will and stewardship. Technical factors are about procurement, information system and system interoperability. Organizational factors include organizational variables needed to maintain and sustain the system. These include; availability of skilled personal, participation of key

stakeholders, finance, local ownership through user involvement, and staff motivation/competence (Chindove and Medge, 2012).

Evaluation of suppliers is very essential to source the required quality of products with in the required lead time. The reliability of suppliers can be evaluated through the financial capacity via legal documents, by physical visit, and visiting their website. However, a number of shortcomings have been noted in the area of supplier sourcing decisions. These include the following; little attention has been given to examine how well suppliers are performing on the criteria for supplier sourcing, lack of periodic planning to evaluate the status of suppliers, lack of comprehension among many suppliers of the attributes that determine buyer decision-making and the importance of these attributes. An organizations profits are to a large extent, determined by how effectively it purchases materials from its suppliers whether it is sourced locally or globally and how these materials are managed by the organization Chindove and Medge, 2012).

Girum and Florian (2013) in their study indicated that the recently introduced ‘Export Trade Duty Incentive Schemes Proclamation No 768/2012’ has several instruments to minimize the problems of inventory stocking and lead time for establishments that import inputs, such as chemicals, for the production of commodities for the export market. They found that bonded input supplies warehouse scheme is one of such instruments whereby exporters are allowed to store inputs without duty payments under the supervision of the customs authority. It is also indicated that this scheme reduces customs clearing time, overstocking of raw material inventory and lead time.

Information technology has been applied to logistics and distribution: for example, tracking systems in transportation, and distribution planning systems. This creates better visibility of the distribution channel as well as allows better control of the logistics systems. Ultimately, IT can lower coordination costs, and in supply chain context, can substantially improve transactional efficiencies through increased information sharing and communications capabilities, resulting in improved supply chain performance (USAID | DELIVER, 2011).

The challenges of logistics and supply chain process are long delays in customs and port handling, complex tariff for imported items, inconsistency of quality raw material during bidding time and final delivery, unavailability of local suppliers for imported items and long processing and delivery time due to lengthy bureaucratic procedure involved in the purchase of the imported raw material. Their study also indicated that the major transportation challenges of Ethiopia is inaccessibility to sea port (Landlocked country) and back ward transport

infrastructure. Due to this the delivery process was expensive and challenging. This hinders the firms' competitiveness of the country (Fasika, Klaus and Marcus.2014).

AHRI imports different chemicals, reagents and laboratory supplies. Due to import strategies, import enterprises are transformed into integrated networks, in which they join their core competences. Time, cost and information were the main challenges of import area. Therefore, virtualization of processes and supply chain ensure smooth inter-company operations giving real time access to important information for all participants by internet. This makes that companies' boundaries deteriorate as autonomous systems exchanging data, gained by embedded systems throughout the entire value chain (Brettel, Friederichsen, Keller, & Rosenberg, 2014).

The common ILS challenges that Ministry of Health (MOHs) experiences in low-resource settings are untrained workers and in adequate skill sets on how to practice and implementation of ILS that fits supply chain requirements and inadequate resources for structural, resource, and organizational support such as workforce and budget (SIAPS, 2014).

#### **2.1.4. Integrated logistics system performance**

The IL is a performance-improving approach that develops linkages between the information, procurement, distributor/transportation, inventory management and functions within a supply chain to optimize quality service. The objectives of supply chain/logistics integration are to improve efficiency and reduce redundancy. Supply chain integration attempts to better connect demand with supply, which can both enhance quality service and lower costs. Well-functioning (integrated) supply chains are characterized by clarity of roles and responsibilities, agility, streamlined processes, visibility of information, trust and collaboration, and alignment of objectives (USAID/DELIVER PROJECT, 2011).

Stevens (1989) identified four stages of supply chain integration implementation and discussed the planning and operating implications of each stage as follows:

(1) Stage I, "the base line." The supply chain is a function of fragmented operations within the individual company and is characterized by staged inventories, independent and incompatible control systems and procedures, and functional segregation;

(2) Stage II begins to focus on internal integration, characterized by an emphasis on cost reduction rather than performance improvement, buffer inventory, initial evaluations of internal trade-offs, and reactive customer service;

(3) Stage III reaches toward internal corporate integration and is characterized by full visibility of purchasing through distribution, medium-term planning, tactical rather than strategic focus, emphasis on efficiency, extended use of electronics support for linkages, and a continued reactive approach to customers; and

(4) Stage IV achieves supply chain integration by extending the scope of integration outside the company to embrace suppliers and customers.

Performance is a strong determinant of national income and is the result of actions from a wide array of private and public actors. The components of logistics performance have significant effect in improving the efficiency of transport system and quality of trade regulation. So understanding and decomposing those elements is essential. Performance is defined as ‘analysis of both effectiveness and efficiency in accomplishing a given task’ (Mentzer&Konrad, 1991). Performance has been seen as multi-dimensional and is defined as the degree of efficiency and effectiveness and differentiation associated with the accomplishment of activities (Fugate, *et al.*, 2010) Researchers have always find it difficult to define Logistics Performance (LP) because organization’s have multiple and frequently conflicting goals. In the context of this study, efficiency is a measure of how economically the firm’s resources are utilized (Mentzer& Konrad, 1991) and (Neely, 2005). Several critical areas in LP effectiveness as described by (Langley and Holcomb, 1992) are product guarantee, availability and fulfillment time. They also extended the definition of effectiveness by adding differentiation as the ability to create value for the customer through the uniqueness and distinctiveness of logistics services.

At the logistical level, the importance of analyzing performance was first shown in the work of (Bowersox, 1996) as cited in (RuiMansidão and Luís A. G. Coelho, 2014), who reported that measurement of logistics performance consisted of a methodology for analyzing resources of the logistics function, and its main objectives were monitoring and control of the logistics operations.

#### ***2.1.4.1. Performance measurement***

Performance measurement is to accurately assess how well the business is performing; you need to develop some quantifiable measures. Ideally, your measures clearly identify those aspects of your business processes that need improvement and those that are working well. Organizations can use performance measures to evaluate their company's productivity over a set period of time (Harrington, 1995).

According to (Rose 1995) describing performance measurement activities says’ it is a process that records measures, display results, subsequent actions. Performance measurement activities

and processes is the issue that “performance indicators are to a large extent domain specific” (*Lai et al.*, 2004). Hence, there is no unique subset of indicators that can be selected. Therefore, frequently the choice is company specific and orientation of the company is important. Existing literatures on performance measurement in logistics provides a large number of potential useful indicators.

Literatures on the logistics industry are in abundance in the form of survey-based empirical research and reviews of the existing literatures from user perspectives. However, it is still rare noted previously, the performance measurement framework and models become several due to importance and complexity of logistics performance measurement (Brewer and Spey 2000; Griffins, Golds, Cooper, and Closs, 2004). One such model developed by (Fugate, *et al.*, 2010), logistics performance is supported by several other scholars who agree logistics performance is a multidimensional function of efficiency, effectiveness, and differentiation (Fugate, 2010) and that all can and should be “pursued simultaneously,” (Fugate, *et al.*, 2010). Thus, the model provides a useful lens from which to compare the identified body of literature to the industry data in order to assess the fashion setting role of logistics scholars.

Research in the area of logistics performance measurement supports this vital role of performance measures, and, furthermore, has concluded that success in the performance of logistics activities and capabilities is linked to improved organizational performance (Fugate, *et al.*, 2010).

There are several indicators in the literature and in business organizations recommended for use in measuring the performance of an SCM system (Folan & Browne, 2005). However, few attempts have been made to determine the minimum number or set of indicators needed in order to measure an SCM system’s performance with maximum effectiveness and minimum operating cost (Gunasekaran & Kobu, 2007). Aromyan et al. (2007) noted that studies have shown that supply chains lack accurate indicators of performance for comparison, benchmarking and decision-making. Traditionally, companies have tracked performance based on financial accounting principles, which date back to the ancient Egyptians and Phoenicians (Bora, Chiamsiri & Krairit, 2004). The performance-based measures include (Bora *et al.*, 2004): the Balanced Scorecard; the Supply Chain Operations Reference (SCOR) model; the Logistics Scoreboard; Activity-Based Costing (ABC) and Economic Value Analysis (EVA). However, the authors noted that the measures are not exhaustive and merely show some of the most popular approaches to measure supply chain performance. The Supply-Chain Operations Reference

(SCOR) model was developed by the Supply-Chain Council to provide a process-based approach to SCM and assist firms in evaluating the effectiveness of their supply chains. The SCOR model is based on five distinct management processes: plan, source, make, deliver and return. Reliability, responsiveness, flexibility, cost and asset are the major performance aspects SCOR model (The Supply-Chain Council, 2008).

Many researchers have proposed new performance measures and metrics considering the changes in markets and enterprise environments. Basu (2001) defined performance measures in five categories, namely: external, consumer, value-based competition, network performance and intellectual capital. Stewart (1995) claims that companies that have outperformed their competitors are found to be superior in four key operational areas: (1) delivery performance, (2) flexibility and responsiveness, (3) logistics costs and (4) asset management.

Fitzgerald et al. (1991) suggest that there are two basic types of measures in an organization relating to competitiveness and financial performance, which focuses on the determinants of the results (quality, flexibility, resource utilization and innovation). Gunesekaran and Kobu (2007) asserted that business and environmental performance measures can be categorized in terms of quality, time, cost, flexibility and innovation Indicated by Sezen (2008, p. 233), supply chains should be evaluated based on their ability to respond to changes in products, delivery times, volume and mix; hence flexibility. According to Petterson, (2009) the three types of performance measures identified as the necessary components of a supply chain performance measurement system are: flexibility, resource and output. In this regard, Table 2.1.4.1 consolidates a list of possible indicators that could be used to enhance the supply chain performance.

Table 2.1.4.1: List of Key Supply Chain Performance Indicators

Quality	<ul style="list-style-type: none"> <li>❖ Meeting quality performance standards</li> <li>❖ Defect detected per unit produced per unit purchased</li> <li>❖ Quality awards standards</li> <li>❖ Products per unit sold</li> <li>❖ Fitness of use</li> </ul>
Flexibility	<ul style="list-style-type: none"> <li>❖ Supply chain response time</li> <li>❖ Production flexibility</li> </ul>
Cost	<ul style="list-style-type: none"> <li>❖ Cost measures within the organization</li> <li>❖ Total supply chain management cost (across the supply chain)</li> </ul>
Order Delivery Lead Time	<ul style="list-style-type: none"> <li>❖ Fulfillment of orders on time</li> <li>❖ Damage-free delivery</li> <li>❖ Complete delivery as required</li> <li>❖ Delivery meets customers' requirements</li> </ul>

(Source: adopted from Petterson, 2009)

## **Quality**

It is one of performance indicator which conformance to requirement or fitness for use. It is the responsibility of all stakeholders to managing product quality in the supply chain. Managing quality in the supply chain needs the integration of the of supplier quality system, the internal system of the vantage point firm and the quality the customer expects. Some of the indicators of quality include a formal quality assurance system, continuous improvement; statistical process control, six sigma limits, fail-safe lot traceability and incoming quality assured assert that the quality of a specification of a product relates to decisions and actions made relative to the design and quality of conformance to the design. Adherence to the quality of the design and conformance ensure that the product meets customers' objectives. This is often termed "fitness for use" and it entails identifying the dimensions of the product that the customer wants and developing a quality control program to ensure that the dimensions are met (Petterson, 2009).

