Analysis of Supply Chain of Fertilizers in Ethiopia

A Thesis Submitted to the School of Commerce of Addis Ababa University in partial fulfillment of the requirement for the Award of Master of Arts Degree in Logistics and Supply Chain Management

By

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June 2016

Addis Ababa, Ethiopia

ANALYSIS OF SUPPLY CHAIN OF FERTILIZERS IN ETHIOPIA

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Addis Ababa University

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June 2016

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Statement of Declaration

I, Reta Hailu, declare that this thesis entitled **ANALYSIS OF SUPPLY CHAIN OF FERTILIZERS IN ETHIOPIA** is submitted in partial fulfillment of the requirements for the Master of Arts degree in Logistics and Supply Chain Management at the School of Commerce, Addis Ababa University. This project contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this project is my own work.

Declared by

Reta Hailu	_____	June, 2016
Student	Signature	Date

ACKNOWLEDGMENTS

I would like to take the opportunity to acknowledge the support and help of all who have support me in this study. Without their contribution and advice, I would have never been able to progress with the work in the project. I am grateful to those who agreed to participate in this research by completing the questionnaire, conducting the survey, data capturing, analysis and editing. Words cannot express enough my appreciation to my family for their love, patience and support during the entire period especially to my beloved wife Meron Mindaye. Again, I would like to thank Ato Shebiru Demissie from AISE, W/ro Eskedar Behailu Amare from ESLSE, Ato Mulugeta Halefom from Trans Ethiopia PLC, Ato Meseretu Lema from Oromia regional state agricultural input office and my colleague Ato Nigussie Wabella for their support in the process of collecting the necessary data. And also Ato Busha Temesgen (PHD candidate) had been with me right the day I was registered for the program until submission of thesis report and I thank him for the time and all his support. Above all, I glorify the Almighty God for the strength, courage, wisdom and inspiration throughout the period of my studies. Last but not least, this work will not come to end without my Advisor, Dr. Birhanu D. and I thank him for his patience, encouraging support and all his suggestion during the whole course of the research.

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ABBREVIATIONS

AISE	Agricultural Input Supplies Enterprise
AISCO	Agricultural Input Supply Corporation
ESLSE	Ethiopian Shipping and Logistics Services Enterprise
MOFED	Ministry of Finance and Economic Development
CU	Cooperative Unions
MT	Metric Ton
JIT	Just - in - time
NBE	National Bank of Ethiopia
BoARD	Bureau of Agriculture and Rural Development
RATES	Regional Agricultural Trade Expansion Support Program
MOA	Ministry of Agriculture
ATA	Agricultural Transformation Agency
GDP	Gross Domestic Product
ATD	Transport Association of Djibouti
ha	Hectare
DAP	Diammonium phosphate
IFPRI	International Food Policy Research Institute
SPSS	Statistical Package for Social Sciences
FAO	Food and agriculture organization
SNNP	Southern Nations, Nationality, and Peoples' Region
ERCA	Ethiopian Revenue and Customs Authority
SCPI	Supply chain performance indicators

OPERATIIONAL DEFINATIONS

Supply chain is a network of connected and interdependent organisations mutually and co-operatively working together to control manage and improve the flow of materials and information from suppliers to end users.

Fertilizers are chemical products that improve the levels of available plant nutrients and/or the chemical and physical properties of soil, thereby directly or indirectly enhancing plant growth, yield, and quality.

Lead-time is the clock time spent by the supply chain from procuring fertilizers imports until placing it into the hands of farmers.

Total supply chain costs include all the supply chain costs, including material, transport, inventory, and facility and overhead costs.

Efficiency refers to whether the chain organization is able to deliver fertilizers with lowest cost possible.

Effectiveness refers to whether farmers are provided with fertilizer within shorter lead time, better quality, and appropriate quantity, in the right place and as per farmer's requirement.

ABSTRACT

This study analyzes the supply chain of fertilizers in Ethiopia by assessing the major stakeholders in the country. This study investigated whether fertilizer is delivered to farmers in an efficient way, at the lowest possible costs and in an effective way, with shortest lead time. The researcher employed analytical approach of research design named supply chain analysis which comprises supply chain mapping and measuring chain performance. The study relied on secondary data articles, books, publications and stakeholders records as well as primary data collected from actors of supply chain of fertilizers right from importer up to farmers. Both qualitative and quantitative data interpreted using narrations, tables, graphs, charts, descriptive and inferential statistical methods. The thesis addressed major stakeholders and map out what the supply chain of fertilizers looks like; the study also finds out the lack of integration an d communication among stakeholders, inefficient supply chain in terms of high cost of fertilizers, ineffective supply chain in terms of longer lead time, little involvement of farmers in demand estimation, mismatch between quantity supplied and demanded. Ultimately, recommendation provided for policy improvement from government side and capacity and capability change from supply chain stakeholders including Agricultural Input Supply Enterprise, Ethiopian Shipping and Logistics Service Enterprise, Ethiopian Revenue and Customs Authority and transport companies and that at the end could add knowledge in the area and be also an insight for other researchers to undertake further researches and contribute for efficient and effective supply chain of fertilizers in Ethiopia.

Key words: supply chain, fertilizer, monopoly, cooperatives, Ethiopia

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

In Ethiopia, agriculture accounts about 41.6 percent of the GDP, employs about 83 percent of the labour force and contributes around 90 percent of the total export earnings of the country. (MOFED 2005; RATE 2003; NBE 2007/08).The sector is dominated by about 11.7 million smallholders cultivating about 95 percent of the national agricultural production and large farms contributed to only 5 percent of the total production (MOA, 2011). About 80-85% of the population depends on agriculture for livelihood. Despite majority of population involved in agriculture, Ethiopia is known in food shortage and poverty resulted from lower agricultural productivity .The student researcher believe low level fertilizer application by farmers is one of the factors that cause to lower the productivity of farmers among others. Fertilizer play important role in agricultural yields. However, less than 40% of farmers use fertilizer and those who do, apply rates significantly below those recommended. Ethiopia is not producer but depends on imports of fertilizer from overseas and that makes the supply chain of fertilizers more complex. Thus, streamlining the supply chain of fertilizers is highly demanded by involving stakeholders and working towards improving the chain performance has important contribution to increase productivity and improve the livelihood of the population.

Handfield and Nichols (2004) defined supply chain management the integration of all activities associated with the flow and transformation of goods from raw materials through to end user, as well as information flows, through improved supply chain relationships, to achieve a sustainable competitive advantage. It is the series of companies eventually making products and services available to consumers including all of the functions enabling the

production, delivery and recycling of materials, components, end products and services. Supply chain includes all facilities, functions, and activities associated with flow and transformation of goods and services from raw materials to customer, as well as the associated information flows.

The structure of the fertilizer market in Ethiopia has changed over time. After its introduction in the country in 1967, fertilizer importation and distribution was controlled by the government company known as the Agricultural Input Supply Corporation (AISCO) and later renamed Agricultural Inputs Supply Enterprise (AISE). This state monopoly prevailed until the fall of the central planning in 1991 (Matsumoto & Yamano, 2009). Subsequently, the market was liberalized and private companies became involved (Spiel- man et al., 2010). However, in 2001, the private companies exited the market because of strong competition from companies subsidized by regional governments which entered the market in 1996 (Demeke et al., 1997). By 2005, facing an increasing deficit in their budget due to subsidies granted to their regional companies, regional governments decided to support agricultural cooperatives who were expected to be more efficient in delivering fertilizer to farmers. From 2006 onwards, cooperative unions (CU) became dominant actors of fertilizer import and their market share reached 75% in 2007/2008 (IFPRI, 2012). However, in 2008, the Ethiopian federal government decided to coordinate all fertilizer import through only one company, in order to benefit from economies of scale by purchasing in bulk and save foreign currency (World Bank, 2011).

Fertilizers in the broadest sense are products that improve the levels of available plant nutrients and/or the chemical and physical properties of soil, thereby directly or indirectly enhancing plant growth, yield, and quality. A fertilizer applied to soil to enhance its ability to produce plentiful, healthy plants. Fertilizers are natural and manufactured chemicals containing nutrients known to improve the fertility of soils. Nitrogen, phosphorus, and

potassium are the three most important nutrients for crop growth. Fertilizer is an important dry bulk cargo imported from abroad that have greater impact on economy of the country. Since Ethiopian economy is an agrarian economy in which the livelihood of about 85% of the population directly or indirectly depends on the agricultural sector, fertilizer is a key input for productivity of the sector. The release of FY 2008/09 GDP statistics revealed that the service sector now comprises 45.1 percent of GDP, followed by agriculture at 43.2 percent of GDP and the remaining accompanied by the industry sector.

Agriculture has actually been overtaken by service sectors and shows in decreasing trend in the last decades. It is then important that increasing agricultural productivity is critical to stimulate the rate of economic growth in Ethiopia. The important contributories, fertilizer and other inputs , can significantly improve the productivity of agricultural sectors of the country with a key factors of availability of water. However, the efficiency of use of these commodities in the agriculture sector can be affected by their higher farm gate price which has a direct impact on a low income farmer. The high farm gate price can be contributed from less effective logistics chain which incur a higher total cost for end users. Since price of fertilizer in worldwide is showing an increasing trend, improvement of the whole chain efficiency is critical to maintain sustainable use of this commodity by the end user farmers.

1.2 STATEMENT OF THE PROBLEM

According to Spielman et al., (2013) less than 40% of farmers use fertilizer and those who do, apply rates significantly below those recommended in Ethiopia.This low fertilizer use is primarily due to prices being two to three times higher than prices on the world markets. Reducing the price of fertilizer requires a sound understanding of the product´s supply chain. This study tried to investigate whether fertilizer is delivered to farmers in an efficient way and at the lowest possible costs. There are many parties involved in supply chain of fertilizers and the in adequate performance of these parties, seasonality and huge volume of fertilizers demand could also be the cause of increase in cost and lead time.

Out of the following mission of supply chain management; getting the right goods or services to the right place, at the right time, and in the desired condition at the lowest cost and highest return on investment. Little has been research with regard to time and place utility but there is huge gap what the supply chain concept reach now a days and the recent practice of supply chain of fertilizers in Ethiopia.

Only few studies have dealt with the supply chain of fertilizers in Ethiopia and most of them evaluate the chain from the angle they were mostly interested in; According to Agbaney et al., 2015, the supply chain of fertilizers were found to be effective in supplying farmers in a timely manner but the study pinpointed as there is high supply chain inefficiency due to increased stocks and storage costs as well as inaccurate demand estimation process. Chombe., 2012 identified on his research as transportation cost was the major contributor to increase for total cost of fertilizers, there was seasonal variation of demand of fertilizers and there is huge lack of information and communication among stakeholders in supply chain of fertilizers.

Therefore, the student researcher believed there is a gap in knowledge what the supply chain of fertilizer of Ethiopia looks like despite the chain has direct effect to millions of farmers of

the country and consumes huge amount of foreign currency for a country with larger deficit. Little attention was given to study area both from scholars and stakeholders of the supply chain. There is no clear supply chain map to visualize what supply chain of fertilizers looks like and the performance of supply chain actors was not measured adequately. Thus, this study tried to investigate the casual relationship of cost, time, quantity, quality, place of delivery, farmer's involvement in demand determination, occurrence of stock out and place of delivery of fertilizers as independent variable and effective and efficient supply chain performance as dependent variable. The study tried to investigate the current chain performance and make recommendation and suggest suitable supply chain strategy. And also the study expected to attract other researchers to undertake further study in the area and important to be a background for policy improvement from government side and capacity and capability change from supply chain stakeholders in general.

1.3 RESEARCH QUESTIONS

The student researcher designs the following basic research questions:

1. How supply chain of fertilizers in Ethiopia visualized?
2. How much is the total supply chain cost of fertilizers until it reaches central warehouses in Ethiopia?
3. How long is the lead time of fertilizers in Ethiopia?
4. What are the specific bottlenecks or challenges of each actors of supply chain of fertilizers in Ethiopia not to practice efficiently and effectively?
5. To what extent the supply chain performance indicators affect supply chain performance (low cost and shorter lead time)?