## **Flexibility**

Wisner, Tan & Leong, (2012) noted that flexibility in the supply chain is its agility in responding to random changes in the marketplace in order to gain or maintain competitive advantage. Flexibility is thus a performance dimension that considers how quickly automotive manufacturers can respond to the unique needs of customers (Jonsson, 2008). Flexibility has become particularly valuable in new product development. Some organizations compete by developing new products faster than their competitors. This requires supply chain partners who are flexible and willing to work closely with designers, engineers and marketing personnel (Bozarth & Handfield, 2006). The two indicators of flexibility are supply chain response time and production flexibility (Cohen and Rousell, 2005). The amount of days which the supply chain takes to respond to a market place without cost penalties is measured by supply chain response time (Bowersox, Close & Cooper, 2010).

## **Costs**

Cost is an important performance supply chain indicator. Bolstorff & Rosenbaum (2003), noted that supply chain costs include all costs associated with operating the supply chain, including the cost of goods and total supply chain management cost. The supply chain costs are associated with forecasting demands and other relevant issues, administration, transportation, inventory, manufacturing, customer service and supplier relationship management (Burt, Petcavage & Pinkerton, 2010). The cost performance is critical and that needs to be tracked more wisely and systematically than any other aspect of competitive performance (Fawcett *et al.*, 2007). Cost

control and cost reduction capabilities must be intrinsic to structure, processes, culture and technology foundation for an organization to survive and thrive.

### **Response time**

According to Wisner et al. (2012), order delivery lead time encompasses the fulfillment of the average percentage of orders among supply chain members that arrive on time, complete and damage-free, satisfying customer requirements. Order lead time is an important and significant source of competitive advantage for top-performing supply chains and their member companies (Handfield, Monczka & Giuinipero, 2011). The key indicators are due dates, scheduled or promised, and delivery windows. According to Handfield *et al.* (2011), this measure should identify total cycle time and its key components. Measures should focus on reduction through elimination of delays and delivering continuous improvement on target times.

### **Customs**

The World Customs Organization (WCO), established in 1952, is the international coordinating center for development, review of and ratification of the documents relating to global and particular customs regulations. To level the laws concerning the coordination of customs procedures and the impediments to the international trade, the International Convention on the simplification and harmonization of Customs procedures (Kyoto Convention) was adopted in 1973. It was reconsidered two times (in 1999 and in 2006), with the last wording concerning recommendations for the introduction of IT in customs operations. Goods transported between the states are coded according to the Common Commodities Nomenclature, introduced in 1988 by the International Convention on the Harmonized Commodity Description and Coding System (adopted in 1983). Coding simplifies declaration of goods and allows trading participants to independently calculate rates of customs duties.

The important act, regulating goods transportation, is Customs Convention on the ATA carnet for the temporary admission of goods (ATA Convention), adopted in 1990.

Two acts of recommended status are the Arusha Declaration (adopted in 1993 and revised in 2003), that mainly combats corruption and professional conduct advocacy of customs officers, and the Framework of Standards to Secure and Facilitate Global Trade (SAFE).

The World Trade Organization (WTO), adopted on 1 January 1995, is acting on establishing general trade regulations, consolidating customs duties and harmonizing customs procedures. Its operations are governed by more than fifty international conventions, among which is the General Agreement on Tariffs and Trade (GATT), adopted in 1947 and revised in 1994. A related

point to consider is that subject of regulation to the GATT last edition has been not only goods, but services as well, since their increased role in the modern world compared with the first wording. Today the WTO numbers are 164 states. China joined the WTO in 2001, and Russia became its member eleven years later (2012).

All customs regulation documents adopted after the entry into the WCO have been developed in China and Russia according to the normative-legal acts of the organization. That is, at the national level, the principle of unity and consistency with international regulatory instruments does work.

China entered the WTO more than 15 years ago, and this allows of mentioning not only the prospective results of membership in the organization, but also estimating their true significance in a global context (2). For the period of membership in the WTO, China has achieved the following indicators: the world's second economy by GDP; the first largest exporter of goods; the second largest importer of goods; the fourth largest supplier of commercial services; the third largest importer of commercial services; the first place in the foreign direct investment in developing countries; the first place in the distribution of foreign direct investment among developing countries.

The accession to the WTO has also entailed some negative aspects: the effect of reducing international tariffs has been considerably overestimated; many Russian enterprises will not meet the competition.

In the overwhelming majority of the papers, trading costs are primarily associated with transportation costs and time required for delivery. One of the most important contributions in this area Hummels et al. (2012), study the impact of transportation time associated with different transportation modes on the trade sensitivity to time. Long transportation time implies larger inventories that, in its turn, entail larger costs for the time holding and depreciation costs as well. Bigger inventories are needed in order to prevent disruptions in assembly line if the cargo is being delayed. All these extra costs are ready to be paid by customers to prevent downtime.

Hummels et al (2012), develop a model that reveals consumers' perception of the service quality that directly depends on delivery time. This factor makes producers improve customer experience by shipping products by air to obtain faster delivery time. The costs of transportation are charged proportionally to quantity rather than value of goods shipped by cargo carriers. Therefore, the ad-valorem cost of airfreight diminishes in product prices, i.e. the higher prices are for the product, the less part transportation will constitute in it. Hence, firms with the high price products will be more likely to use airfreight, while firms with low-price products will be using cheaper

ocean shipping. A consumer may not be willing to overpay for the fast delivery to save just a few days if a supplier is relatively close to him, but he may want to if a supplier is overseas and the ocean transit takes many weeks.

## ***2.2. Empirical literature review***

### **2.2.1. Integrated logistics system Practice**

#### ***2.2.1.1. Inventory Management.***

According to a cross-sectional descriptive study conducted in Ethiopia by Desalegn, to assess the status of laboratory LMIS used for managing HIV/AIDS and TB laboratory commodities, reports used in LMIS (IFRR and RRF) have multiple portions arranged as columns requiring various data sets (such as the beginning balance, quantity received, loss and adjustments, and ending balances) and involving additional computations (consumption, quantity needed to reach maximum stock level). Evaluation of those report formats in two review periods between Dec 2013 to Mar 2014 showed that 24 (92.6%) and 21 (87.5%) of facilities had completed data items on RRF and IFRR, respectively. However, a total of 24 (92.6%) facilities reported stock out for one or more of Laboratory commodities within six months while 22 (84.6%) facilities reported that HIV/AIDS and TB laboratory commodities were not refilled as per their request (Desalegn, 2011). Even though most of the health facilities were using stock/bin cards for all HIV/AIDS and TB laboratory commodities in main pharmacy store, almost half of them were not updated with accurate information matching with the physical count done at time. In addition, most of the facilities (60.5%) were stocked out for at least one ART monitoring and TB laboratory reagents and the highest stock out rate was for chemistry reagents. Besides, expired ART monitoring laboratory commodities were found in 25 (73.5%) of facilities.

A study conducted in China by Jianling et al (2010) on the Analysis of inventory Management in the China enterprises reveals that, in order for organizations to maintain exuberant competitive advantages and higher profitability, they need to pay more attention on stocks control system as shown from fig 1. David, (2009) adds that organizations need to adopt effective stocks control methods in their internal control system and implement scientific stocks control ways.

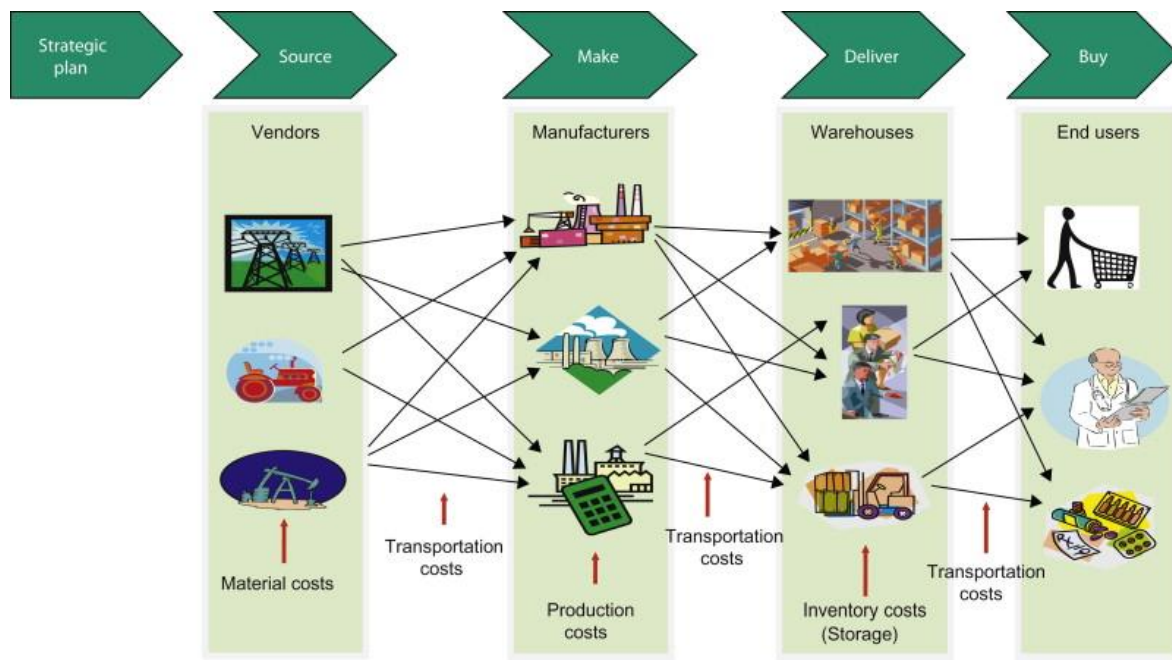


Fig 1 medical logistic practice

(Source: Jianling *et al*, 2010)

PFSA, (2014) noted that inventory management is vital for ILS, which involves the management of laboratory reagents, chemicals and supplies ordering process. It helps to maintain steady supply to research units, hence preventing product stock out, while minimizing the costs of holding inventory. Accurate and updated stock records are crucial for proper inventory management since they are input to calculate future needs. Holding stocks is important to ensure availability of essential items almost all the time. The selection of items to stock should rely on their value to research units and volume of consumption. Nowadays, inventory management is assisted with computerized Logistics Management Information System (LMIS) that allows easy recording of all reagents, supplies transactions and connects all levels of supply chains. Despite the importance of LMIS in improving efficiency of the overall inventory management process, it is underutilized in developing countries like Ethiopia. Ministry of health of Ethiopia developed standardized inventory management tools expected to be utilized by public health facilities throughout the country whether operated manually or use LMIS. These are bin card, stock card, Internal Facility Request and Resupply form (IFRR), Report and Requisition Form (RRF). The bin card is kept with the product inside the store and up dated in every transaction while stock card is similar to the bin card but is used to track stock based on issuing and receiving orders. The IFRR voucher is used to report internal transfer of items between the facility's store and dispensing units. The ministry recommends physical inventory and updating of bin cards and stock cards on regular basis. As per the WHO recommendation, most of the institutions and

health facilities are using bin card and stock card but it is estimated that about one-third of the world population does not have access to medicines, right examination particularly in Africa and Asia. Poor inventory management might lead to overstocking or under stocking which subsequently results wastage of resource and increased delay of delivering new findings. In addition, poor inventory management challenges availability of reagents, chemicals and supplies in the country.

As per the author, Inventory management is a pivotal in effective and efficient organization in controlling materials and goods that have to be held (or stored) for later use in the case of production or later exchange activities in the case of services. The inventory management practices are Automatic Replenishment, ABC Inventory Model, Just-In Time (JIT) Inventory, Economic Order Quantity (EOQ) and Vendor Managed Inventory. (David, 2019).

In step with David (2009), stock is a totally high priced asset that can be changed with information that's a much less expensive asset but to do this, the facts has to be correct, well timed, reliable and regular. While this happens, you bring fewer inventories and lessen cost. This consequently implies that stock management could be very crucial if a company wants to reap a balance among performance and responsiveness. David (2009) explains the following targets of stock management: maximizing customer service, maximizing the efficiency of purchasing and production, maximizing stock funding and maximizing earnings. It is well worth noting that assembly these goals requires balancing quick-term in addition to long-time period goals.

Wolcott, 2010 noted that stock management systems and stock management techniques provide information to effectively controlling the flow of supplies and reagents, effectively utilizing employees and equipment for coordinating internal activities and communicate with customers.

Powerful stock control determined how earnings of an agency can be maximized. Maximizing of earnings rely upon minimizing cost and maximizing revenue. Maximization is a good concept which requires growing income without growing the sources used (Hugo *et al.*, 2009). The import of stock management in corporation is to make certain that at any point in time the capital of the business is not necessarily tied down in shape of fabric in the store, which may additionally offer possibility for fraud and theft. In different word the management desires to place at minimal charge inventory losses, which emanate from store operation (Letinkaya & Lee, 2010).

Ethiopian Federal Ministry of Health ( 2010) states that there are special areas for the storage of dangerous and narcotic medicine, products requiring cold storage, possibilities to secure products

and stores are shaded from direct sunshine. Stock management is done manually with stock holding cards and follows the first-expired-first-out (FE-FO) strategy (Anna Schöpferle, 2013).

#### ***2.2.1.2. Information technology***

Information Management support for ILS implementation was significantly associated with improved data quality and utilization of information technology. There exists a well-designed logistics system for laboratory commodities with trained pharmacy personnel, distributed standard LMIS formats and established inventory control Procedures. However, majority of laboratory professionals were not trained in LMIS. Expired ART monitoring laboratory commodities were found in 73.5% of facilities. Among which only 25% & 20.8% of them were updated with accurate information matching to the physical count done at the time of visit for Hospitals and Health centers respectively. The study also found out that order fulfillment of laboratory commodities were 25% (Darko E *et al*, 2014).

In Zambia and Tanzania, the central-level, LMIS interface with the ERP and WMS software used in each country, respectively. They help to process orders for delivery by the Medical Stores Department (MSD) in Tanzania and the Medical Stores Limited (MSL) in Zambia. The result is a reduced data collection burden on health facility workers and simplified end-of-the-month reporting and requisition process (USAID | DELIVER PROJECT, 2016).

The automated inventory system (SILCOM) helped a lot in standardizing and sustaining the availability of logistics information for decision-making.

A study in integrated pharmaceutical logistics system for management HIV/AIDS and Tuberculosis laboratory diagnostic commodities, (Tilahun, J, 2016) on assessment of laboratory logistics ,management information system practice for HIV/AIDS and Tuberculosis laboratory diagnostic commodities found that, there was no a well-designed logistics system supported by information technology for laboratory commodities, majority of laboratory professionals were not trained in MIS.

#### ***2.2.1.3. Transportation Management.***

The Global Competitiveness Report, (2011) stated that Ethiopia is a landlocked country located in Eastern Africa bordering the Sudan, Eritrea, Djibouti, Somalia, and Kenya with a land area of about 1.13 million sq. km and a population of about 102.8 million in 2010, out of which only about 16 % live in urban areas. It has a tropical monsoon climate with wide topographic-induced variations. The country has wide topographic features varying between an altitude of 4,620 m above mean sea level (RasDejen) to about 120 m below mean sea level (Denakil Depression)

with a very difficult terrain (highlands crisscrossed by numerous river valleys and the Great Rift Valley) which made the provision of transport facilities very expensive.

In the context of Ethiopia's topography and pattern of settlement as well as its dependence on other countries' seaport for import and export, transport plays a crucial role in facilitating logistics system of the country. The Addis Ababa-Djibouti railway (781 km old line of nonstandard gauge of 1067mm) is the only railway that the country owns with Djibouti, but recently the Government has initiated the development of railway network with the establishment of Ethiopian Railways Corporation (ERC). Ethiopia has one of the most successful airlines in Africa providing local and international transport services for passenger and freight.

Efficiency implies minimization of overall machine extensive charges from transportation and distribution to inventories of raw substances, paintings in manner and finished items. To be green, companies should utilize techniques aimed at creating highest cost efficiency and for such efficiencies to be performed, non-cost including sports should be eliminated, economies of scale pursued and optimization techniques deployed a good way to get the great usage potential (Wolcott, 2010).

Road transport is the mode of transport for import materials that the country relies on for both domestic as well as international transport services. Recognizing the importance of the road infrastructure, the Government has launched the Road Sector Development Program (RSDP) in 1997 to address the constraints of the low coverage of road network and standards. The network which was about 26,550 km at the beginning of RSDP in 1997 has increased to 46,812 by the year 2010.

#### ***2.2.1.4. Procurement Management.***

Accessing affordable essential medicines is an important factor to address patients' satisfaction and increase their health seeking behavior. Most leading causes of death such as malaria, infectious diseases, and HIV/AIDS can only be prevented or treated effectively by having improving procurement systems i.e. appropriate medicines, reagents, chemicals and detecting equipment consistently available. WHO estimates about one-third of the world's population is without the access to medicines they need, mostly in Asia and Africa. For this, availability and affordability of essential medicines, reagents and supplies are taken as one of the millennium development goal in developing countries. This can be improved by transport facilities and good procurement practice. Ethiopia is one of the developing countries in Africa with infectious diseases such as TB, HIV, STI, diarrheal diseases, pneumonia and malaria being the major health

problems. So enhanced procurement system must be implemented. AHRI is one of the health research institutions in Ethiopia and will deliver findings to concerned body to improve the health system of Ethiopia. This relies, among other factors, on availing the most cost-effective laboratory test that satisfy priority healthcare needs of the population in adequate amount, appropriate manner and of assured quality at all times.

The main reasons for entering into collaboration were primarily for cost reduction purposes, and then delivery and quality improvements followed by supply base reduction strategies. They noted that concepts such as improved time-to-market, joint product development; co-design and outsourcing were ranked at the bottom end of the scale. This would indicate that the main reason for entering into long-term relationships was to gain instant cost advantage. They further explained that skill set for purchasing personnel who work in strategic relationship management tends to focus more on process skills such as team based working, inter-personal communication, commercial awareness, negotiation and analytical skills(Paul D Cousins and Robert Spekmen, (1999).

There are a number of principles of procurement that can be identified that are shared by some most, principles or many systems of public procurement. These principles are implemented through various means of legal and regulatory rules on conducting public procurement procedures are one of these means Arrow, S. (2010). Shaw (2010) points out that the procurement process can be wrapped into three steps. These are need identification, planning and specification of goods or services required, and sourcing, awarding, and supplier management to facilitate timely delivery.

Once the needs have been identified, the procurement department should develop or communicate a plan on how to deliver the service or goods required. The plan must be developed in collaboration with the other functions within the organization, so that it is integrated into the organizations strategy and therefore provided for adequately Shaw, (2010). To be able to purchase the right goods or services, the specifications of what the organization needs must be clear. These specifications are used to communicate to the supplier what is needed and what should be supplied. It is therefore important to have clear, precise and accurate specifications. Most organizations have standard specifications for the most regularly procured items and services such as medical and construction Shaw, (2010). Shaw (2005) says that sourcing is the process of identifying sources of supply that can meet the organization's immediate and future requirements for goods and services. The sourcing process adopted will depend on the situation

and on the time available to carry out sourcing. For instance, in a sudden on-set emergency the need to respond quickly to the emergency will mean there will be limited time to gather sourcing information and approve suppliers; therefore, an organization may make use of existing suppliers.

After evaluating and awarding of tender, the next step in the process involves placing orders for the goods or services with the supplier, or establishing contracts which need to be sent to suppliers. In emergency situations the approval levels and limits are adjusted, based on an approved process, to speed up the process of acquiring goods and services. Under normal circumstances, the approval processes may be more elaborate. The orders establish contractual relationships between the organization and the supplier Shaw, (2010).

When goods or services are received and accepted into stock, procurement then facilitates payment of the supplier by providing necessary documentation to Finance Department. Orders are normally generated in procurement, as the goods are delivered in the warehouses and transported to final distribution points; additional documents are generated in the process to support transactions. All these documents are finally consolidated to support vendor payments Shaw, (2010).

## **2.2.2. Challenges of ILS Implementation**

### ***2.2.2.1. Inventory Management.***

It was further noted that the inventory control system is not clearly understood by all health workers which resulted for un-standardized method of calculating resupply quantities. Tanzania, Wastage of expired reagents and medicines and overstocking of near-expired medicines was more common than stock outs (Brown and Gilbert, 2014). The author indicates that logistics skill level was poor and inventories were not well managed. The major contributing factors for stock out in institute were poor logistics skills. Another report by the Tanzanian Ministry of Health and Social Welfare (MOHSW) showed that stock management practices in the country were weak. In addition, it was shown that the bottlenecks throughout the supply chain management system are lack of regular ordering cycles, delivery delays, transportation cost, and stock outs (MOHSW, 2008). Furthermore, 27% of research institute, assessed had experienced stock-out in the last three months prior to the assessment visit. The findings of this assessment had also indicated that many personnel in procurement management and laboratory workers lack training that would enable them to better perform their responsibilities (Mochacheet *al.*, 2011).

In Malawi the Principal Secretary of Health Ministry *et.al* (2013) state that drugs stock outs was amounting to 95%. It was noted that causes were theft, tedious and bureaucratic process of procuring drugs and parallel system to purchase medication for treatment programmers. The identified causes of stock outs in this case are within the stocks control system and they are revealing the weakness of the system. (Mochachee *et al.* 2011).

In keeping with Dobler and Burt (2008), finances can be a constraining element to effective stock manages when price range allotted cannot cater absolutely for the organizations equipment requirements in the price range length. Sources lead to a higher organizational dedication and also overcome organizational obstacles. Due to the relative largeness of inventories maintained by the groups substantial sum of an agency's fund is being committed to them. For that reason it will become actually imperative to control inventories efficiently to avoid unnecessary price and make sure high-quality product (Dobler & Burt, 2008).

For stock control function to gain an advanced overall performance, Bailey and Farmer (2012) imply that it's far important to recruit, educate and broaden personnel with the capability and motivation to do better process. Education of staff is vital if full use is to be made from their abilities and talents. For a business enterprise to be triumphant, qualification is therefore a prerequisite and need to be matched with process requirement, for this reason the need to rent and develop bold employees. If workforce worried in inventory management isn't always qualified and able, then there can be ineffectiveness in inventory management.

Accuracy of inventory information is essential to provide first-class customer service, decide replenishment of character gadgets; ensure that material availability meets restore or undertaking demand, analyze stock levels and take away extra inventory as indicated with the aid of (power, 2005). Inventory information also provides the management with the facts that is used to make certain responsibility through stocktaking and inventory audit workout. Consistent with Power (2005), developing incorporated inventory systems is one of the challenges that groups face as they develop stock systems. Similarly, complex structures are expensive to expand and hence discourage organizations from growing them.