1.4 OBJECTIVES

The major objective of the study is to analyze the supply chain of fertilizer in Ethiopia.

The specific objectives are to:-

- Assess the flow of fertilizer across the supply chain.
- Understand and map out the supply chain of fertilizers in Ethiopia.
- Find out if farmers receive fertilizers in lowest cost possible and shortest lead-time.
- Identify the major stakeholders and their challenges.
- Identify the barriers and bottlenecks in the supply chain fertilizers in Ethiopia.
- To propose best supply chain strategy in fertilizers supply chain.

1.5 SCOPE OF THE STUDY

This research focuses on supply chain of fertilisers in Ethiopia by studying supply chain mapping and supply chain performance of stakeholders starting right from importer to ultimate consumers by analyzing the lead time and cost of logistics system. Some of the actors including suppliers, ports, insurance companies and financial institutions that have great role in supply chain of fertilizers were excluded due to time and budget constraint.

1.6 LIMITATION OF THE STUDY

Supply chain of fertilizer involves a wider group of stakeholders from supplier's supplier up to end consumer, farmers. It is beyond the scope of this study to address all of them. This is because such studies have to include the input of all stakeholders and require huge investment of time and money to understand the complete picture of the problem and get a solution for it; In this study for the interest of time and budget, only importer, transports, logistics service provider and farmers found in four Woredas surrounding Addis Ababa investigated by selecting samples during data collection due to the fact that the student researcher constrained by limited time and budget.

1.7 ORGANIZATION OF THE STUDY

This thesis has been organized under five chapters. The first chapter presents introduction consisting of background of the study, statement of the problem, limitation of the study, research questions, objectives and scope of the study. The second chapter demonstrates a survey of literature relevant to the study. The third Chapter discusses methodology and data collection instrument. The fourth chapter deals with the data collection, result analysis, interpretation and discussion. The last but not the least, the fifth chapter, provides conclusion, recommendations and limitations and implications of research topic for further study.

CHAPTER TWO

LITERATURE REVIEW

2.1 BACKGROUND OF SUPPLY CHAIN MANAGMENT OF FERTILIZERS AND ITS EVOLUTION IN ETHIOPIA

Traditionally, most organizations have viewed themselves as entities that exist independently from others and indeed need to compete with them in order to survive. Thus, value creation was seen to be created with the companies rather than between companies. This view of the organization as a self contained island is now beginning to be replaced with the recognition that companies may have to cooperate in order to compete. Behind this seemingly paradoxical concept is the idea of supply chain. Supply chain is a network of connected and interdependent organisations mutually and co-operatively working together to control manage and improve the flow of materials and information from suppliers to end users as per J. Aitken (2000) definition while Martin Christopher (2011) defined supply chain management as the management of upstream and downstream relationships with suppliers and customers in order to deliver superior customer value at less cost to the supply chain as a whole. Supply chain management can also be defined as a set of approaches that efficiently integrate and coordinate the materials, information and financial flows across the supply chain so that merchandise is supplied, produced and distributed in the right quantities, to the right locations, and at the right time, in the most cost-efficient way, while satisfying customer requirements (Hilletofth, 2009: 16; Hugo, Badenhorst-Weiss & Van Biljon, 2011: 4; Shukla, Garg & Agarwal, 2011: 2059). The objective of supply chain management is to achieve a sustainable competitive advantage (Handfield, Monczka, Giuinipero & Patterson, 2009: 12). According to Fawcett et al. 2007, Supply chain management is defined as “the design and management of seamless, value-added process across organizational boundaries to meet the

real needs of the end customer". Thus, the title "The analysis of supply chain of fertilizers in Ethiopia" is mainly concerned the evaluation of the major stakeholder in the chain including importer, transportation companies, logistics service providers and ultimately end customers, farmers; which have direct effect to the majority of Ethiopian livelihood.

Chemical fertilizer was first introduced to Ethiopia under the Freedom from Hunger Program of the FAO in the late 1960s (Agricultural Transformation Agency (ATA), 2012 - unpublished). Despite successful field demonstrations and several deliberate policy attempts to increase fertilizer use in the late 1970s and early 1980s, fertilizer application levels remained very low (Agricultural Transformation Agency (ATA), 2012 - unpublished). At the national level, total imports of fertilizer increased from about 3,500 tons in the early 1970s to only 34,000 tons in 1985/86. With the introduction of the Peasant Agricultural Development Program (PADEP) in 1986, total imports of chemical fertilizer reached about 140,000 tons by the time the central planning regime of the Derg collapsed in 1991. In contrast, it grew from 140,000 tons in the early 1990s to about 890,000 tons in 2012 (Rashid et al ., 2013). Yet, fertilizer use in the country is low. Only 30–40 percent of Ethiopian smallholders use fertilizer, and those who do apply on average only 37–40 kilogram per hectare (ha), significantly below recommended rates (Spielman, Alemu, and Kelemwork 2013). Since 1992, there have been a number of policy shifts that have shaped and re-shaped fertilizer supply in the country. The unpublished Ethiopian Agricultural Transformation Agency (2012) document prepared by the IFPRI (2012) and Rashid and his colleagues at the same institute (2013) have summarized the policy shifts into five stages; These were complete government control (1967-1992), partial liberalization, with private sector entry and elimination of subsidies (1992-1996), competition among public, private, and regional holding companies (1997-2000),exit of private companies (2001-2006), and since 2007, the

exit of regional holding companies and the entry of farmers' cooperatives as the distribution channel, with AISE as the sole fertilizer importer since 2008.

From the earliest days of field-level fertilizer demonstration plots to the collapse of central planning in 1991, fertilizer markets in Ethiopia were controlled by the government through its parastatal input marketing agency, called Agricultural Inputs Supply Corporation (AISCO), which was re-named as Agricultural Inputs Supply Enterprise (AISE) in 1992. The AISCO had its own marketing network throughout the country, which included marketing centres and service cooperatives for distributing fertilizers to the farmers. Like in many African countries, AISCO controlled marketing was inefficient and expensive, involving government subsidies to cover its large administrative costs (ATA, 2012 - unpublished).

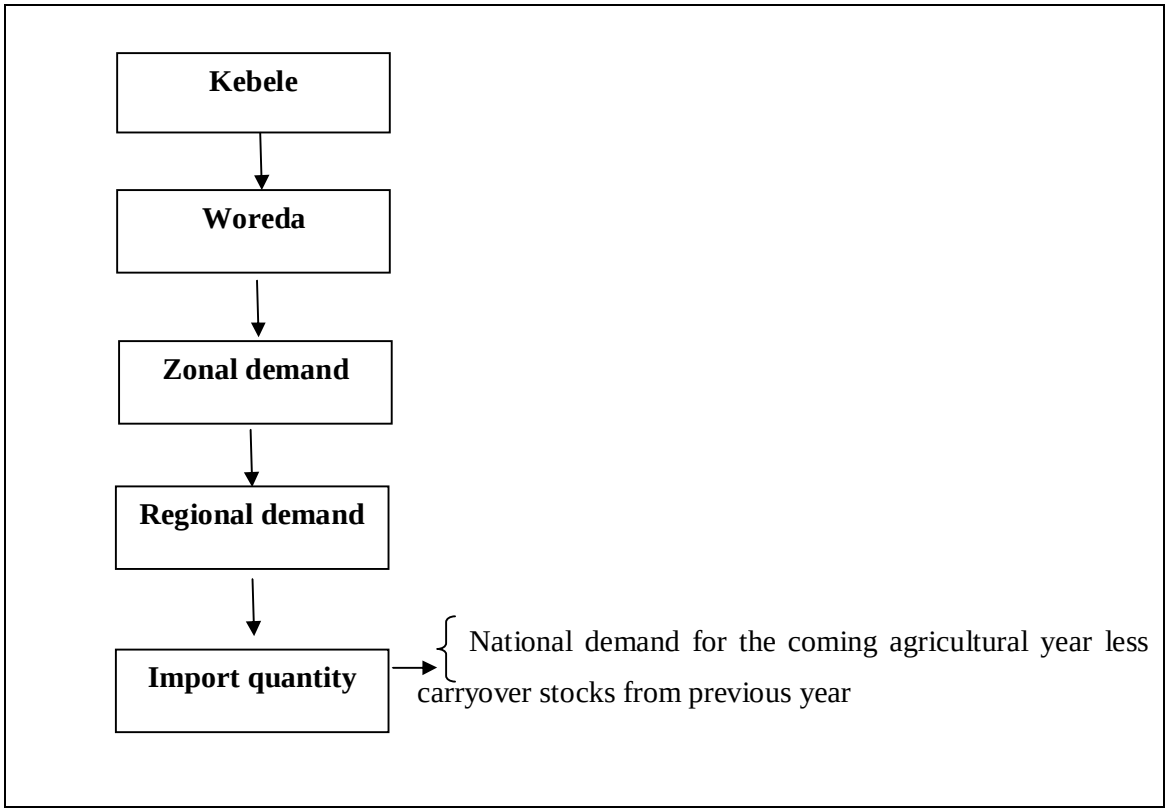
2.2 VALUE CHAIN OF FERTILIZERS IN ETHIOPIA

Kaplinsky et al., (2000), describes a value chain as a full range of activities required to bring a product or service through the different phases of production, including physical transformation, the input of various producer services, and response to consumer demand. The fertilizer value chain in Ethiopia involves numerous actors who perform three broad sets of activities. These are import planning, import execution and marketing and distribution.

The import planning begins with a demand assessment, conducted by the woreda (district) agricultural bureau based on primary data collected with community surveys by the extension workers, called development agents. Some primary cooperatives also conduct demand assessments. The estimates by the development agent and cooperatives are reconciled by the woreda bureau offices and then sent to the zonal offices. The zonal offices aggregate woreda-level data and then send the estimates to the Bureau of Agriculture and Rural Development (BoARD). Since the adoption of the Growth and Transformation Program in 2010, production targets set by the program over a five-year plan are also factored in when

finalizing the estimates at the Bureau of Agriculture offices. Finally, the Ministry of Agriculture and Rural Development aggregates the regional estimates and comes up with the national demand estimates. The net import requirement is determined by deducting the previous year's carry-over stocks from the current year's demand as shown in Figure 2.1 below.

Figure 2.1 Fertilizers demand estimation process



Source: IFDC, 2012

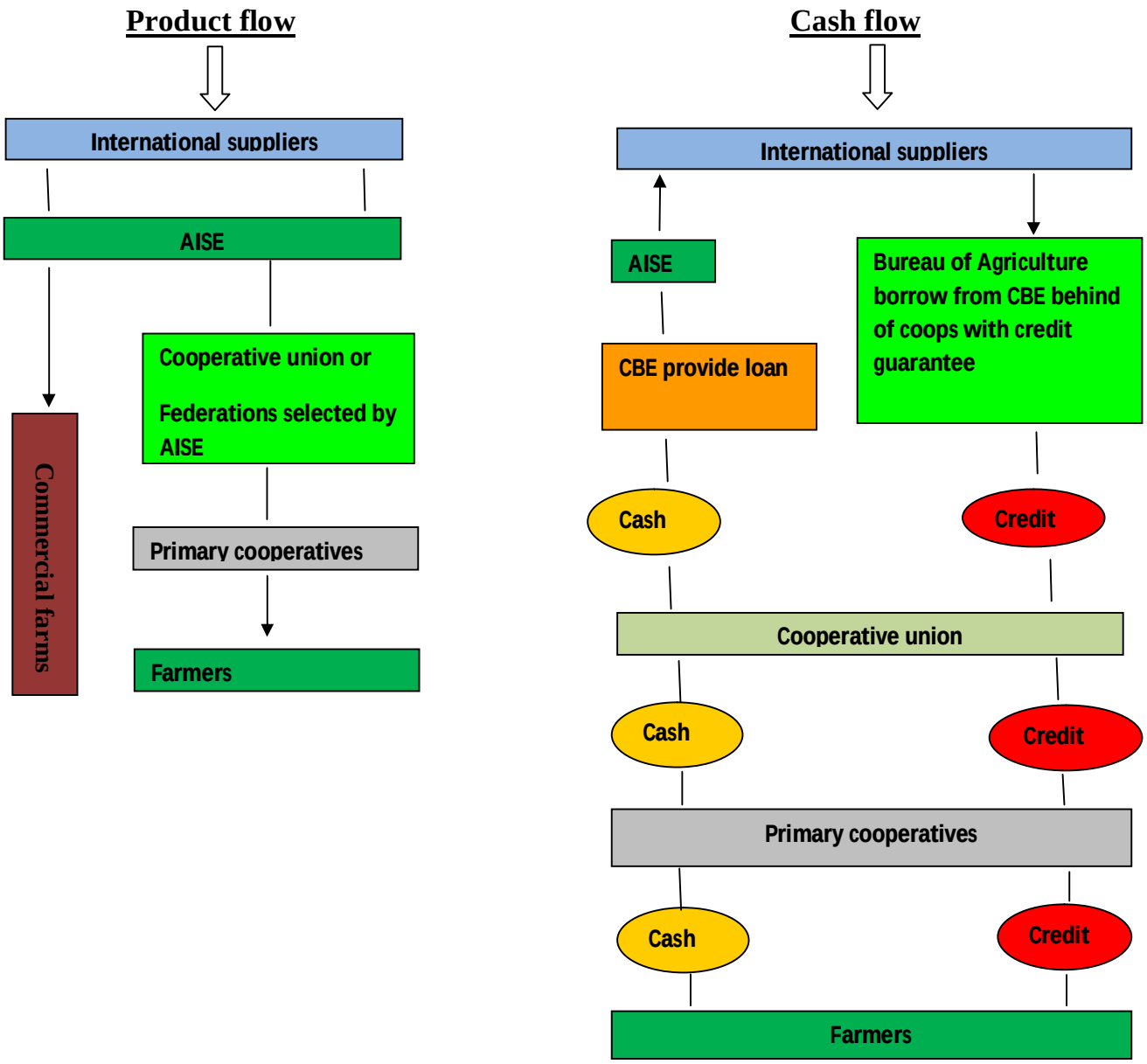
In executing the imports, the Ministry of Agriculture (MoA) prepares tender documents and invites a consortium of public institutions (Ministry of Finance and Economic Development, National Bank of Ethiopia, Commercial Bank of Ethiopia, and Quality and Standard Control Office) to review and approve the projected demand, necessary foreign exchange requirements, and opening of international procurement tender. As indicated previously, since 2008, the execution of imports has been carried out exclusively by AISE. The logic for

giving monopoly power to AISE is to take advantage of economies of scale. The idea is simple: Importing in large quantities gives a buyer more bargaining power to negotiate lower prices. In addition, large-scale imports can arguably reduce transaction costs and make value chain management more efficient. A recent MoA report argues a discount of 2–4 percent per ton could be obtained for a bulk purchase of 25,000 metric tons (MT) or more (Ethiopia, MoARD 2012). However, this is hard to validate. In 2011, several regional cooperative unions wanted to break out of AISE and requested the MoA to import fertilizer by forming a regional federation of cooperatives. The MoA, however, decided that allowing three or more cooperative federations to import would inefficient. Therefore, the AISE was nominated again as the sole importer of fertilizer on behalf of farmers' cooperative unions. After imported fertilizer arrives at Djibouti port, the AISE informs the regional cooperative unions to transport the consignment to the central warehouses. The cooperative unions determine where to store it, depending on the storage capacity. The option given first priority is to deliver fertilizer directly from the Djibouti port to the warehouse of the cooperative unions. If the unions do not have storage capacity or are not ready to receive the shipments, AISE stocks fertilizer in its central warehouses. From central warehouses, the union distributes to the primary cooperatives, from which farmers can get direct access to buy. In regions that have no cooperative unions or are inaccessible, AISE takes the responsibility to deliver, with primary cooperatives acting as a wholesaler. The BoARD plays an active role in the marketing and distribution of fertilizers. This includes facilitating the input credit guarantee to the Commercial Bank of Ethiopia, providing transportation facilities if needed, and ensuring on-time delivery of fertilizer. The BoARD is also involved in the determination of prices and margins. The AISE determines weighted average price of fertilizer at the central warehouse level. The BoARD then adds margins (both for unions or federations and for primary cooperatives) and determines loading and unloading costs, warehouse rent, bank

interest rates, and other administrative costs. The regional BoARD officials determine price in each region is made in consultation with the unions. In Tigray and SNNPR, price coordination between the Bureaus of Agriculture at the regional level and cooperative unions is either through strong guidelines (in Oromia) or exchange of information (in Tigray, Amhara, and SNNPR) in fertilizer distribution to the primary cooperatives. In all regions, priority has been given to areas where the cropping season starts earlier and also to zones that are determination is done twice a year for meher (the main cropping season) and belg (minor season in selected areas from February to May) seasons. The meher season prices are set by taking into account the weighted average prices of carry-over stock and compensating for storage and other administrative costs and new import. The belg season prices (September–April) are set using the meher season price plus the bank interest and administrative costs. Figure 2.1 below shows product and cash flow with all actors involved in the value chain. To import fertilizer through AISE, the regional governments offer credit guarantees for cooperative unions. The payments to AISE are processed through two instalments, first during opening of the letter of credit, and second, upon arrival of fertilizer at the Djibouti port. The primary cooperatives receive fertilizer on credit from unions and sell mostly in cash to smallholder farmers. However, in remote and food-insecure areas of Amhara and SNNPR, farmers can receive fertilizer with a 50 percent down payment with the understanding that the remainder be paid after the harvest. Other sources of credit include microfinance and rotating savings and credit unions. Estimates from the EAHMS survey suggest that 60 percent of the farmers borrowed money to purchase fertilizer. The long chain of money transactions has some serious problems, especially with regard to accountability and incentives. Since the BoARD provides credit guarantee, banks have no risk in lending money. However, when it comes to credit collection, the responsibility lies with the cooperatives, with which BoARD has no authority. Besides, the BoARD does not have any incentives to increase collection

because the burden of defaults is shouldered by a guarantee scheme among regional governments.

Figure 2.2—Product and cash flows in Ethiopian fertilizer value chain



Source: IFRI discussion paper 01304 on fertilizer in Ethiopia, Rashid et al., 2013

2.3 SUPPLY CHAIN STRUCTURE OF FERTILIZERS IN ETHIOPIA

Low agricultural productivity of Ethiopia due to declining soil fertility, population growth and low level of commercial input is threatening the livelihood of the country. The use of yield enhancing technologies to increase production can help increase rural incomes and lead to agricultural transformation from a low income, low productivity, subsistence-oriented economy to one characterized by specialized, high input agriculture and a rise in rural incomes (Timmer, 1990). An agricultural transformation is usually necessitated by increasing population growth and increased land scarcity, which both put pressure on agricultural sector to adopt intensive, high-input technologies (Boserup 1961, 1981). The rising incomes that generally accompany the use of high input technologies, in turn, stimulate consumer demand for market goods and thus facilitate a structural transformation of the economy (Mellor, 1990). For over a decade, the Sasakawa-Global 2000 (SG) program, in partnership with African governments, has promoted the green revolution approach to development by introducing African farmers to high-input technologies such as improved seed and fertilizer. However, high cost of maintaining these input technologies became a constraint for promotion of productivity. The higher costs resulted from the increased transport cost and related charges to reach the final destination. Fertilizer is imported from abroad crossing neighbouring coastal country which results in substantial increase from world price.

The structure of fertilizer markets in Ethiopia has constantly changed since the mid-1990s when, following the fall of the Derg regime, the state monopoly on the distribution of fertilizer was lifted. By 1996, 67 private wholesalers and about 2,300 retailers handled roughly two-thirds of the fertilizer market (World Bank, 2006).This had changed. By 2004, a combination of companies with potential political affiliation and a public enterprise, the Agricultural Input Supply Corporation, dominated the wholesale market, with cooperatives

handling an increased share of the wholesale market by 2006 and fertilizer was distributed to farmers through a combination of extension agents, local governments and cooperatives and some private retailers. The changing structure of fertilizer markets came as a consequence of a government decision to promote “packets” of high-yielding seeds, fertilizers and extension services. Following a set of successful pilots, the approach was rapidly expanded under Ethiopia’s Participatory Demonstration and Extension Training System (PADETS). For the most part, the packets are sold on credit after a 10 to 35 percent down payment (DSA, 2006). Credit is extended through the Commercial Bank of Ethiopia through cooperatives, local authorities and micro-lending institutions, which also handle record keeping and the collection of interest and principal. Timely and adequate supply of fertilizer is one of the major problems reported by a significant proportion of the households surveyed in the 2004 round. More than 70% of the households reported that fertilizer is often supplied late and around 40% of the households reported that supplies were inadequate. The survey results also point to high fertilizer price and tight credit repayment schedules as problems that constrain fertilizer use. (World Bank, 2010).

2.4 SUPPLY CHAIN PERFORMANCE MEASURES

Measuring supply chain performance is necessary to identify the supply chain performance indicators that constitute the overall supply chain performance (Lambert and Pohlen, 2001 or Lebas, 1995). A supply chain performance indicator (SCPI) is understood as an empirically observable numerical reference or illustration that is relevant for the supply chain success of an organization (Neely, 2003; Lapide, 2000). SCPIs show regularly how well supply chain processes are executed and they can be expressed in absolute or in relative terms (Keebler et al., 1999). For the measurement of supply chain performance the efficiency or the effectiveness of an outcome of a supply chain activity is analyzed (Fugate et al., 2010).

Efficiency describes an input/output relation while effectiveness shows how well supply chain goals have been achieved (Bowersox et al. 2010). In this sense, supply chain performance can be seen as a function of the utilization of supply chain resources or as a function of supply chain results as compared to supply chain targets. There are basically three functions attributed to supply chain performance indicators (SCPI) (Morgan, 2004 or Lapide, 1999 or Gilmour, 1999): Information function in order to inform management, support decision making and to identify problem areas; steering function in order to set targets and give directions to desired outcomes; controlling function in order to supervise process execution. Overall, any supply chain manager has to ensure that a certain service level can be guaranteed to the customers and that this service level is achieved at minimal costs and at the highest quality level. The cost aspect includes the total costs for order management, storage and commissioning, inventory management and transport (Bowersox et al. 2010). The service level represents the intended relationship between the number of orders received and the number of orders executed, while the quality level refers to the way of how the orders are executed. Service quality includes the reliability of the service performance including the quality of the shipment and the quality of the delivery as well as the availability of the supply chain service (Chopra and Meindl, 2007 or Mentzer and Konrad, 1991).

A performance measure or a set of performance measures is used to determine the efficiency and effectiveness of an existing system, or to compare competing alternative systems. Performance measures are also used to design proposed systems, by determining the values of the decision variables that yield the most desirable level(s) of performance. Available literature identifies a number of performance measures as important in the evaluation of supply chain effectiveness and efficiency (Schrettle et al, 2013).

Evaluating the performance of supply chain of a product is not an easy task as there are wide range of performance measures and dimensions (Bain, 1968; Sosnick, 1964; and Brandow, 1977). According to these authors, some of the key performance criteria of the fertilizer subsector were to be reduced costs in the sector, price transparency, timely delivery, adequate supply, product suitability and adequate level of profit rates.

More broadly, production decisions should be responsive qualitatively and quantitatively to consumer demands (demand equals aggregate supply, and the sector is low-cost; operation of producers should be progressive; that is, there should be increased output per unit of input over time; operation of producers should facilitate stable, full employment of resources) (Scherer, 1980).