Inventory management systems are advanced with the goal of decreasing charges associated with inventory management (Jones & Riley, 2009). This is attributed to the reality that stock management spans via maximum of the departments inside an institution each having its own heterogeneous features.

Inventory troubles of too splendid or too small quantities available can reason business disasters. If a small business stores inventory-out of a vital inventory object, production halts ought to result (Whitin, 2009). It is as a consequence the management of this economics of stockholding, this is accurately being refers to as inventory management. Consequently it should be correctly looked after as it has to do with income of the commercial enterprise. A nicely planned and powerful stock management can make contributions significantly to a company annual turnover (Dess& Robinson, 2014).

#### ***2.2.2.2. Information technology***

In this new era of economic development, both soft and hardware of logistics infrastructure are lacking in the country. This is another challenge for ILS. The fourth industrial revolution- that is characterized by the increasing digitalization and the interconnection of products, value chains and business models- requires a significant investment. The study made by the company's Strategy in 2015 in the German sector of manufacturing and service industries, is based on surveys of 235 German companies. The respondents expected that regarding to the digital transition will lead to a significant transformation of their companies by good ILS and they estimate that the share of investment will account for more than 50% of the planned capital investments for the next 5 years. Poor information technology and untrained personnel of the new technology are the constraints of ILS.

#### ***2.2.2.3. Transportation Management***

Economic growth and trade depend on transportation. Without transport infrastructure, manufactured products cannot be delivered to AHRI on the right time. The road infrastructure in Ethiopia and the freight transport vehicles in terms of size, age and capacity, are not sufficient to support the growth in the IL activities. As an integral part of national production and distribution system, an adequate transportation network is necessary to provide a means of servicing domestic and international markets.

As a landlocked country, Ethiopia is dependent on seaports of other countries for its import. Although, due to the existing circumstances the country is depending mainly on port Djibouti, future possibilities of using Port Sudan, Berbera, Assab, and Massawa. The cost of freight transport is a challenge in IL of AHRI. With high transport costs, large economies of scale will remain unexploited, and IL will therefore be inefficient. The estimated total cost of border crossing in Africa is the equivalent of the cost of inland transport of over 1600km (Harmon *et al*, 2009). This is the main challenge for ILS of Ethiopia. Experience from developing regions such as Latin America and Asia suggests that combined trade liberalization and a supportive trade-

transport chain tend to create a virtuous cycle of lower costs, increasing trade volume, and economies of scale and scope in distribution and production activities (Konings et al, 2008). Efficient trade logistics are also important for attracting foreign direct investment, which in turn can increase a country's export capacity. With current trends in reduction in maritime transport cost and more advanced logistics technology that compensates for the handicap of intercontinental distances, lack of direct sea-access presents growing challenges to the global integration and growth prospects of many landlocked developing countries. The problem mostly affects the poorest countries: 20 out of 54 low-income economies are landlocked, with a majority of them in Sub-Saharan Africa (Arviset al, 2007), one of which is Ethiopia. The port charges at the monopolistic Djibouti port have become unbearably high for Ethiopian import of goods.

A logistics system is a network of related activities with the purpose of managing the orderly flow of material and personnel within the logistics channel (Stock and Lambert, 2001). In general, logistics systems have been described in terms of operational characteristics, structural context and managerial context (Persson, 1995). Furthermore, Woxenius and Sjöstedt (2003) have worked out a combined model of transportation and logistics sub-systems both for freight and passenger movement. In the freight model, four different entities or components are identified: goods, vehicles, facilities and infrastructure. The four entities are associated by relationships: sourcing and distribution, land use, transportation and finally traffic. Logistics activities take place in facilities located in relation to infrastructure, warehouses, terminals and production facilities. These facilities are supplied with products by means of transportation. The transportation is carried out by vehicles/vessels, which results in traffic. Transportation is the activity within logistics that achieves the movement of products along a supply chain between point-of-origin and point-of-consumption. It creates time and place utility since a product produced at one point has very little value to the prospective customer unless it is available at the point where and at the time when it will be consumed (Stock and Lambert, 2001). These sub-systems are seen as complementary and necessary to reshape the landside logistics patterns, which are complex multimodal transports of networks linking the main gateway position with the correspondent network of nodes.

#### ***2.2.2.4. Procurement Management***

Sourcing is the first step in IL. The research on sourcing has been extensive in recent years. This leaves open room for a supplier to improve efficiency over time by further optimizing the delivery processes. The dynamic change of supply costs affects the negotiation of sourcing contracts. A noticeable issue is the utilization of auctioning in the sourcing strategy. One of the

first researches in this regard might be Chen's(2005), which studies a procurement challenges with one buyer and multiple potential suppliers who hold private information about their own delivery and other costs. Specification difference, time and cost difference are the problem under procurement. An optimal procurement strategy is considered for the buyer who first specifies a payment for each possible purchase quantity and then invites the suppliers to bid for this contract. The auction can be conducted in many forms such as the English auction, the Dutch auction, the first-priced auction, sealed bid auction, and the Vickers auction. Chen and Vulcano (2005) study a supply chain where an upstream supplier auctions his inventory or capacity as a bundle, which formulates the problem as a two-stage supply chain comprising a single supplier and two resellers.

The procurement also affected by external factors i.e. by external and virtual integration. External integration refers to unified control of functions and processes across trading partners. Upstream examples include the sharing of production plans and costs with suppliers, banks, stakeholders, while downstream examples include the various shared information and processes associated with collaborative planning, forecasting and replenishment.” (Germain and Iyer, 2006).

Virtual integration refers to a temporary tightly coupled collaboration effort between independent entities (suppliers, customers, competitors) that are linked by technology. This technology facilitates the sharing of costs, skills and access to global markets (Byrne, 1993). Some of the attributes discussed in the literature on virtual collaboration include the use of information networks to maintain firstly, the connectivity of the participants during the relationship; and secondly, dissolution of the network once the companies have met the specific market opportunity.

Companies might choose whether horizontal or vertical integration is appropriate (Barrat2004) and Simatupang and Sridharan (2002) proposed horizontal, vertical and lateral integration as forms of supply chain integration strategies. These strategies have impact for developing countries because they are importer on many items. And hence this is challenge for procurement. Horizontal integration occurs when two or more unrelated or competing organizations (at the same level of the supply chain) producing similar products or different components of one product, form a cooperative association to share resources such as warehouse space and manufacturing capacity (Simatupang and Sridharan, 2002). These have resulted in reduced logistics and administration costs for individual organizations; improved procurement terms through group purchasing power; lowering of the fixed costs of indirect labor (e.g. marketing,

quality assurance, technical, sales and financial departments); improved access to markets because continuity of supply can be assured. Vertical integration takes place at different levels of the supply chain. The integration between producer and the distributor enables better physical and information flows, improvements in the trade-off between level of service and average stock, more economical inventory management control and better transportation systems (Caputo and Mininno, 1996). Lateral collaboration combines the benefits and sharing capabilities of both vertical and horizontal integration.

### **2.2. 3. Performance**

#### ***2.2.3.1. Inventory Management***

A study conducted in Lesotho showed that, majority (67%) of laboratories had no stock cards and thus did not conduct a physical inventory of reagents and supplies; where indicators used to assess inventory management practices for laboratory commodities were the formula used to calculate orders, current stock levels, availability of basic reagents and supplies, occurrence of stock-outs and the presence of expired items. The study resulted that 67 percent of the laboratories assessed did not have a set minimum stock level for reagents and consumables at which orders needed to be placed, while 83 percent reported that they did not have maximum stock levels for reagents and consumables. Some laboratories used to send reports to the Central Laboratory and District level on stock status, and only 17 percent of the sites reported that the forms they complete are integrated with the Hospital Management Information System (Pharasi B, 2007).

A site-level survey of 42 facilities, conducted in 2013 in Addis Ababa city, showed that 95 percent of antiretroviral (ARV) drugs were available. An assessment done by the Dire Dawa city administration (2013) showed a reduction in the expiry rate for the region from 4.4 percent in 2009/2010 to 1 percent in 2011/2012. Patients at the health center are pleased that medicines are available to safeguard their health. According to Ahmedsam Abdella (2013), curative and rehabilitative core process owner at Dire Dawa RHB, this could not have been achieved without IPLS (USAID/DELIVER, 2014).

#### ***2.2.3.2. Information technology***

Information technology has been applied to logistics and distribution: for example, tracking systems in transportation, and distribution planning systems. This creates better visibility of the distribution channel as well as allows better control of the logistics systems. Additionally, it tools

such as RFID, barcodes, and EDI platforms have enabled firms to be more proactive in the management of inventory in the supply chain ((USAID | DELIVER, 2011))

An assessment on integrated logistics in Africa has revealed that the LMIS is weak and does not capture all essential logistics data. The findings have shown that the percentages of the assessed having traditional methods were 39%, facilities who accurately practice were found 27% and facilities having staff trained was found to be 17%. The survey done on the Integrated Logistics System of Ethiopia had shown that the ILS has not brought significant performance improvements to the supply chain in Ethiopia. The survey by Abiy.S,(2007) provided valuable insight into the status of ILS, including access to essential medicines, and the use of the LMIS formats and storage conditions and pass through different phases as shown in fig 2.

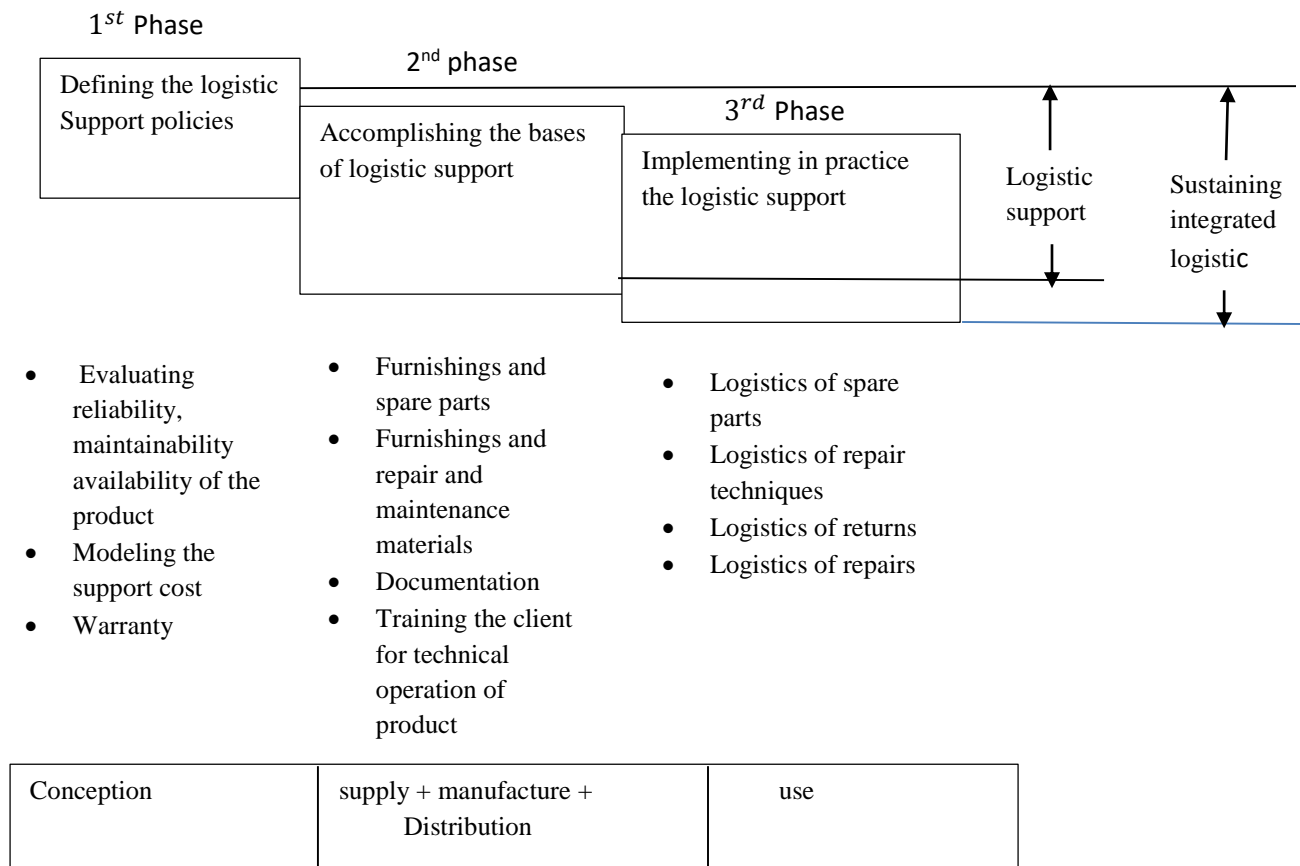


Fig.2 Implementation ILS phase

(Source: Abiy.S, (2007))