2.5 THE MODERN CONCEPTS OF SUPPLY CHAIN OF FERTILIZERS AND COMPARISON WITH ETHIOPIAN CONTEXT

According to Handfield and Nichols (2004), successful supply chain management is extremely complex because of large number of players with varying interest or objectives are involved. Though the supply chain of each company has its own unique features, the following general principles help in management of supply chains. These are: begin with the customer, manage logistic assets, and organize customer management, integrate sales and operations planning, leverage manufacturing and sourcing, focus on strategic alliances and relationship management and finally develop customer driven performance measures,

A significant new trend has been evolving in logistics management in the last decades. One that involves the collaboration of all participants in the supply chain in order to reduce the cost of total logistics system. It has been referred to as "Supply Chain Management",

"Logistics Partnership" or "Inter-Corporate Logistics Management". In traditional Logistics "total cost concepts" model, companies worked to manage logistics as an entity and to lower the total logistics costs to the organization. The model evolved balancing trade-off among production run lengths, inventory, transportation, and warehousing and customer service. Later an increasing number of companies realized that though the total cost concepts might be useful, it is tainted because it does not consider the efficiency of the entire supply chain. The supply chain management on the other hand involves the active collaboration of two or more participants in the supply channel (Supplier, manufacturer, distributor, and/or customer) to manage all the logistics resources in the most efficient manner possible. (Handfield and Nichols (2004).

The concept of "quick response" gained broad favour as companies in all parts of supply chain developed an appreciation of its potent benefits. Quick response involves the integration of the supply chain, effectively linking retailers, suppliers (manufacturers/ distributors) and carriers in close communication and integrated decision making. Key elements of quick response include: point-of-usage data capture, rapid Communication, partnerships, discipline and commitment. Effective quick - response systems' benefits include lowering inventories by as much as 40 percent, improving in-stock availability significantly, cutting transaction and administrative costs in to half, reducing replenishment lead to a third or less of their former levels, identifying slow-selling items sooner, and reducing operating costs for all players in the supply chain.(Christopher, M. and Peck, H., 2003)

Supply chain management strategy involves determination of what performance criteria the logistics system must maintain - more specifically, the service levels and cost objectives the logistics system must meet. As cost and service normally involve a trade-off, a company must consciously consider that trade-off and determine the desired supply chain performance. This

process involves consideration of the company's strategic objectives, its specific marketing strategy and customer service requirements and its competitors' cost service position.

Supply chain planning involves the development and management of all logistics resources in order to attain the desired cost-service performance consideration, it might include number and location of warehouses, type of warehouses, mode and carrier selection, inventory position, inventory levels, order entry technologies, information system etc. Opportunities for differentiation - based on operational, logistics, or customer services excellence are more likely to be exploited. Supply chain management tends to have a more visible and more important role in the Company. Investments in the supply chain function or infrastructure are more likely to be approved.

Just - in - time (JIT) Logistics: It is useful to classify JIT programs into two categories, JIT production and JIT logistics. These programs typically focus on the reduction of set up funds for key operations, the reduction of lot size, and the enhancement of quality - all leading to lower work - in - progress inventories. JIT logistics programs, on the other hand, apply JIT principles to the management of raw materials, inventories and beyond supplies. For JIT logistics plans to work, four `Pillars' must be in place. They are: stable production schedules, efficient communication, co-coordinated transportation and quality control. (Amir, 2011: 288; El-Tawy & Gallear, 2011: 817)

These four principles are critical to the integrated management of suppliers. The 1990s have been called the "decade of customer service". All industry sectors are placing a premium on quality, including quality customer service. Serving customers as they want to be served and "making company easy to do business with" is competitive objective for the next millennium. At the same time the meaning of effective customer service is changing, and companies must meet an increasingly higher standard. Customer Service Pyramid is an effective framework

for formulating a customer service strategy in a fluid marketing environment. (Aitken, J, 1998)

The last decade of this century has seen many significant changes. The important ones are: the end of cold war, breaking up of the former USSR, formation of trade blocks (EU, ASEAN, NAFTA, etc.), emergence of World Trade Organization, and globalization of World Economy. Feasibility of global sourcing and marketing of quality products and services at competitive prices in the world market have called for serious re-look into the logistics functions in such industries as steel, cement, fertilizer, chemicals, petroleum, etc., where logistics cost forms a significant component of the cost of goods sold. Gyulaet. al. (1994) And Scully and Fawcett (1993) gives details on global manufacturing. Based on a survey of Loon Major European companies, Kearney (1995) observes that logistics function is becoming more demanding and complex as the business environment itself is becoming complex and demanding. According to this author, the critical factors responsible for demanding logistics management are: escalating customer expectations and demand, cycle time compression, global sourcing, global market, corporate restructuring, supply chain partnership, productivity pressures and environment awareness.

Though supply chains have existence since the beginning of civilization, this name and associated approach to looking at the issue is new. The focus so far in the area has been to look at different aspects of the supply chain such as procurement, storage, production, distribution etc, separately and there are different specialists for each. An integrated view of the links as parts of a supply chain is of quite recent origin. Therefore, when one changes the focus from different functional areas to the supply chain concept, some fundamental issues arise that need to be addressed.

The entities of the chain or the departments of the supply chain become dominant and try to form sub-goals and achieve them at the expense of the total supply chain goal. Different entities in the supply chain have different strength. This leads to a condition that the chain is only as strong as the weakest link. The extra money spent in making some areas of the supply chain very strong is wasted because this extra strength does not in practice contribute to the operation of the total supply chain significantly. In a chain if two adjacent rings are not connected the chain is not one but two. The same is the case with the case of a supply chain where strong connections between adjacent links are vital for its existence and functioning. These are called supply chain disconnects. The presence of a loop or a cross-link in the supply chain creates multiple paths to choose from one end of the chain to another. At each such loop or cross-link the conditions under which each path should be taken should be spelt out clearly.

Looping and cross linking of supply chains create many information flow problems, information about the same thing coming from different links might not be at agreement. It has been found that in most supply chains there are people to study and look at the individual departments, because of the organizational structure followed, but almost no one looks at the supply chain as such in total. It is the performance of this complete chain that ultimately matters.

Ethiopia is land locked country and the movement of the import and export commodities depends on parts of neighbouring coastal countries. There are four main ports that are currently accessible to Ethiopia for foreign trade. Djibouti port is the primary port that currently comprises about 93% of the import–export flow of commodities (Afro Consult& trading plc, 2010). The other three, Berbera, Mombasa and Port Sudan are optional ports that are not as viable as that of Djibouti port in current situation.

Fertilizer marketing in landlocked countries is a low margin and a high risk commodity. Fertilizer transport costs are high because it is a bulky product and distances transported are great. In addition, risks are high in investing in fertilizer due to seasonality of demand, storage costs and bank interest incurred. Due to these factors and political importance of the provision of low-cost and stable fertilizer prices has usually meant heavy government intervention in setting prices and organizing distribution system. The seasonality of demand is also basic condition that plays out in shaping market structure. Stepanek (1998) stated that fertilizer is consumed primarily during the larger, meher season (roughly July to November), but also during the earlier belg (April to July). Most fertilizer is actually applied between March and July. All fertilizer consumed in a given season cannot be offloaded in the months immediately prior to distribution. Thus, coordination of imports required in order to ensure sufficient fertilizer supplies by scheduling over the quarters of a year. Stepanek (1998) also sorted out that organizational fertilizer market structures of all regions were almost similar but differing only in the number of wholesalers and retailers. In 1998, nationally, there were 7 large wholesalers (AISE, EAL, Fertiline, Guna, Ambasel, Dinsho, and Guna-5) and also worked as importers. However, only one to three companies may have operated in any zone. Primarily one company in Amhara: two companies in south; three companies in Oromia and Tigray.

By comparing the modern concept of supply chain of a product and narrowing down the practical experience of supply chain fertilizer in Ethiopia, this paper tried to show readers how the supply chain performance could be improved for the future practice and all the stakeholders could be benefited.

2.6 THEORETICAL FRAMEWORK

Agbaney et al., 2015 used supply chain analysis method to recognizes the supply chain of a product as the result of the interaction of many institutions that need to be identified and their roles and relationships well described in order to understand the structure of the chain. Supply chain analysis is comprised of two main stages mapping the chain and measuring chain performance. In this study major stakeholder in fertilizers supply chain of Ethiopia investigated to understand their roles and their performance measured mainly in terms of cost, time, quality, quantity, place, farmers involvement in demand determination, occurrence of stock out as independent variables and effective and efficient supply chain performance as dependent variable.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 RESEARCH DESIGN

The researcher planned to use analytical approach of research design named as supply chain analysis. This approach recognizes the chain as the result of the interaction of many institutions that need to be identified and their roles and relationships well described in order to understand the structure of the chain. Supply chain analysis is comprised of two main stages: mapping the chain and measuring chain performance. In mapping the chain, the chain functions, the main institutions and organizations identified and visualised to understand supply chain of fertilizers easily while in measuring chain performance, the performance assessed in terms of efficient and effective delivery of fertilizers. Efficiency in this context refers to whether the chain organization is able to deliver fertilizers with lowest cost possible. Effectiveness relates to whether farmers are provided with fertilizer within shorter lead time, better quality, appropriate quantity, in the right place and whether demand of fertilizers determined as per farmer's requirement.

The design enabled the study to combine both qualitative and quantitative research approaches. Qualitative approaches enables collection of data form of words rather than numbers. It provides verbal descriptions rather than numerical (Kothari, 2011). Mugenda and Mugenda (2003), states that qualitative methods can be used to gain more in depth information that may be difficult to convey quantitatively. Quantitative approach strives for precision by focusing on items that can be counted into predetermined categories and subjected to statistical analysis (Taylor,2013).The use of these two approaches reinforces each other (Zhu et al,2013). The research used this approach because the data collected used the main questionnaire was quantitative and was analyzed using descriptive statistics.

Qualitative on the other hand involve interpretation of phenomena without depending on numerical measurement or statistical methods (Styles et al, 2012). As noted in Creswell,(2009) mixed research is an approach that combines or associates both qualitative and quantitative research methods: Enables mutual collaboration of each other via the use of multiple sources of collecting data, contextualizes the analysis by providing richer details and initiates new lines of thinking through attention and surprises, turning ideas around and providing fresh insights. Following the assessment, the results discussed in the light of the modern business supply chain principles and recommendations provided to improve the supply chain performance and to give insight for other researchers to undertake further study.

3.2 POPULATION, SAMPLE SIZE AND SAMPLING TECHNIQUE

The population of the study comprises of actors from overseas suppliers of fertilizers up to final consumers, farmers. As per the scope this study, samples selected from main participants: importers, transportation companies, logistics service providers and farmers. Since the sample frame is not available, non probability sampling techniques was used. Among the non probability sampling techniques, convenience sampling technique was selected because the research used respondent that are available at a certain specific time and place. From sole importer of fertilizers, employees who are key participants in the supply chain of AISE were interviewed; as fertilizer imported in unimodal mode of import, managers from ESLSE were interviewed to get as much information as possible regarding Djibouti port handling, transportation and customs clearance; management team of Trans Ethiopia PLC interviewed to assess transportation issues and for the researcher convenience, oromia region selected to assess the use of fertilizers and agricultural office experts, farmer's unions and farmers investigated regarding fertilizers consumption by taking samples from

four woreda's; Sululta, Sebeta, Holeta and Bishoftu Woreda's found surrounding Addis Ababa as shown in Figure 3.1 below.

Figure 3.1. Map of study area

According to oromia region agricultural office, a total of 47,570 farmers found in the area and by using sample data determination mechanism, the sample size needed are 384 with 5 confidence interval and 95% confidence level as shown below.

$Ss = \frac{Z^2 * p * (1-P)}{C^2}$

Z = 95% = 1.96 from Z table

P = .05

C = 5% = .05

Where: Ss = Sample size

Z = Confidence level

C = Confidence interval

P = the largest possible proportion

$Ss = \frac{3.8416 * 0.5 * .5}{.0025} = \mathbf{384}$

By dividing the sample size into four approximately 100 questionnaires distributed to each Woreda and the data collectors translated the English version of questionnaires into local

language and collected primary data from farmers and a total of 300 fully answered questionnaires selected for analysis which is a response rate of 78%.

3.3 TYPES OF DATA COLLECTED

The study used both primary as well as secondary data. The primary data refers to data gathered from the respondents through interview and questionnaire while the secondary data collected from past records like brochures, books, magazines and journals that deal about supply chain management in general and supply chain analysis of fertilizers in Ethiopia in particular.

3.4 METHODS OF DATA COLLECTION

Primary data

The primary data gathered through distributing the questionnaires filled by each actor in the chain as well as from focus group discussion, interviews with managers or team leaders in the main institutions involved in supply chain of fertilizers in Ethiopia including Agricultural Input Supplies Enterprise (AISE), Ethiopian shipping and Logistics Services Enterprise (ESLSE), oromia regions agricultural officer workers and farmers and 4 data collectors including the researcher translated the questionnaire to farmers to get data with regard to fertilizers final consumption.

Secondary data

Secondary data collected from related articles, books, publications and stakeholders records such as Ministry of Agriculture, Agricultural Input Supply Enterprise, Ethiopian Central Statistical Agency, primary farmers' cooperative, Ethiopian Transport Authority, National Bank of Ethiopian.

Pre-Test

Before conducting the main survey, a pre-testing (pilot study) conducted to validate the instrument. According to Zikmund (2003, p. 359), a pre-testing study provides an opportunity for the researcher to determine whether the respondents has any difficulty understanding the questionnaire. The pre-test affords an opportunity to check whether there are any ambiguous or biased questions. The pre-testing study administered on 25 farmers selected on a convenience basis and 17 questionnaires responded fully which was good response rate (68%) and slight changes made on questionnaire after conducting pre-test.

Reliability analysis

Testing goodness of data is testing the reliability and validity of the measures. According to Ticehurst and Veal (2000), reliability is the extent to which research findings would be the same if the research were to be repeated at a later date, or with a different sample of subjects.

In other words, the reliability of a measure indicates the extent to which the measure is without bias (error free) and hence offers consistent measurement across time and across the various items in the instrument. It helps to assess the goodness of measure, and indicates accuracy in measurement (Sekaran, 2003).

This research used consistency reliability that is the Cronbach‘s alpha by using SPSS and has been used to identify the validity of items used in survey. According to Sekaran (2000), reliabilities less than 0.6 are considered to be poor, those in the 0.7 range, acceptable, and those over 0.8 good and in our case the Crobach’s Alpha if item Deleted all the variables is greater than .94. The closer the reliability coefficient gets to 1.0, the better. According to Hendrickson et al (1993) and McGraw and Wong (1996) the alpha of a scale should be greater than .700 for items to be used together as a scale. Therefore minimum 0.700

coefficient alpha values accepted to finalize the item validity. As per shown in Table 3.1 all the variables have appropriate reliability.

Table 3.1 Scale Reliability (Cronbach Alpha) for fertilizers supply chain factors

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Farmers involvement in fertilizers demand determination process	18.18	53.654	.945	.947
High quality of fertilizers delivered to farmers	16.53	50.015	.864	.948
Quantity of fertilizers delivered to farmers	17.82	45.779	.907	.946
Timely delivery of fertilizers	18.12	47.735	.884	.947
Place of delivery of fertilizers	16.59	48.757	.827	.952
Price of fertilizers	18.94	57.559	.749	.960
Occurrence of fertilizers stock out	16.65	50.118	.906	.945

3.5 METHODS OF DATA ANALYSIS

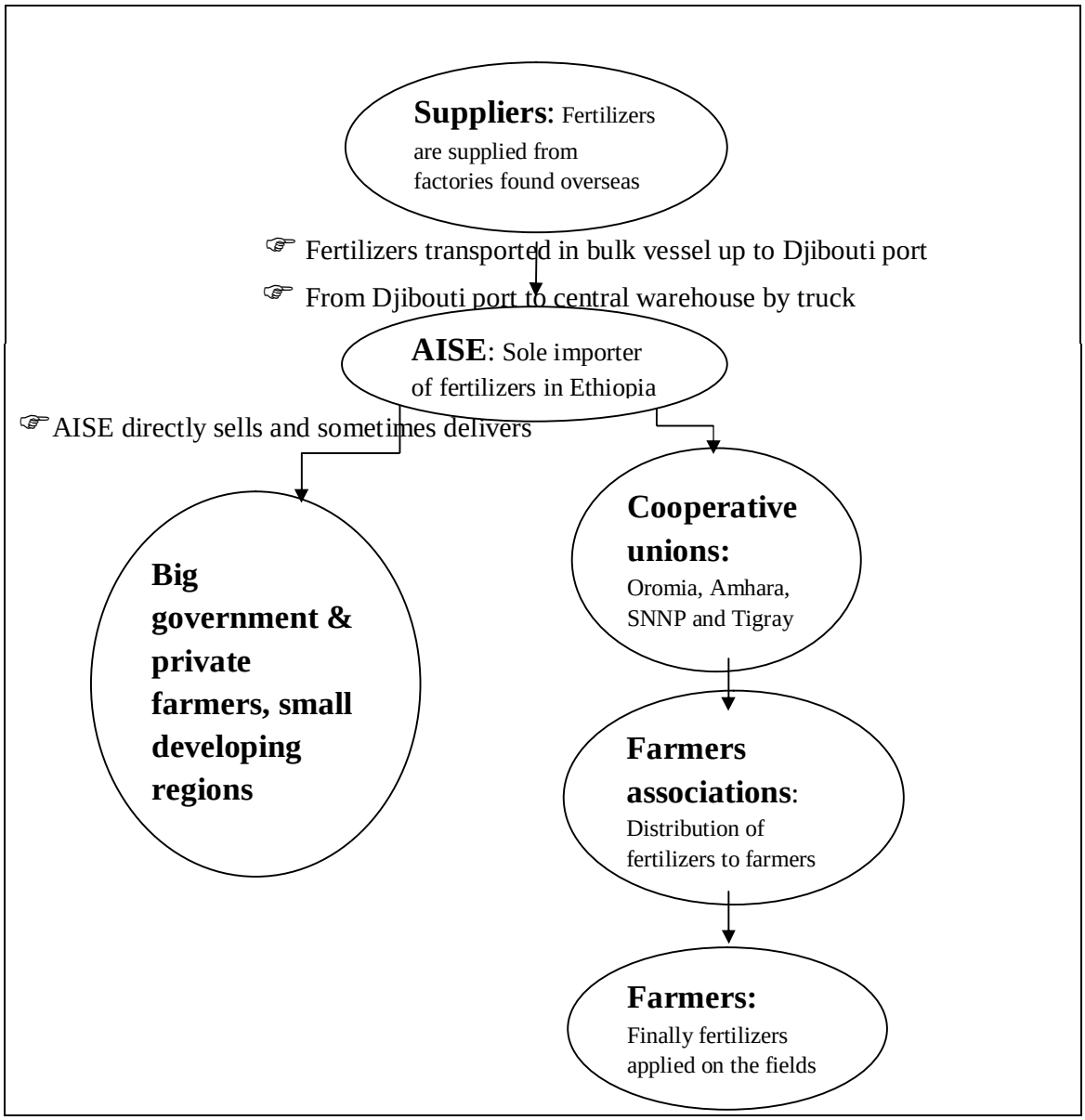
The collected data analyzed and interpreted by using both qualitative and quantitative data analysis techniques. The data collected by interview responses analyzed qualitatively. Thus closed ended questionnaires analyzed quantitatively by using tables and percentages. The quantitative data analyzed using Microsoft Excel and SPSS software version 20.0.The data gathered via the likert scale coded, encoded and analyzed using descriptive statistics to interpret demographic data of farmers and summarize farmers response with regard to fertilizers consumption level into frequency tables and inferential statistics was used to check the correlation between supply chain performance indicators with that of efficient and effective supply chain of fertilizers in Ethiopia.

CHAPTER FOUR

DATA COLLECTION, ANALYSIS OF RESULTS, INTERPRETATION AND DISCUSION

4.1 MAPPING THE SUPPLY CHAIN OF FERTILIZERS IN ETHIOPIA

Figure 4.1. Supply chain of fertilizers in Ethiopia



Source: Authors illustration

4.2 KEY FERTILIZERS SUPPLY CHAIN ACTORS WITH THEIR CHALLENGES

Agricultural inputs Supply Enterprise (AISE)

As the per the interview administered with Ato Shibiru Demissie, Agricultural Inputs Marketing Directorate Director, AISE as sole importer of fertilizers in Ethiopia and main role players in the chain has three major roles including:

- Supply agricultural inputs by purchasing from local and international suppliers
- Price stability
- Work agricultural related works

In general, Process of importing fertilizers commences by receiving demand of fertilizers from MOA and AISE prepares bid document and post in advertisements, bid document opened in the presence of suppliers and evaluated as per document and approved by MOA, the winner received award and contract signed, supplier provide performance bond and Performa invoice, cargo insured by local insurance company from suppliers warehouse until final delivery, ESLSE issue a waiver letter to ship fertilizers in any available shipping company other than ESLSE because it doesn't have a vessel which transports bulk shipments, Letter of credit (LC) opened at the bank and same notified to suppliers and its advising bank to start loading process, get delivery order (DO) from bank and submit together with other copy docs to ESLSE to open operation, once the vessel arrives Djibouti get berth and discharge, bagging and loading on truck happens at the same time. In the mean time AISE get transporters list from ministry of transport and select some larger transporter by competitive bidding, similarly inspection surveyor companies selected to undertake survey at port of loading and discharge and contract signed with winners; AISE follow up delivery of fertilizers as per the encoterm agreed with suppliers and logistics service providers and then

closing of foreign currency with national bank not to be included in delinquent list and finally make sure payment done from regions. The company in collaboration with MOA set the price of fertilizers to the four main regions but for other smaller regions and big government and private farms, AISE set the price by marking up smaller margins.

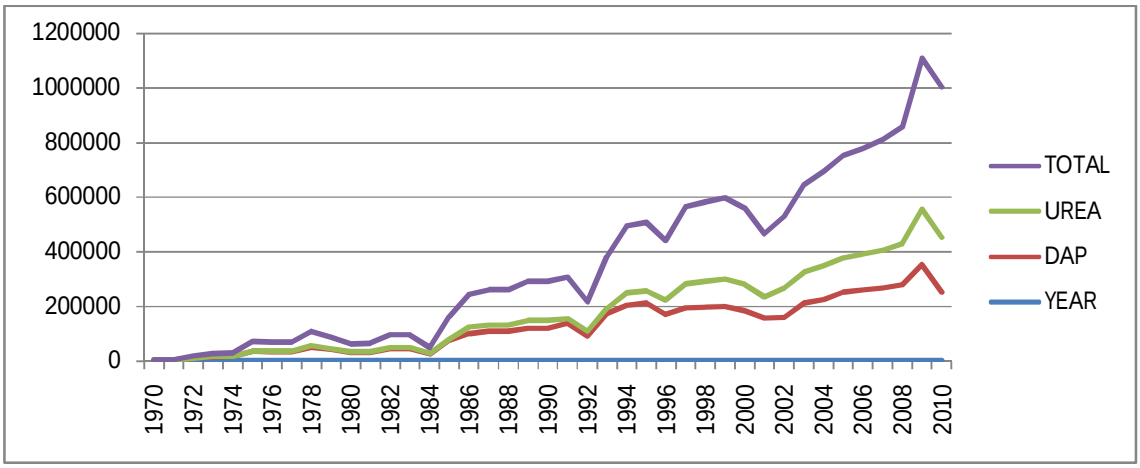
As it clearly shown in Table 4.1 and figure 4.2 below, the import of fertilizers in Ethiopia has increased from year to year and farmers demand more fertilizers when they get better yield and better supply chain performance is required from all actors to satisfy this high demand of professional and logistics coordination.