The logistics information is the motor that drives the medical logistics. Information has to be gathered and analyzed about each activity in the cycle to coordinate subsequent actions. But the performance in referral hospitals and health centers are 68% and 71% on average respectively. Thus, there is a need to manage the information system for other activities of the logistics to

function properly. Logistics management information system (LMIS) is the collection, processing and utilization of logistics information for pharmaceutical supply decision making (PFSA, 2014).

Paperwork expects conformity in behavior as opposed to overall performance considering employees are dealt with impersonality and they're predicted to rely upon rules and regulations, they're unwilling to enjoy character judgment and keep away from risks (Kenneth & Keneth, 2008).

#### *2.2.3.3. Transportation Management*

Transportation modes that ship small quantities with lower inventory levels are more expensive. This is the practice of 34% of health institutes. Under certain circumstance combining orders decreases a firm's responsiveness because of shipping delay. And, similarly it decreases transportation costs because of economies of scale that result from larger shipments. Firms should consider the trade-off between responsiveness and transportation cost at the time of designing transportation network (Chopra and Meindl 2007).

The design of a transportation network affects the performance of inbound logistics. A well designed transportation network allows logistics to achieve responsiveness at a low cost. Actually, there are different types of design that will be applicable depending on the situation at hand. The most used types are direct shipment network, direct shipping with milk runs, all shipments via central distribution center, shipping via distribution centers using milk runs and tailored network. All shipments come directly from each supplier to each buyer location, in the case of direct shipment network option. In this case, the routing of each shipment is specified together with the quantity to ship. So, the decision requires a trade-off between transportation and inventory costs. In the case of milk run, product delivers from single supplier to multiple retailers or from multiple suppliers to a single buyer location. In direct shipping with milk runs, a supplier delivers directly to multiple buyer locations or a truck delivers for the buyer from many suppliers. In order to use this option, it is necessary to decide on the routing of each milk run. Shipping directly to buyer benefits eliminating intermediate warehouses. On the other hand, milk runs lower transportation cost by consolidating shipments to multiple locations using a single truck. In this case, buyer will be responsible to divides locations by geographic region and build a distribution centers for each region and shipments buyer will be made from the distribution centers (Frantisek, 2002).

#### ***2.2.3.4. Procurement Management***

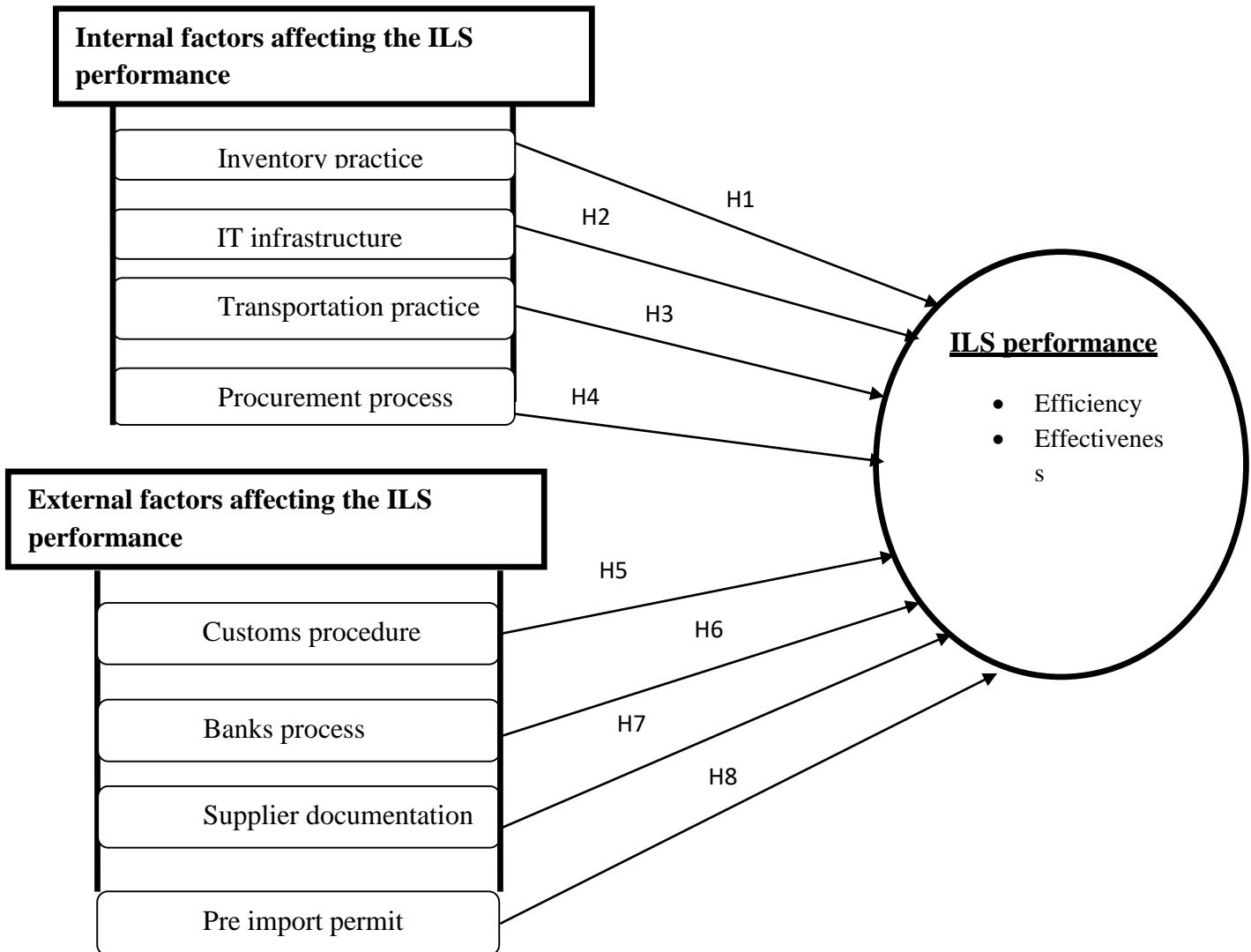
Van Weele (2006) maintained that there is a link between procurement process, efficiency, effectiveness and performance. Procurement performance starts from purchasing efficiency and effectiveness in the procurement function in order to change from being reactive to being proactive to attain set performance levels in an entity. Performance provides the basis for an organization to assess how well it is progressing towards its predetermined objectives, identifies areas of strengths and weaknesses and decides on future initiatives with the goal of how to initiate performance improvements. Procurement performance is not an end in itself but a means to control and monitor the procurement function. For any organization to change its focus and become more competitive, performance is a key driver to improving quality of services. Batenburg and Versendaal (2006) noted that use of inappropriate means can be a barrier to change and may lead to deterioration of procurement operations. Organizations which do not have performance means in their processes, procedures, and plans experience lower performance and higher customer dissatisfaction and employee turnover. Measuring procurement performance yields benefits to organizations such as cost reduction, enhanced profitability, assured supplies, quality improvements and competitive advantage. Electronic processes have replaced physical and paper-based processes. E-procurement moves tendering, negotiation and purchasing processes to websites.

#### ***2.3. Identified literature gap***

To the knowledge of the researcher, no prior study has been conducted in the area of ILS at AHRI. All the reviewed studies showed the general ILS of the health facility.

The main contributing challenge for the low performance of ILS is inappropriate transportation method, incompatible specification and response time problem in procurement process, untrained and insufficient number of human resource, poor information technology infrastructure and inadequate practice of inventory which is not supported by tools. The study tried to bridge these gapes.

## 2.4. Conceptual frame work



Source: adopted from Huan Neng Chiu National Taiwan Institute of Technology, Taipei, Taiwan, Republic of China, 2017.

### Hypothesis summery

- H1: Inventory practice positively and significantly affects PILS.
- H2: IT infrastructure positively and significantly affects PILS
- H3: Transportation practice and infrastructure positively and significantly affects PILS.
- H4: Procurement practice positively and significantly affects PILS.
- H5: Customs procedure positively and significantly affects PILS.
- H6: Banks process positively and significantly affects PILS.
- H7: Supplier documentation positively and significantly affects PILS.
- H8: Pre import process positively and significantly affects PILS.

NB:

- ❖ ILS practices of AHRI are viewed from the perspectives of Inventory management, Procurement management, transportation management and Information Technology.
- ❖ Effectiveness is viewed from the cost perspectives of ILS.
- ❖ Efficiency is also viewed from responsiveness, flexibility and quality of ILS.

## CHAPTER THREE

### METHODS OF THE STUDY

#### **Introduction**

The methodology of the study covered the description of study area, research approach on the specific purpose that the research tried to address, the approach in terms of being qualitative and quantitative, sampling design, data collection as well as analysis, and reliability tests.

#### ***3.1. Description of the study area***

This study was conducted at AHRI. The AHRI has been engaged in capacity building activities in the area of biomedical research since 2001. Since then, there is an increasing trend in the clinical trial activities with six to seven clinical trials running for some time now. Beside the research activities, AHRI has been also involved in different short term and long term (MSc and PhD) trainings in collaboration with different National and International Universities and Institutes contributing to the national capacity building in medical research. The training has been given for MSc and PhD students who were registered in different local and international universities. AHRI also organizes several multidisciplinary short courses for undergraduate students as well as for university staffs.

Since its establishment, for about 35 years, AHRI had been functioning as an independent research institute and during those years the research agenda was mainly donor driven and primarily focused on basic research. AHRI had undergone an important transition in its status in Ethiopia in July 2004, when it joined the Ethiopian Ministry of Health as part of the ALERT Centre.

#### ***3.2. Research design***

According to Kothari (2004), research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. As the general objective of the study is the assessment of major factors affecting the performance of integrated logistics system of Armauer Hansen Research Institute (AHRI), the study used explanatory research design because the explanatory research design was used to examine the relationships among variables; (i.e. the relationship of integrated logistics system practices, internal & external factors affecting the performance of integrated logistics system and performance of ILS implementation of the AHRI).

### ***3.3. Research Approach***

The study used mixed research approach by employing both quantitative and qualitative data. In mixed research approach quantitative results were expressed in numerical and quantifiable terms, while qualitative results were expressed verbally in order to create understandings on the relationships or complex interactions. Yin (2009, p. 64) states that a mixed research approach can enable the researcher to address either broader or more complicated research questions. In general, mixed research approach has used for the researcher to have a full picture and deeper understanding on the investigated phenomenon by linking complementary findings to each other.

### ***3.4. Study Population***

AHRI has a total of 348 employees who are working under 16 working units/directorates. From these, 105 of them are working under the seven working units/directorates namely Mycobacterial disease research directorate, Bacterial and viral Diseases Research directorate, Malaria and Neglected Tropical Disease (NTD) Research directorate, Bioinformatics and Biotechnology Research directorate, the clinical trial directorate, Non-Communicable Disease directorate, Finance and Procurement directorate, General Service directorate. The employees of the Finance and Procurement directorate, and General Service directorate are part of integrated logistics system and the employees of the remaining five directorates are engaged in research activities and frequently request integrated logistics system of the organization to fulfill chemicals, reagents and laboratory supplies for their research activities. Because of this, the employees of these directorates have direct relation with the integrated logistics system of AHRI. Thus, 105 employees and 7 directorate directors were the target population for this study.

### ***3.5. Sample size***

A sample is a smaller group obtained from the accessible population to represent the whole population while sampling is the process of selecting the individuals for the study from the population (Mugenda and Mugenda, 2003). For this research a census of the whole population was done. The total number of people in the target population was not significantly much to collect data for the study at this level. The study used census to collect a wide variety of views. And thus, the total sample size of the study was 112.

### ***3.6. Source of Data***

The staff of AHRI who are working in the seven directorates were the source of data for the study. The data of the study was obtained by structured questioner from 65 workers of the seven

selected working units. The data of the interview was also collected from the directorate directors of the 4 working groups.

### ***3.7. Data Collection Instruments***

In this study, primary data sources was mainly employed. The data was collected through questionnaires via electronically & by hard copy and telephone interviews.

### ***3.8. Data Collection Procedure***

During the data collection process, the researcher tried to maintain the validity and reliability of data by using the two major components (validity and reliability tests) to measure the quality or trustworthiness of the study.

#### **3.8.1. Validity test**

Validity refers to the extent to which an instrument measures what is supposed to measure (Brink 1993). Data need not only to be reliable but also true and accurate. If a measurement is valid, it is also reliable (Joppe 2000). In an attempt to ensure content validity, the questionnaires were developed on the basis of a thorough review of the existing literature concerning the area of inquiry with a little modification. In addition, the same set of questions was administered to respondents so that responses would be similar to facilitate comparison

In order to maintain the external validity of the research, the interview guide was created together with some questions which was asked during the interview. The summarized note in the case of the challenges, practice and performance of logistics system was sent back to the respondents for corrections and additional information to supplement points which were missed.

In terms of the internal validity of the research, focusing on an open approach was conducted in order to maintain a high internal validity. The open approach did not manipulate the outcome and also kept an open mind by being quiet and listening to the respondents for the most time during the interviews. In this context, to ensure internal validity the researcher had undertaken pilot test and then analyzed to check whether the research questions were answerable or not.

Generally, qualitative research had a high internal validity, rather than external validity due to the fact that external validity could be difficult to accomplish.

### **3.8.2. Reliability test**

Reliability refers to the consistency or dependability of a measurement technique, and it is concerned with the consistency or stability of the score obtained from a measure or assessment over time and across settings or conditions. If the measurement is reliable, then there is less chance that the obtained score is due to random factors and measurement error (Geoffrey et al, 2005).

To ensure reliability, it is important to have a properly sized sample to achieve statistically significant and reliable results. The researcher therefore conducted a census of expert staff in the organization to ensure that the data collected was reliable. A census of all the expert staff would also provide different perspectives to the research questions and allow the researcher to compare responses and draw more reliable conclusions. Cronbach's alpha is a coefficient of reliability that gives an unbiased estimate of data generalization. Thus, the reliability test of the data collected for this research is above the standard threshold level of Cronbach's alpha (0.7). An alpha coefficient of 0.7 or higher indicates that the gathered data are reliable as they have a relatively high internal consistency and can be generalized to reflect opinions of all respondents in the target population (Zinbarg2005).

### **3.9. Methods of Data Analysis**

The collected quantitative data was entered, coded and analyzed using SPSS software version 25.0. The qualitative data was altered into categories linked to the topics and coded individually so as to give qualitative description. After quantitative data entry is over, it was analyzed using both descriptive and statistics and then some correlational tests were made to know whether or not the independent and dependent variables had some kind of correlation and/or association.

The chi-square test of independence, inferential statistics was used specifically variance, mean, mode, correlation and regression to attest the relationship between the dependent variable and a set of explanatory/independent variables.

### **3.10. Ethical consideration**

The researcher had got ethical clearance before conducting the study. Ethical clearance was approved from ethical review committee of the college, Addis Ababa University. Approval also obtained from AHRI management. The researcher explained about the goals and rationale of the study. i.e. it is for academic. All records were kept confidential such that each workers file is going to be identified only by a code.

## CHAPTER FOUR

### RESULT, DISCUSSION AND INTERPRETATION

#### **Introduction**

This chapter focused on the presentation, analysis and interpretation of data based on the questioner. The questioner was distributed to 105 respondents electronically and hard copy and from this 65 of them have responded. The interview questions were also planned to conduct from 7 directors however 4 of them were volunteer to be interviewed through telephone. And thus, interview was conducted through telephone.

#### **4.1. Profile of the respondents**

Respondents' demographic information or profile describes the respondents' gender, work experience in the organization and their educational qualification using frequency distribution.

As it is shown in the table 4.1.1 below, 70.8% of the respondents were male and the remaining 29.2% were Female. The gender of the respondents' is not proportional .i.e. The number of male respondents is more than 2.4 times the female responds. Most of the respondents were degree holders. i.e. 34(52.3%). 23(35.4%) of the respondents were MA, 5 (7.7%) of the respondents were PhD and 3(4.6%) were diploma holders consecutively. 24(36.9%) of the respondents have 0-2 years of work experience in the organization, 12(18.5%) of the respondents have work experience of 2-5, 10(15.4%) of the respondents have work experience of 5-8 years and 19(29.2%) of the respondents have above 8 years work experience in the organization respectively.

Table 4.1.1 Demographic Profile of the Respondents.

S.No	Variables	Categories	Frequency	Percentage
1	Sex	Male	46	70.8%
		Female	19	29.2%
		Total	65	100%
2	Educational status	Diploma	3	4.6%
		Degree	34	52.3%
		Master	23	35.4%
		PHD	5	7.7%
3	Work experience	(0-2)	24	36.9
		(2-5)	12	18.5
		(5-8)	10	15.4
		>8	19	29.2

## 4.2. Integrated logistics system practices

The ILS practice of AHRI was assessed from inventory management, information technology, transport management and procurement management perspectives.

Table 4.2.1 integrated logistics system practice

<b>Inventory management practice</b>	Mean	Std. Deviation
AHRI manages Inventory using Economic Order Quantity (EOQ) approach	2.51	1.09
AHRI experience no surplus or shortage of inventory	2.23	.96
AHRI disposes expired items timely	2.68	.83
AHRI uses bin card and stock card to manage its inventory	4.00	.83
<b>Grand mean inventory management practice</b>	<b>11.44</b>	
<b>Group mean of inventory management practice</b>	<b>2.86</b>	
<b>Information technology integration</b>		
AHRI practices IT infrastructure to modernize inventory management	2.2	1.14
AHRI uses IT infrastructure to manage transportation.	2.2	1.23
AHRI uses IT infrastructure to speed up the procurement process	2.8	1.12
AHRI practices IT infrastructure to speed up the overall integration of logistics system.	2.46	1.08
<b>Grand mean of information technology integration practice</b>	<b>9.68</b>	
<b>Group mean of information technology integration practice</b>	<b>2.42</b>	
<b>Transport management practice</b>		
AHARI practices cold chain transportation to move reagents, chemical & supplies safely.	2.94	1.33
Transport management of AHRI is curious to move items (reagents, chemical & supplies) on time.	3.35	1.04
AHRI uses least cost transportation system	2.74	.99
The transportation management of AHRI works in collaboration with external transport companies.	3.25	.94
<b>Grand mean transportation management practice</b>	<b>12.28</b>	
<b>Group mean of transportation management practice</b>	<b>3.07</b>	
<b>Procurement management practice</b>		
<b>Specification of items to be procured are confirmed before supplier selection</b>	<b>3.83</b>	<b>.82</b>
Contract management is conducted according to the bidding and contract document terms and conditions	3.94	.81
The working units of AHRI raise their procurement need in organized and planned way.	3.34	1.16
AHRI practices piecemeal purchasing.	4.17	.98
<b>Grand mean of procurement management practice</b>	<b>15.28</b>	
<b>Group Mean of procurement practice</b>	<b>3.82</b>	

Table 4.2.2 Table I: Weighted Averages for 5-point Likert Scales

Weighted Average	Result	Result Interpretation
1.00-1.79	Strongly Disagree	Very un influential
1.80-2.59	Disagree	Un influential
2.60-3.39	Neutral	Neutral/do not know
3.8-4.19	Agree	Influential
4.20-5.00	Strongly Agree	Very Influential

(Source : Alfarra, W.A., 2009)

The inventory management practice of AHRI practiced as AHRI manages Inventory using Economic Order Quantity (EOQ) approach, AHRI experience no surplus or shortage of inventory, AHRI disposes expired items timely and AHRI uses bin card and stock card to manage its inventory with a group mean of 2.86. The result of the analysis is neutral. The respondents were neutral or did not know either the organization was implementing the inventory management practice or not.

The information technology practice of AHRI practiced as IT infrastructure uses to modernize inventory management, manage transportation, uses to speed up procurement process and uses to the overall integration of ILS with a group mean of 2.42. The result of the analysis is disagree. This means that the information technology practice was uninfluential and the organization was not practicing it properly so as to modernize and speed up organizational activities.

The transportation management practice of AHRI practiced as use of cold chain transportation, curiosity, least cost transportation and works collaboratively with external transport companies with a group mean of 3.07. The result of the analysis is neutral. This means that the respondents of transport management did not know that either the organization was implementing transportation management or not.

The procurement management practice of AHRI practiced as use of specification of items, contract management and raising planned procurement need and piecemeal purchasing with a group mean of 3.82. The result of the analysis is agreed. This means that procurement management practice was influential and relatively well practiced in the organization.