Table 4.1. Fertilizers import trend of Ethiopia per MT (1970-2010 G.C)

Year	DAP	UREA	TOTAL
1970	811	136	947
1971	1,744	303	2,047
1972	7,666	710	8,376
1973	12,413	667	13,080
1974	13,209	770	13,979
1975	33,636	1,409	35,045
1976	32,535	1,455	33,990
1977	32,217	1,717	33,934
1978	48,277	6,010	54,287
1979	40,742	2,545	43,287
1980	29,668	1,444	31,112
1981	30,255	1,418	31,673
1982	42,047	4,737	46,884
1983	42,147	4,737	46,884
1984	22,296	1,823	24,119
1985	74,345	1,918	83,263
1986	99,076	22,196	121,272
1987	107,108	22,404	129,512
1988	107,011	22,460	129,471
1989	117,866	27,843	145,709
1990	117,392	27,843	145,709
1991	135,467	17,191	152,658
1992	90,109	17,348	107,457
1993	170,000	20,000	190,000
1994	202,312	44,410	246,722
1995	209,883	43,629	253,152
1996	168,623	51,808	220,431
1997	193,395	87,976	281,371
1998	195,345	94,919	290,264
1999	197,345	100,562	297,907
2000	181,545	98,057	279,602
2001	155,941	76,329	232,270
2002	157,955	106,394	264,349
2003	210,837	112,105	322,942
2004	224,819	121,735	346,554
2005	251,156	124,561	375,717
2006	259,020	129,121	388,141
2007	265,768	138,988	404,756
2008	278,239	148,437	426,676
2009	352,309	201,576	553,885
2010	250,233	200,345	550,575

Source: Ministry of Agriculture (MOA)

Figure 4.2 Fertilizers import trend of Ethiopia per MT (1970-2010 G.C)



Source: Authors illustration based on data from MOA.

AISE use unimodal mode of shipment to import fertilizers, that is, bulk fertilizers shipped up to Djibouti port and bagged directly from vessel berth and loaded to trucks directly and the enterprise coordinates the operation by collaborating with ESLSE that handles port handling and dispatch of trucks from Djibouti and various transporters until it reaches to central warehouse to the four bigger region; Oromia, Amhara, Tigrai and SNNP (Southern Nations, Nationality, and Peoples') regions. AISE receive smaller profit margin from each regions for providing this service. The distribution of fertilizers from central warehouse until final farmers have been done by cooperative unions (CU) found in each region. But AISE sells fertilizers directly for farmers not organized in unions like that of Afar, Benishangul Gumuz, Ganbella and Somali regions, big government farms and NGOs where AISE determines the demand by doing its own survey.

AISE selects transporters by floating local competitive bid and relatively bigger transport owners association like Trans Ethiopia PLC, Tikur Abay cross boarder transport, Comet transport, Bekelcha freight transport among others, compete and AISE choose some of them and give award by assigning a quota to each transporters, this is because as the shipment is

very huge, more than 500,000 MT annually and fertilizers should be loaded out from Djibouti immediately not to pay extra port demurrage charges.

Ato Shibiru pointed out that AISE had been the only government institution competing with 2 private companies and 11 cooperative unions named as Guna, Ambassel and Dinsho but since 2007/08 calendar year, AISE has been sole importer of fertilizers because the total cost of fertilizers will be minimal as a result of bargaining power of buyer is high for larger volume of purchase and operational cost also will decrease due to benefit of economics of scale in charges like sea freight, loading/ unloading, inland transportation, warehousing among others.

The major challenges in fertilizers supply chain according to the director include:

Foreign currency problem: There are times AISE faced foreign currency problem for example this year government purchases huge amount of wheat to combat drought occurred and the country faced big foreign currency to purchase fertilizers and for other commodity imports and such problem usually solved by close discussion of MOA and MOFED.

Storage facility: no enough storage fertilizers and currently fertilizers have been stored in private houses and liable for theft and spoilage.

Stock out: Demand estimation problem and stock out occur and when farmers sometimes get favourable conditions to harvest land.

Supplier performance: Not much supplier performance problem only when new suppliers win the bid and they become confused with the high documentation and customs formalities while most of the suppliers accomplish as per the contract agreement.

Customs process: Delay in Customs process and so many documentation formalities.

Labourer's problem: Labourers don't have capacity and capability to handle huge shipments and truck detention and so many problems occur during offloading.

Ethiopian Shipping and Logistics Service Enterprise (ESLSE)

According to W/ro Eskedar Behailu Amare, Manager, Import and export division manager; ESLSE has significant role in prioritizing vessel discharge and loading of shipment at Djibouti when vessel carrying humanitarian aid, construction materials, project materials and fertilizers arrives at the same time; prioritizing usually done in participation of ESLSE, Ethiopian Embassy at Djibouti, Maritime affairs authority and Djibouti port.

ESLSE by taking the job from AISE handles port clearance, following vessel arrival, discharge, trucking and dispatch, local customs clearance and delivery up to respective central warehouse of the four regions; Oromia, Amhara, Tigrai and SNNP (Southern Nations, Nationality, and Peoples') regions. The enterprise need only two days to get ECD (Ethiopian customs declaration or transit permit) this is a document sent to Djibouti to load the cargo from Djibouti port to customs check point for inspection by Ethiopian standard agency and Ethiopian Revenue and Customs Authority.

W/ro Eskedar also pointed out that all stakeholders including ESLSE have to participate to mitigate problems like transportation, foreign currency, port congestion and infrastructure. She gave a counter example that there have been situations when vessel stranded at Djibouti port waiting to berth and clearance and paying too much demurrage for more than 80 days despite the KPI (key performance indicator) set was 29 days and ESLSE has been trying such problem by collaborating stakeholders to give priority for fertilizers and government in the name of ministry of transport authority force truck owners not to load other type of cargo like construction materials, humanitarian cargos and privately owned commodities.

Trans Ethiopia PLC

By representing transporters, student researcher visited Trans Ethiopia PLC, one of the largest transport companies in Ethiopia owning about 500 heavy load trucks with a capacity of 40 tons load and the company use GPS tracking system in all of the trucks and the company can update clients the where about of the trucks in real time. Trans Ethiopia has been playing a major role in logistics activity of Ethiopia by transporting fertilizers, aid cargo, construction materials and other heavy load cargo since 1993.

With a warm discussion with Ato Mulugeta Halefom, Marketing and sales department head of the company, he explained that Trans Ethiopia has so many years of experience in transporting fertilizers from Djibouti to central warehouses, about a total of 20 destinations across the country. After getting the job of transportation from AISE by participating in open bidding and provide competitive freight rate and sometimes forced by government to assign trucks. The company accomplish the job as per the instruction from AISE and Ministry of Transport.

Ato Mulugeta also pointed out some of the challenges they encountered while transporting fertilizers are : issuance of gate pass at Djibouti port which ESLSE has to get a solution for it, long queue at Djibouti due to port congestion which is to be solved by Djibouti government to invest in port expansion, long queue at Mille and Galafi customs check point where ERCA has to assign competence employees and modern inspection machineries in each check point and last but not least truck detention at most of final destinations due to labour and warehouse shortage should be solved with regional states and cooperative unions.

Farmers

Farmers, large, medium or small, are the end customer and final consumers of fertilizers which pays for all the costs accumulated in supply chain. The researcher collected data from farmers found in four Wereda's found surrounding Addis Ababa in oromia regions also named by the region oromia Addis Abeba special zone by excluding Wolmera and Bereh Aleltu Woredas, the study conducted only on Sululta, Holeta, Sebeta and Bishoftu Wereda's. Experts in agricultural offices and farmers were interviewed using close ended and open ended questionnaire. As shown in Appendix B, farmers profile, the survey report in the study area shows, 80.3% are male, 68.7% of them are between 30-50 years old, 45% of them are married and 48.3 % has got 5 up to 10 children, 42.3% of them has estimated monthly income of less than 1000 birr, 32.3% are expected to be illiterate and 41% attended primary education level. Farmers profile directly or indirectly affect fertilizers consumption level and their bargaining power in supply chain of fertilizers in Ethiopia.

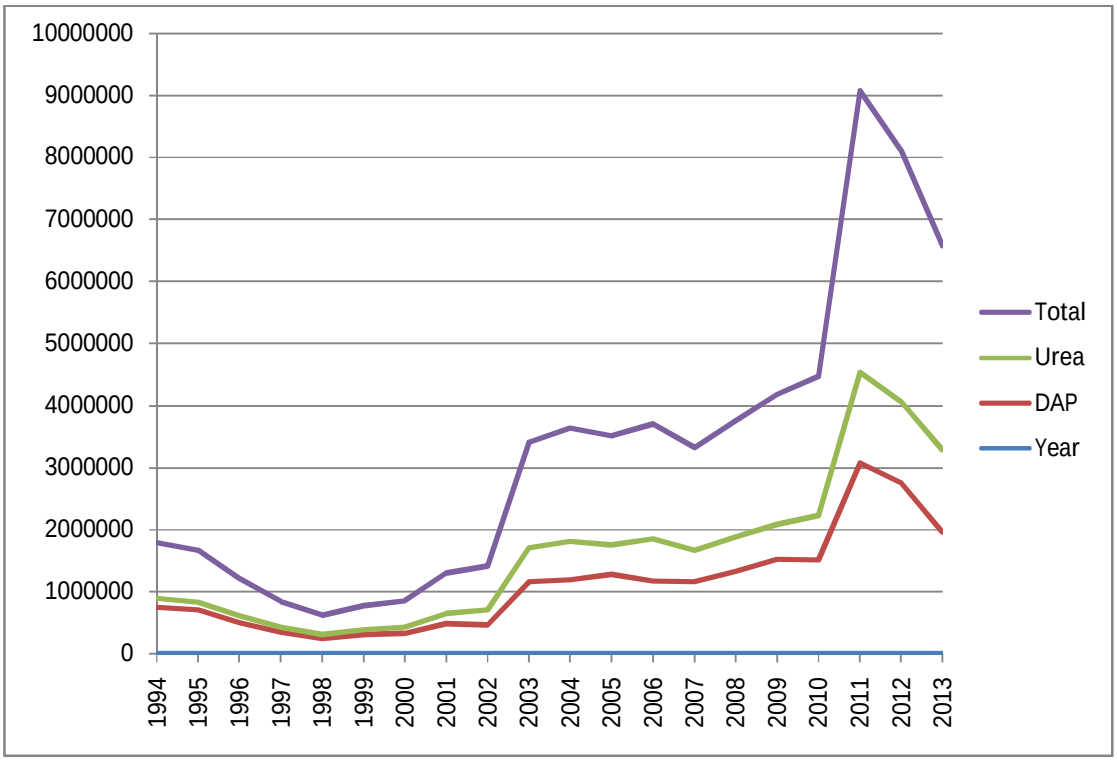
In general, Oromia region covers one third of the country's geographical area has got a total of 4,129,233 farmers, which holds the majority numbers of farmer's population in Ethiopia. There are 71,295 thousand farmers in oromia Addis Ababa special zone and out of which 47,530 thousand farmers in the study area and we have taken 384 samples and questionnaire interviewed with data collector. An approximate total of 400 farmers surveyed and the author selected 300 questionnaires with full response which is a good response rate of 78%.

TABLE 4.2. Fertilizers consumption trend in oromia region per Quintal (1994-2013 G.C)

Year	***DAP***	***Urea***	***Total***
1994	745,879.50	149,534.00	895,413.50
1995	705,758.25	128,550.50	834,408.75
1996	506,792.00	103,290.25	610,082.25
1997	344,883.50	78,485.50	423,369.00
1998	240,013.50	70,295.50	310,309.00
1999	310,487.50	75,194.50	385,682.00
2000	323,698.00	100,802.50	424,500.50
2001	480,164.00	167,856.00	648,020.00
2002	461,477.50	244,187.00	705,664.50
2003	1,167,121.00	536,499.00	1,703,620.00
2004	1,189,720.00	625,426.00	1,815,146.00
2005	1,282,276.50	473,423.00	1,755,699.50
2006	1,175,463.00	674,426.00	1,849,889.00
2007	1,165,527.00	498,925.00	1,664,452.00
2008	1,328,769.00	546,685.00	1,875,454.00
2009	1,525,620.00	561,067.50	2,086,687.50
2010	1,515,625.50	715,838.00	2,231,463.50
2011	3,075,248.00	1,459,877.00	4,535,124.00
2012	2,753,327.45	1,303,082.24	4,056,409.68
2013	1,960,534.05	1,323,247.10	3,283,781.15

Source: Oromia agricultural bureau.