### 4.3 internal and external factors affecting the performance of ILS

Table 4.3.1 internal and external factors

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	29.824	5.836		5.110	.000
	Inventory management	.313	.453	.136	.690	.493
	Information technology	.364	.371	.187	.982	.330
	Transportation management	.791	.435	.343	1.820	.074
	Procurement management process	1.411	.425	.793	3.321	.002
	Custom procedure	.948	.337	.532	2.818	.007
	FMHACA's pre-import procedure	.310	.416	.179	.745	.459
	Bank procedure	.138	.226	.070	.612	.543
	Supplier documentation	.165	.349	.065	.471	.639

a. Dependent Variable: ILSP(integrated logistics system performance)

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.836 <sup>a</sup>	.698	.560	0.24489

The significance level of Inventory management, Information technology, Transportation management, Procurement management process, Custom procedure and FMHACA's pre-import procedure were 0.493, 0.330, 0.074, 0.002, 0.007 and 0.459 respectively. This indicates that Inventory management, Information technology, Transportation management, Procurement management process, Custom procedure and FMHACA's pre-import procedure were positively and significantly affecting the performance of integrated logistics system of AHRI at 56 % of adjusted  $R^2$ . The result/test of the analysis is aligned with hypothesis H1, H2, H3, H4, H5 and H6.

Bank procedure and suppliers documentation were not affecting the dependent variable (ILSP) significantly. Hypothesis H7 and H8 were rejected.

The predictors of the inventory management in the study are deploying skilled man power, top management commitment, availability of resources and inventory management training. These predictors affect the inventory management performance of the organization. As per the result of the analysis, inventory management was positively and significantly affecting the performance of integrated logistics system of the organization.

From the interview, the interviewees said that deploying skilled manpower is essential to manage inventories properly by avoiding misuse and wastage of resources however the organization cultured to deploy less qualified employees there. This practice created the inconsistency on the stock management of the organization. Besides, the organization is not working to upgrade the employees' skill by providing on job training in inventory management.

Generally, the top management of the institute provided less attention to improve the quality of the institution's inventory management comprehensively.

This study is in line with Germain, R. and Iyer, K.N.S., 2006, inventory management training affect the inventory performance of ILS.

The variables of information technology in the study are adoption of IT infrastructure, skilled work force, training in IT. These variables have effect on the performance of information technology of the organization. The result of the analysis showed that information technology was positively and significantly affecting the performance of the integrated logistics system of the organization. This result was supported by the interviewees. i.e. the interviewees discussed that the organization was not widely using the adoption of IT infrastructure to simplify the office works, like integration of user departments with procurement, procurement with finance, procurement with transport management e.t.c . In addition to this, the organization was not in a position to provide frequent IT training to its employees so as to update and develop their IT skill. These issues affect the performance of the information technology system of the organization. The interviewees further described that the weak performance of information technology has adverse effect on the performance of the integrated logistics system of the organization.

The finding of the study is in line with Desale, A., Taye, B., Belay, G. & Nigatu. 2013, IT training affect the IT performance of ILS.

The predictors of transport management are availability of vehicles and related resources, top management commitment, availability of skilled work force and transport management training. These predictors have effect on the performance of the transport management of the organization. The study indicated that transport management was positively and significantly affecting the

performance of integrated logistics system of the organization. The result of the analysis was supported by interview. i.e. the interviewees explained that the availability of vehicles and related resources are essential for the organization to move procured items (chemicals, reagents and equipment) however, the organization do not have adequate number of vehicles to move such sensitive items with a good condition. The interviewees further described that the top management lacks commitment to improve the quality of transport management by providing training for the employees of the organization to develop their skill.

The finding is in line with findings of Bowersox, D. J & Cooper, M. B (2010), transportation infrastructure, availability and managing transportation resource affects the ILS performance. The predictors of procurement management process are skilled procurement staff, top management commitment in decision making, availability of resources and procurement training.

Skilled procurement staff understands the procurement methods and the procurement procedure of the country. And tries to conduct the procurement activities efficiently and effectively. The procurement training is used to improve the employees' procurement skill and further help them to enhance the procurement activities of the organization. Top management commitment in the decision making of procurement issues have effect on the organization's procurement performance. When the management is fast and committed in decision making, procurement will be enhanced whereas if the top management is less committed, the procurement process will also be delayed. Thus, these predictors have effect on the performance of the organizations' procurement process. The performance of procurement process also have effect on the performance of integrated logistics system of the organization.

The result of the study showed that the procurement management process was positively and significantly affecting the performance of integrated logistics system of the organization.

The result of the analysis was supported by the interviews as follows:

As per the interviewees, the procurement process is long and the organization does not have adequate number of skilled procurement staff. They further noted that skilled procurement staff is the major factor affecting the performance of procurement. It does not deliver the items for the user departments within the required lead-time and it further affects the efficiency and effectiveness of the organization.

The predictors of custom procedure of the country are custom procedure of the country increases the responsiveness, flexibility and quality of ILS performance and reduce the cost of ILS performance of AHRI.

The flexible, responsive and quality custom procedure is very essential for countries like Ethiopia which are highly dependent on importing chemical, reagents and health facilities from abroad. The efficient custom procedure enable to induce the effectiveness of imported items. Thus, these predictors have effect on the performance of custom procedure of the country. And the performance of the custom procedure of the country have also effect on the performance of ILS of AHRI.

The result of the study revealed that the custom procedure of the country was positively and significantly affecting the performance of integrated logistics system of the organization. This result was backed by the interview as follows:

As per the interviewees, the custom procedure of our country is long and requires bulk document to clear the imported items. They further noted that as it takes more than a week to conclude custom procedure for a single document and release the item from custom premises.

The finding of the study is in line with Shaw, F.N., 2010, custom procedure of the country reduce the cost has significant effect in performance of ILS.

The predictors of the FMHACA's pre-import permit approval are FMHACA's pre-import permit approval increases the responsiveness, flexibility and quality of ILS performance and decrease the cost of ILS performance.

Food, Medicine & Health Care Administration and Control Authority (FMHACA) approves pre import for list of items from the proforma invoice and checked them after they are imported to the country against the approved pre import document at cargo.

The predictors of the FMHACA's pre-import permit approval have effect on the performance of FMHACA's pre-import permit approval procedure of the country. And the performance of the FMHACA's pre-import permit approval procedure of the country have also effect on the performance of ILS of AHRI.

The result of the study showed that the FMHACA's pre-import permit approval of the country was positively and significantly affecting the performance of integrated logistics system of the organization. This result was backed by the interview as follows:

From the interview, the FMHACA's pre-import permit approval is the major challenge for the performance of integrated logistics system. Although, FMHACA scheduled 3 days to approve the pre import documents sent online from AHRI, in reality it takes three to four weeks to get approved pre import documents and this causes delay of procurement activities and further affects the effectiveness of ILS.

USAID/DELIVER PROJECT, 2011, the country pre-import permit approval has significant effect in the quality and cost of ILS.

#### 4.4. Integrated logistics system performance of AHRI from efficiency

**Table 4.4.1. performance measurement indicators from efficiency perspective: quality, flexibility responsiveness**

<b>Quality</b>	<b>N</b>	<b>Mean</b>	<b>Std. Deviation</b>
The integrated Logistics System practice of AHRI increased the quality of inventory management of the firm	65	2.15	.71
The Integrated Logistics system practices of AHRI increased the quality of information technology utilization of the firm	65	2.34	.85
The Integrated Logistics system practices of AHRI increased the quality of Transportation management of the firm	65	2.55	.94
The Integrated Logistics system practices of AHRI increased the quality of procurement of the firm	65	2.25	.79
<b>Grand Mean</b>		<b>9.28</b>	
<b>Group mean</b>		<b>2.32</b>	
<b>Flexibility</b>			
The integrated Logistics System practice of AHRI increased the flexibility of inventory management of the firm	65	2.23	.84
The Integrated Logistics system practices of AHRI increased the flexibility of information technology utilization of the firm	65	2.30	1.04
The Integrated Logistics system practices of AHRI increased the flexibility of Transportation management of the firm	65	2.66	.96
The Integrated Logistics system practices of AHRI increased the flexibility of procurement of the firm	65	2.31	.71
<b>Grand mean</b>		<b>9.52</b>	
<b>Group Mean</b>		<b>2.38</b>	
<b>Responsiveness</b>			
The integrated Logistics System practice of AHRI increased the responsiveness of inventory management of the firm	65	2.38	.89
The Integrated Logistics system practices of AHRI increased the responsiveness of information technology utilization of the firm	65	2.22	.89
The Integrated Logistics system practices of AHRI increased the responsiveness of Transportation management of the firm	65	2.58	.89
The Integrated Logistics system practices of AHRI increased the responsiveness of procurement of the firm	65	2.20	.96
<b>Grand Mean</b>		<b>9.4</b>	
<b>Group mean</b>		<b>2.35</b>	

The group mean of quality, flexibility and responsiveness are 2.32, 2.38 and 2.35 respectively. These group means fall between the cut off points of weighted average (1.80-2.59). The result of the analysis is disagree. The interpretation of the results is that quality, flexibility and responsiveness of the performance of integrated logistics system of the organization is not influential. This indicates that the integrated logistics system practices of the organization (inventory management, IT integration, transport management and procurement practices) are not in a position to increase the performance of the ILS. That is:-

- AHRI did not well practiced the economic order quantity approach in inventory management; IT infrastructure to speed up the organizational activities; use cold chain transportation to move reagents, chemicals and conduct procurement in planned and organized way to increase the quality of integrated logistics system performance of the organization.
- AHRI did not well practiced no surplus or no shortage of inventory; use of IT infrastructure to speed up the overall integration of logistics system and collaboration of transport management to work with external transport companies to speed up the flexibility of integrated logistics system performance of the organization.

AHRI did not well practiced the use of bin card and stock card; use of IT infrastructure to speed up procurement process; curiosity of transport management to move items timely and preparation of specification ahead of supplier selection to improve the responsiveness of the integrated logistics system performance of the organization. Thus, the efficiency of the performance of integrated logistics system of AHRI is weak.

#### 4.5. Integrated logistics system performance of AHRI from effectiveness perspective.

**Table 4.5.1. performance measurement indicators from effectiveness (cost) perspective**

<b>Cost</b>	<b>N</b>	<b>Mean</b>	<b>Std. Deviation</b>
The Integrated Logistics system practices of AHRI decreased the cost of inventory management of the firm	65	2.89	.89
The Integrated Logistics system practices of AHRI decreased the cost of information technology utilization of the firm	65	2.88	.86
The Integrated Logistics system practices of AHRI reduced the cost of Transportation management of the firm	65	2.66	.89
The Integrated Logistics system practices of AHRI reduced the cost of procurement of the firm	65	2.75	1.13
<b>Grand Mean</b>		<b>11.18</b>	
<b>Group mean</b>		<b>2.79</b>	

The group mean of cost is 2.79. It falls between the cut off points of weighted average (2.60-3.39). The result of the analysis is neutral. This indicates that respondents of effectiveness indicators (cost) did not know the effects of integrated logistics system practices on the performance of integrated logistics system of the organization.

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSION AND RECOMMENDATION**

This chapter presents the study summary of major findings in line with the objectives of the research. Besides, it comprises conclusion, recommendations and future research recommendations

#### ***5.1 Summary of Major Findings***

The mean result of information technology integration practice respondents is 2.42 (disagree). This indicates that the information technology practice was uninfluential and the organization was not practicing it properly so as to modernize and speed up organizational activities.

The mean results of inventory management and transportation management practice respondents is 2.86 and 3.07 respectively. The result of analysis is neutral. This designates that the respondents did not have any knowledge about transport management and inventory management practices of the organization.

The mean result of procurement management practice respondents is 3.82. The result of the analysis is agree. This shows that procurement was relatively better practiced in the organization.

Inventory management, information technology, transport management and procurement management process are the internal factors which were significantly affecting the ILS performance of AHRI.

Custom procedure and FMHCAs' pre import permit approval are external factors which were significantly affecting the ILS performance of AHRI.