Figure 4.3: Fertilizers consumption trend in oromia region per Quintal (1994-2013 G.C)



Source: Authors illustration based on data from oromia agricultural bureau

As shown in the above table 4.2 and figure 4.3 above, fertilizer consumption trend has been increasing in the past 20 years and Ato Meseretu Lemma from oromia agricultural bureau also pointed out that oromia region agricultural input utilization show progress with some drawback like left over of fertilizers, late delivery, low purchasing power of farmers and unavailability of warehouses. He also mentioned that they are trying to apply blended fertilizers (NPS, Zinc and Boron mix) instead of DAP since last year and farmers has been getting better yield.

As clearly shown in Table 4.3 below, the majority of farmers about 62.3% report that they received quality fertilizers and only 16.3 % of them reported the low quality of the fertilizer supplied and the rest are not sure whether fertilizers are quality or not. According to farmers,

when they receive old stocks of fertilizer, the quality in their opinion is lower than the quality of the new supplies.

Table 4.3 High quality of fertilizers delivered to farmers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly disagree	40	13.3	13.3	13.3
	Disagree	9	3.0	3.0	16.3
	Neutral	64	21.3	21.3	37.7
	Agree	78	26.0	26.0	63.7
	Highly agree	109	36.3	36.3	100.0
	Total	300	100.0	100.0	

Source: Survey report

With regard to involvement of demand estimation of fertilizers as shown in Table 4.4 below, most farmers 57 % disagree their involvement in demand estimation despite the fact that MOA collects data starting from each Kebele and most farmers in their opinion demand of fertilizers done on paper in Kebele office without consulting farmers in the field.

Table 4.4 Farmers involvement in fertilizers demand determination process

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly disagree	79	26.3	26.3	26.3
	Disagree	92	30.7	30.7	57.0
	Neutral	85	28.3	28.3	85.3
	Agree	32	10.7	10.7	96.0
	Highly agree	12	4.0	4.0	100.0
	Total	300	100.0	100.0	

Source: Survey report

Table 4.5 shows as most farmers 71.7% of them do not agree that the amount or quantity of fertilizers delivered to their respective kebeles as there are some times shortages and sometimes carryovers.

Table 4.5 Quantity of fertilizers delivered to farmers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly disagree	95	31.7	31.7	31.7
	Disagree	120	40.0	40.0	71.7
	Neutral	10	3.3	3.3	75.0
	Agree	32	10.7	10.7	85.7
	Highly agree	43	14.3	14.3	100.0
	Total	300	100.0	100.0	

Source: Survey report

As shown in Table 4.6 below, most farmers 65.3% of them agree that stock out occurs most of the time and this result also supported by above findings about quantity of fertilizers delivered to respective destinations.

Table 4.6 Occurrence of fertilizers stock out

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly disagree	39	13.0	13.0	13.0
	Disagree	10	3.3	3.3	16.3
	Neutral	55	18.3	18.3	34.7
	Agree	97	32.3	32.3	67.0
	Highly agree	99	33.0	33.0	100.0
	Total	300	100.0	100.0	

Source: Survey report

Most surveyed farmers 78.7% agree that fertilizers are delivered in the right place of delivery as indicated in Table 4.7 below while only 14% of farmers complain fertilizers not delivered in the right place this is due to according to farmer's poor accesses to the remote areas were resulting transporting fertilizer for longer distances with donkey and mules.

Table 4.7 Place of delivery of fertilizers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly disagree	32	10.7	10.7	10.7
	Disagree	10	3.3	3.3	14.0
	Neutral	22	7.3	7.3	21.3
	Agree	89	29.7	29.7	51.0
	Highly agree	147	49.0	49.0	100.0
	Total	300	100.0	100.0	

Source: Survey report

The main challenges of farmers with regards to agricultural inputs in general and fertilizers in particular are high price of fertilizers, infrastructure problem like road network, late delivery and distribution, apply fertilizers not as per soil requirement, unavailability of credit facility, no appropriate storage facility in farmers association which make fertilizers liable for theft and spoilage, farmers apply fertilizers but still productivity has been still low, other agricultural inputs like pesticides not ready at the appropriate time.

4.3 TOTAL SUPPLY CHAIN COST OF FERTILIZERS

The total cost of fertilizers accumulated while the fertilizers moves from supplier's up to end farmers include purchase cost, transportation (both sea and land leg), insurance, bank charge, bank interest, warehousing, inspection, clearing and transit cost, bagging and re-bagging costs, standard authority charges, spoilage and other overhead costs. Which interns have significant effect on ultimate price of fertilizers that farmers pay to buy fertilizers? Though this study could not capture all these costs to say the level of inefficiency in cost by each actor, the researcher used secondary data to show how significant is the difference between purchase price of fertilizers from suppliers and selling price to end user, farmers.

Table 4.8. Fertilizers total cost analysis by region, in USD per MT, 2012.

Cost Element	Tigray		Amhara		Oromia	
	DAP	Urea	DAP	Urea	DAP	Urea
CFR Djibouti	701.2	558.4	701.2	558.4	701.2	558.4
AISE price at central warehouse	805.2	655.3	804.4	654.4	792.9	643.3
Union price	815.4	665.5	811.7	661.7	806.4	655.2
Farmers purchase price	864	712	814	648	828	641
World market price	517	368	517	368	517	368
Difference b/n Farmers purchase price and World market price	347	344	297	280	311	273
Percentage increase from world market price to Farmers purchase price	67.12%	93.48%	57.47%	76.09%	60.15%	74.18%

Source: Authors calculation based on MOA/AISES (IFRI, 2012) and World Bank commodity price (2014) data.

As shown above in table 4.8 there is big difference between fertilizers world market price and farmers purchase price, a minimum of 57.47% increase in price of DAP in Amhara region and a maximum of 93.8% increase in price of Urea in Tigray region. All in all, farmers have been paying high price above 60% of the price of fertilizers which greatly affect the poor farmers of Ethiopia not to buy enough fertilizers and get better yield out of it. As shown below in Table 4.9, The high cost of fertilizers supported by the response of farmers surveyed responded 65 % highly disagree, 27.3% disagree for the question asked if fertilizers have been delivered to them with low cost and only 4.7% agree with low cost of fertilizers and the researcher concluded that the cost of fertilizers is too high that they couldn't afford to buy it and according to some farmers they choose to harvest their land without applying fertilizers rather than buying expensive fertilizers.

Table 4.9: Delivery of fertilizer in low cost

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly disagree	195	65.0	65.0	65.0
	Disagree	82	27.3	27.3	92.3
	Neutral	9	3.0	3.0	95.3
	Agree	8	2.7	2.7	98.0
	Highly agree	6	2.0	2.0	100.0
	Total	300	100.0	100.0	

Source: Survey report

4.4 LEAD TIME ANALYSIS

Various factors could contribute for this high cost of fertilizers: lack of coordination among stakeholders, inefficiencies across each supply chain actors, largeness of the distance the fertilizers originates from supplier up to end users, high port congestion at Djibouti port, using of only Djibouti port to move huge shipment like fertilizers, being landlocked of the country, involvement many stakeholders which don't add value, . . etc.

After AISE receive annual demand amount of fertilizers in August every year from MOA and the first vessel will arrive Djibouti starting from November of the same year as the letter of credit (LC) expiry duration is only three months, bank process, documentation, port handling, inland transportation and distribution of fertilizers take at list two months and summed up to an average of 6 months until it delivered to farmers. Half a year lead time is too long to procure and deliver fertilizers; throughout all this time, fertilizers incur storage, demurrage and overhead costs and also the quality of fertilizers could be affected during longer handling and transit time. According to personnel in Agricultural office of survey area, they are farmers who need to harvest different items throughout the year but fertilizers usually not ready to pick from the warehouse. For instance, government encountered foreign currency problem as too much wheat purchased from overseas to combat drought which makes late

delivery of fertilizers up to May or June, which negatively affects the main harvest season of farmers in June.

Table 4.10 Timely delivery of fertilizers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly disagree	123	41.0	41.0	41.0
	Disagree	71	23.7	23.7	64.7
	Neutral	30	10.0	10.0	74.7
	Agree	48	16.0	16.0	90.7
	Highly agree	28	9.3	9.3	100.0
	Total	300	100.0	100.0	

Source: survey report

As shown above in table 4.10, 41% and 23.7% of farmers with a total of 64.7% highly disagree and disagree respectively that fertilizers not delivered timely to the nearest warehouse and only 25.3% of the farmers agree that fertilizers are delivered on timely bases. Based on the data we can conclude that farmers do not receive fertilizers on time.

4.5 Correlation analysis

The statistical treatment of the study included the determination of the correlation between the supply chain performance indicators like timely delivery and low cost of fertilizers with each other and also with efficient and effective supply chain performance. These were made of Pearson‟s coefficient to determine the level of association. The level of association as measured by Pearson‟s co-efficient that falls between -1.0 and +1.0, which indicates the strength and direction of association among variables.

A correlation analysis with Pearson´s correlation coefficient (r) was conducted on all variables in this study for two purposes. On the one hand, it was used for conducting the

correlation analysis to explore the relationships between variables and one the other hand, to rank the variables that have the strongest influence on supply chain performance.

In order to interpret the strengths of relationships between variables, the guidelines suggested by Field (2005) were followed, mainly for their simplicity. His classification of the correlation efficient (r) is as follows: 0.1 – 0.29 is weak; 0.3 – 0.49 is moderate; and > 0.5 is strong. The bivariate correlation procedure was subject to a two-tailed test of statistical significance at the level of 95% significance, $p<0.05$.

The results of the correlation analysis are displayed hereunder in table 4.11.

Table 4.11 Correlation analysis among supply chain performance indicators and efficient and effective supply chain performance

	Timely delivery of fertilizers	Price of fertilizers	Farmers involvement in fertilizers demand determination process	High quality of fertilizers delivered to farmers	Quantity of fertilizers delivered to farmers	Occurrence of fertilizers stock out	Place of delivery of fertilizers	Effective and efficient supply chain performance
Timely delivery of fertilizers	1	.748**	.728**	.540**	.829**	.709**	.567**	.808**
Price of fertilizers	.748**	1	.564**	.297**	.559**	.455**	.337**	.775**
Farmers involvement in fertilizers demand determination process	.728**	.564**	1	.504**	.655**	.732**	.633**	.706**
High quality of fertilizers delivered to farmers	.540**	.297**	.504**	1	.645**	.818**	.675**	.464**
Quantity of fertilizers delivered to farmers	.829**	.559**	.655**	.645**	1	.728**	.578**	.633**
Occurrence of fertilizers stock out	.709**	.455**	.732**	.818**	.728**	1	.722**	.615**
Place of delivery of fertilizers	.567**	.337**	.633**	.675**	.578**	.722**	1	.526**
Effective and efficient supply chain performance	.808**	.775**	.706**	.464**	.633**	.615**	.526**	1

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Survey report

As shown in table 4.11 above, the correlation among each variable indicated that there has been statistically significant correlation among them. The highest correlation has been observed between timely delivery and quantity of fertilizers (r = 0.829), next, quality of fertilizers has been found to be statistically and positively correlated with occurrence of fertilizers stock out (r = 0.818). In the third place, farmers involvement in demand determination process is found to be statistically and positively correlated with occurrence of fertilizers stock out (r = 0.732). Similarly, the correlation between place of fertilizer delivery and occurrence of fertilizers stock out (r=0.722), between timely delivery and occurrence of fertilizers stock out was (r=0.709), between quality of fertilizers and place of delivery (r=0.675), between quantity of fertilizers and farmers involvement in demand determination process (r=0.655), between quantity and quality of fertilizers (r=0.645), between farmers involvement in demand determination process and place of delivery of fertilizers (r=0.633), between place of delivery and quantity of fertilizers (r=0.578), between timely delivery and place of delivery of fertilizers (r=0.567), between price and farmers involvement in demand determination process (r=0.564), between price and quantity of fertilizers (r=0.559), between timely delivery and quality of fertilizers (r=0.540), between quality and farmers involvement in demand determination process (r=0.504), between price and occurrence of fertilizers stock out (r=0.455), between price and place of delivery of fertilizers (r=0.337). And the least correlation was found between price and quality of fertilizers which has been (r=0.297).