The integrated logistics system practices of inventory management, information technology integration, procurement management process and transport management are not in a position to improve the quality, flexibility and responsiveness of the ILS performance of AHRI.

#### ***5.2 Conclusion***

This study has assessed the factors affecting the performance of ILS of AHRI in Addis Ababa. The study has applied mixed research approach by employing both qualitative and quantitative data. It used primary data source employing questionnaires and interviews which were responded by employees of seven departments and directors respectively. The data was analyzed by using descriptive and statistics and further correlational tests were conducted to know the

association of dependent and independent variables. Data analysis was done using SPSS version 25.

### **5.2.1 Practices**

The inventory management practices like EOQ approach and disposing expired items and Transport management practice were not well practiced in AHRI.

The information technology practice of AHRI such as use of IT infrastructure for managing transportation and modernizing the inventory management were weak.

The procurement management practice of AHRI was relatively better than the practice of inventory management, transport management and information technology practice.

### **5.2.2 Internal factors**

The following major findings are listed herewith:

- Inventory management is found to be one of the factors in the performance of ILS that comprises unavailability of resources, lack of inventory management training, lack of skilled manpower and lack of top management commitment.
- Information technology is also one of the factors that affect in the performance of ILS due to lack of adopting IT infrastructure, lack of training and shortage of skilled work force.
- Transport management has been found to be one of the factors affecting the performance of ILS because of lack of top management commitment, unavailability of skill force, unavailability of vehicles and related resources and lack of transport management
- Procurement process has been found to be another factor affecting the performance of ILS at AHRI due to unskilled procurement staff, lack of top management commitment, lack of procurement training and unavailability of procurement resource.

### **5.2.3. External factors**

- Custom procedure of the country has been found to be one of the factors affecting the performance of ILS that includes the custom procedure of the country increase the cost and consequently decrease the quality of ILS.
- FMHCA's pre-import permit approval is also another factor which affects the performance of ILS which includes the pre-import permit approval increase the cost and reduce the flexibility of ILS.

### **5.2.4 Performance measurements**

The performance measurement indicators (variables); quality, flexibility and responsiveness were not influential because the integrated logistics system practice of the organization was not in a position to contribute for the improvement of the performance of ILS of the organization. The result of the analysis of cost of performance of ILS is neutral and difficult to measure the performance of ILS from effectiveness perspective. Thus, the performance of ILS of the organization from efficiency perspective is weak.

### **5.3. Recommendations**

This study identified some issues and gaps to be addressed to improve ILS performance of AHRI. Based on the findings of the study, the following recommendations are forwarded:-

- The top management of the institute should revise and take corrective measures on the practice of inventory management, transportation management and information technology integration.
- The management of the institute should revisit the internal factors such as inventory management, information technology, transport management and procurement process challenges and come up with the practical solutions.
- Provide training on inventory management, information technology and procurement process.
- Has to align its documentation with the country's custom procedure documentation requirements so as to enhance responsiveness and quality of ILS performance.
- The FMHCA's pre-import permit approval have to be improved so as to minimize the responsiveness of procurement and to enhance the flexibility and reduce the cost of ILS performance.

Since the study is conducted in one organization and addressed to assess limited areas, it is unlikely to represent and reflect the actual circumstance in other similar organizations. Therefore, it needs inclusive and further research in the area.

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1.1.1	AHRI manages Inventory using Economic Order Quantity (EOQ) approach.					
1.1.2	AHRI experience no surplus or shortage of inventory.					
1.1.3	AHRI disposes expired items timely.					
1.1.4	AHRI uses using bin card and stock card to manage its inventory.					
<b>1.2</b>	<b>Information technology integration</b>					
1.2.1	AHRI practices IT infrastructure to modernize inventory management.					
1.2.2	AHRI uses IT infrastructure to manage transportation.					
1.2.3	AHRI uses IT infrastructure to speed up the procurement process					
1.2.4	AHRI practices IT infrastructure to speed up the overall integration of logistics system.					
<b>1.3</b>	<b>Transportation management practice</b>					
1.3.1	AHARI practices cold chain transportation to move reagents, chemical & supplies safely.					
1.3.2	Transport management of AHRI is curious to move items (reagents, chemical & supplies) on time.					
1.3.3	AHRI uses least cost transportation system					
1.3.4	The transportation management of AHRI works in collaboration with external transport companies.					
<b>1.4</b>	<b>Procurement practice</b>					
1.4.1	Specification of items to be procured are confirmed before supplier selection					
1.4.2	Contract management is conducted according to the bidding and contract document terms and conditions					
1.4.3	The working units of AHRI raise their procurement need in organized and planned way.					
1.4.4	AHRI practices piecemeal purchasing.					

**Part 3: Factors affecting the performance of Integrated Logistics System of AHRI. Please put a tick mark ( ✓ ) in the box, to the five point Likert Scale responses i.e. 1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree**

<b>2.</b>	<b><u>Internal factors affecting the performance of ILS</u></b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>2.1</b>	<b>Inventory management</b>					
2.1.1	Deploying skilled manpower in inventory management reduces the cost of ILS performance.					
2.1.2	Top management commitment in inventory management enhances the quality of ILS performance.					
2.1.3	Availability of resource improves the responsiveness of ILS performance.					
2.1.4	Inventory management training advances the flexibility ILS performance.					
<b>2.2</b>	<b>Information technology</b>					
2.2.1	Adoption of IT infrastructure increases the quality ILS performance.					
2.2.2	Skilled work force in IT boosts the responsiveness of ILS performance.					
2.2.3	IT infrastructure enhances flexibility of ILS performance.					
2.2.4	Trainings in IT reduce the cost of ILS performance.					
<b>2.3</b>	<b>Transportation management</b>					

**External Factors affecting integrated logistics system of AHRI**

2.3.1	Availability of vehicles and related resources enhance the responsiveness of ILS performance.					
2.3.2	Top management commitment in decision-making increases the quality of ILS performance.					
2.3.3	Availability of skilled work force reduces the cost of ILS performance.					
2.3.4	Transport management trainings increase flexibility of ILS performance.					
<b>2.4</b>	<b>Procurement process</b>					
2.4.1	Skilled procurement staff decreases the cost of ILS performance.					
2.4.2	Top management commitment in procurement decision increases the quality of ILS performance.					
2.4.3	Availability of resource for procurement boosts the responsiveness of ILS performance.					
2.4.4	Procurement training increases the flexibility of ILS performance.					
<b>S.no</b>	<b>External Factors affecting integrated logistics system of AHRI.</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>3.1</b>	<b>Custom Procedure of the country</b>					
3.1.1.	Custom procedure of the country increases the responsiveness of ILS performance.					
3.1.2	Custom procedure of the country reduces the cost of ILS performance.					
3.1.3	Custom procedure of the country enhances the flexibility of ILS performance.					
3.1.4	Custom procedure of the country increases the quality of ILS performance.					
<b>3.2</b>	<b>FMHACA's pre-import permit approval</b>					
3.2.1	FMHACA's pre import permit approval decreases the cost of ILS performance.					
3.2.2	FMHACA's pre import permit approval increases the responsiveness of ILS performance.					
3.2.3	FMHACA's pre import permit approval enhances the flexibility of the ILS performance.					
3.2.4	FMHACA's pre import permit approval increases the quality of ILS performance.					
<b>3.3</b>	<b>Bank Procedure</b>					
3.3.1	The bank process of the country reduces the cost of ILS performance.					
3.3.2	The bank process of the country enhances the responsiveness of ILS performance.					
3.3.3	The bank process of the country increases the quality of ILS performance.					
3.3.4	The bank process of a country maximizes the flexibility of ILS performance.					
<b>3.4</b>	<b>Supplier's documentation</b>					
3.4.1.	Proper Supplier's documentation practices increases the quality of ILS performance.					
3.4.2	Supplier's proper documentation decreases the cost of ILS performance.					
3.4.3	Supplier's proper documentation enhances the responsiveness of ILS performance.					
3.4.4	Supplier's documentation increases the flexibility of ILS performance					

**Part 4: Integrated logistics system performance of AHRI from efficiency (quality, flexibility & responsiveness) and effectiveness (cost) perspectives. Please put a tick mark ( ✓ ) in the box, to the five point Likert Scale responses i.e. 1= strongly disagree, 2= disagree, 3= neutral, 4= agree, 5= strongly agree**

<b>4.1</b>	<b>ILS Performance Efficiency from Quality, Flexibility and Responsiveness dimension</b>					
4.1.1	<b>Inventory Management</b>					
4.1.1.1	The integrated Logistics System practice of AHRI increased the quality of inventory management of the firm					
4.1.1.2	The integrated Logistics System practice of AHRI increased the flexibility of inventory management of the firm					
4.1.1.3	The integrated Logistics System practice of AHRI increased the responsiveness of inventory management of the firm					
4.1.2	<b>Information Technology</b>					
4.1.2.1	The Integrated Logistics system practices of AHRI increased the quality of information technology utilization of the firm					
4.1.2.2	The Integrated Logistics system practices of AHRI increased the flexibility of information technology utilization of the firm					
4.1.2.3	The Integrated Logistics system practices of AHRI increased the responsiveness of information technology utilization of the firm					
4.1.3	<b>Transportation Management.</b>					
4.1.3.1	The Integrated Logistics system practices of AHRI increased the quality of Transportation management of the firm					
4.1.3.2	The Integrated Logistics system practices of AHRI increased the flexibility of Transportation management of the firm					
4.1.3.3	The Integrated Logistics system practices of AHRI increased the responsiveness of Transportation management of the firm					
4.1.4.	<b>Procurement process</b>					
4.1.4.1	The Integrated Logistics system practices of AHRI increased the quality of procurement of the firm					
4.1.4.2	The Integrated Logistics system practices of AHRI increased the flexibility of procurement of the firm					
4.1.4.3	The Integrated Logistics system practices of AHRI increased the responsiveness of procurement of the firm					
<b>4.2.</b>	<b>Effectiveness from cost perspectives</b>					

4.2.1	<b>Inventory Management</b>					
4.2.1.1	The Integrated Logistics system practices of AHRI decreased the cost of inventory management of the firm					
4.2.2	<b>Information Technology</b>					
4.2.2.1	The Integrated Logistics system practices of AHRI decreased the cost of information technology utilization of the firm					
4.2.3.	<b>Transportation Management</b>					
4.2.3.1	The Integrated Logistics system practices of AHRI reduced the cost of Transportation management of the firm					
4.2.4	<b>Procurement process</b>					
4.2.4.1	The Integrated Logistics system practices of AHRI reduced the cost of procurement of the firm					

## Interview Protocol

Dear respondent,

First, I would like to thank you in advance for taking your time to fill this questionnaire.

My name is Habtamu Mekonen, I am an MA graduating student in logistics and supply chain management at AAU, School of Commerce. I am studying the factors affecting the performance of integrated logistics system of AHRI. Therefore, I kindly request you to

participate in this study by completing this questionnaire. This research is only for Research purpose and no other party will have the access to the data collected.

If you need any clarification, please contact me @913050049 or [habtemek178@gmail.com](mailto:habtemek178@gmail.com)

1. How ILS is being practiced at AHRI?
2. What are the internal factors affecting the performance of integrated logistics system of AHRI?
3. What are the external factors affecting the performance of integrated logistics system of AHRI?
4. What is the performance of Integrated Logistics System at AHRI?