All the supply chain performance indicators (statistically) and positively correlated with efficient and effective supply chain performance. Timely delivery of fertilizer (r = 0.808), followed by price of fertilizers (r = 0.775), farmers involvement in fertilizers demand determination process (r = 0.706), quantity of fertilizers delivered to farmers (r = 0.633), occurrence of fertilizers stock out (r = 0.615), place of delivery of fertilizers (r = 0.526) and quality of fertilizers (r = 0.464). All variables except quality of fertilizers have strong association with efficient and effective supply chain performance only quality of fertilizers has moderate association.

CHAPTER FIVE

CONCLUSION AND RECOMENDATIONS

5.1 CONCLUSIONS

Based on the results retrieved from both primary and secondary data, the researcher makes the following conclusions.

The major stakeholders in supply chain of fertilizers in Ethiopia are suppliers from overseas, AISE as sole importer of fertilizers, cooperative unions as retailers and farmers association and farmers as end users of fertilizers as shown in Figure 4.1 above. Besides the above mentioned stakeholders, transporters, ESLSE, Djibouti port, ERCA. Other regulatory and financial institutions play a major role for the worst and better supply chain performance of fertilizers in Ethiopia. All the stakeholders do their activity only and they don't usually work together to streamline the movement of fertilizers and the researchers observes lack of integrations and coordination among stakeholders.

AISE is the one and only one importer of fertilizers by holding all the ownership and risks pertaining to fertilizers imports. The main challenges the enterprise face are foreign currency problem, lack of storage facility throughout the country, delay in customs clearance and transit time and problem with labour force during loading and unloading of fertilizers. The enterprise use unimodal mode of shipment and using such mode together with port congestion and truck shortage become the main problem to incur higher surcharges like storage and demurrages in Djibouti port.

ESLSE is the only logistics service provider to AISE that handles port handling, customs clearance and delivery of fertilizers. The company encountered challenges like transportation, port congestion, foreign currency, delay in customs process and documentation requirement

and infrastructure problems are the major bottlenecks not to provide efficient logistics service.

Transporters that uplift fertilizers from Djibouti port to central warehouses and then to the respective warehouse of cooperative unions have their own challenges like lack of capacity and capability to handle huge volume of shipments, Djibouti port congestion, long queue to load fertilizers at Djibouti and unload in respective destinations, delay in customs check point, warehouse problems, longer turn around and transit time, GPS truck tracking system not installed and applied in most of the trucks and unavailability of backhaul.

The supply chain performance of fertilizers in Ethiopia is inefficient with regard to cost; when comparing farmers purchase price and world market price in 2012, there is 60% difference in between which is caused by many surcharges accumulate while fertilizers moves across the supply chain. The majority 92.3% of farmers in the study area complained with the high cost of fertilizers and it is too high to afford and unable to buy enough amount of fertilizers.

The lead time of fertilizers is found to be 6 months and this longer lead time has significant effect supply of fertilizers such as unavailability of fertilizers in stock throughout the year, accumulation of surcharges while in transit, deterioration of fertilizers quality and high chance for farmers to harvest without applying fertilizers. The survey report also shows about 64.7 % of farmers complain with the late delivery of fertilizers and easy to conclude the supply chain of fertilizers is ineffective with respect to timely delivery.

And finally, the survey in the study area also reviled that 65.3 % agreed with the chance of occurrence of stock out in respective warehouses, about 57% of farmers disagree with their involvement in annual determination of demand of fertilizer, there is no much problem with quality of fertilizers as 62.3% agreed with good quality of fertilizers and only 14% of farmers complain with delivery place of fertilizers due to unavailability of road access to the nearest farms.

5.2 RECOMENDATIONS

Based on findings and conclusions, the following recommendations are made:

- ✓ To make the supply chain of fertilizers well integrated, all the stakeholders; suppliers, importers, retailers, logistics service providers, regulatory and financial institutions and final users have to be in the same page about need, challenges and mitigating mechanisms. Those stakeholders all together have to involve in supply chain plan of fertilizers for effective and efficient supply chain performance.
- ✓ Both government and private institutions has to participate and take ownership to invest in infrastructure development and capacity building, for instance, investment on road construction, modern warehouse development, training and development of professional employees which indirectly has positive effect on capability of smooth supply chain as well as efficiency and effective supply chain of fertilizers in Ethiopia.
- ✓ Government has to re-consider on the monopoly of fertilizers import in its policy and involve competent private importers and logistics service providers to import fertilizers, apply multimodal mode of shipment and as majority of imports in Ethiopia passes via Djibouti port and could not accommodate the huge flow of goods into Ethiopia; alternative ports like Berbera, Mombassa and Port Sudan ought to be considered to import some portion of fertilizers.
- ✓ To improve customs process, ERCA has to assign competent and corruption free employees for prompt clearance and move of fertilizers and other commodities, the institution has to implement customs modernization techniques by balancing its major responsibility: control and trade facilitation.
- ✓ To avoid foreign currency problem, government has to encourage export of goods and services by enabling local companies to participate in foreign market.

- ✓ To mitigate problems related to farmers, government and other stakeholders have to participate to scientifically determine demand, arrange credit facility program, implement awareness creation programs, advise farmers to use fertilizers as per farmers and soil requirement, subsidize fertilizers cost to provide with lowest cost possible and deliver fertilizers in the right time, quality, quantity, place and cost effective way. And government at corporate level has to apply one of the modern supply chain strategies called lean supply chain strategy which is mainly concerned with cost reduction by operating the basic processes with a minimum of waste and this strategy answers the basic inefficiency of fertilizers supply chain in Ethiopia.
- ✓ There should be application of integrated information technology across the supply chain members to end up in transparent communication and information sharing among supply chain members.
- ✓ Finally, the government and private institutions have to work on local manufacture of fertilizers as there is evidence that Ethiopia has natural accumulation of nutrients of fertilizers by inviting local and foreign investors to extract the minerals and produce fertilizers. These does not only supply fertilizers with low cost but also could be taken as one export opportunity for the country.

5.3 LIMITATIONS AND IMPLICATIONS FOR FURTHER STUDY

Supply chain of fertilizers touches every corner of actor's right from suppliers up to farmers and a deeper investigation and data collection should be done across the supply chain actors to understand and get better solutions out of it. This study tried to address some of stakeholders due to time and budget limitations. As it was stated in statement of the problem, there is knowledge gap and little attention has been given to scientifically understand and improve the supply chain of fertilizers and other agricultural inputs despite the fact that these issues have significant effect on the livelihoods of millions of Ethiopians. And the author recommends for other researchers and professionals on the field to undertake further study in the area with more time, resource and sample size.

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APPENDIXES

APPENDIX A; QUESTIONNAIRE AND INTERVIEW QUESTIONS

QUESTIONNAIRE FOR FARMERS

ANALYSIS OF SUPPLY CHAIN OF FERTILIZERS IN ETHIOPIA

Hereby, I would like to express my gratitude for your dedicated cooperation as this questionnaire is conducted for the purpose of fundamental scientific research. Had it not been your genuine cooperation of filling this questionnaire, it would have not been possible to conduct this thesis.

Should you have any questions or enquiries; please contact RETA HAILU via 0911815050 or reta.hailu1@gmail.com.

Thank you.

I. General information

1. Age:

☐ 1= Less than 30 years ☐ 3= 40-50 years

☐ 2=30-40 years ☐ 4= More than 50 years

2. Sex:

☐ 1= Male ☐ 2= Female

3. Educational level:

☐ 1= Illiterate ☐ 3= Secondary level education

☐ 2=Primary level education ☐ 4= Higher level education

4. Monthly income:

☐ 1= Less than 1000 birr ☐ 3= 5000-10000 birr

☐ 2=1000-5000 birr ☐ 4= More than 10000 birr

5. Marital status:

☐ 1= Married ☐ Others (Widowed, Separated , . .)

☐ 2=Single

6. Number of children:

☐ 1= None ☐ 4= 5-10 children

☐ 2=1-5 children ☐ 5= More than 10 children

II. Information related to fertilizers

Please indicate your level of agreement with regard to fertilizers delivery by circling the number.

1	2	3	4	5
Highly disagree	Disagree	Neutral	Agree	Highly agree

In Ethiopia, fertilizers demand estimated as per farmer's requirement.	1 2 3 4 5
In Ethiopia, fertilizers are delivered to farmers in the right quality	1 2 3 4 5
In Ethiopia, fertilizers are delivered to farmers in the right quantity	1 2 3 4 5
In Ethiopia, fertilizers are delivered to farmers in the right time	1 2 3 4 5
In Ethiopia, fertilizers are delivered to farmers in the right place/location	1 2 3 4 5
In Ethiopia, fertilizers are delivered to farmers in the lowest price	1 2 3 4 5
Fertilizers stock out occurs most of the time	1 2 3 4 5
There is an efficient and effective fertilizers supply chain performance in Ethiopia	1 2 3 4 5

1. In which month of the year the demand of fertilizers requested?

1= Jan 2= Feb 3=Mar 4=Apr 5=May 6=Jun 7=Jul 8=Aug 9=Sep 10=Oct 11=Nov 12=Dec

2. In which month of the year fertilizers collected from nearby warehouse?

1= Jan 2= Feb 3=Mar 4=Apr 5=May 6=Jun 7=Jul 8=Aug 9=Sep 10=Oct 11=Nov 12=Dec

3. In which month of the year you start using fertilizers for harvesting?

1= Jan 2= Feb 3=Mar 4=Apr 5=May 6=Jun 7=Jul 8=Aug 9=Sep 10=Oct 11=Nov 12=Dec

4. Which month of the year is preferable for you to receive the fertilizers?

1= Jan 2= Feb 3=Mar 4=Apr 5=May 6=Jun 7=Jul 8=Aug 9=Sep 10=Oct 11=Nov 12=Dec

5. Who do you think really decides on the demand of fertilizers in Ethiopia?

1= ☐ Farmer's 4= ☐ Regional government

2= ☐ Farmer's association 5= ☐ AISE

3= ☐ Cooperative unions 6= ☐ Not sure about it

6. In what bases do you buy fertilizers from government? In cash or on credit?

1= ☐ Cash 2= ☐ Credit

7. Mention the type of defect you observe on fertilizers (if any)

---

8. What are the main challenges/bottlenecks in supply chain fertilizers in Ethiopia?

1= ☐ Demand estimation
2= ☐ Supplier's performance
3= ☐ Transportation
4= ☐ Customs clearance
5= ☐ Warehousing
6= ☐ Port handling
7= ☐ Foreign currency
8= ☐ Others, Specify _____

9. What is/are your suggestion to improve the supply chain of fertilizers in Ethiopia?

_____
_____
_____
_____

ANALYSIS OF SUPPLY CHAIN OF FERTILIZERS IN ETHIOPIA

INTERVIEW QUESTIONS FOR AISE (AGRICULTUREAL INPUTS SUPPLIES ENTERPRISE)

I. General information

1. Age _____

2. Sex _____

3. Educational level _____

4. Department _____

5. Title and responsibility _____

II. Information related to fertilizers

1. What is the role of your company in fertilizers supply chain in Ethiopia?

_____

2. How do you determine the demand of fertilizers throughout the country?

_____
_____

3.How your organization does select fertilizers supplier?

_____
_____

1. Do you have dependable fertilizer supplier? 1= ☐ Yes ☐ 2= No, If yes, clarify the duration and level of relationship with the supplier.

_____
_____
_____
_____

5. Have you faced foreign currency problem?

1= ☐ Yes 2= ☐ No

6.If your answer to question number "3" is yes, how do you solve it?

_____
_____

7. What are the main stakeholders involved in supply chain of fertilizers in Ethiopia?

_____
_____

8. How do you map the supply chain of fertilizers in Ethiopia?

9. What are the cost drivers in total cost of fertilizers until it reaches farmer's hand?

_____
_____

10. How do you set the price of fertilizers distributed to each region?

_____
_____
_____

11. Do you have enough storage facility of fertilizers through the country?

1= ☐ Yes 2= ☐ No

12. If your answer for question number "9" is "No", what measures should be taken to solve warehouse problem?

13. There is an efficient and effective fertilizers supply chain performance in Ethiopia.

1= ☐ Highly disagree 2= ☐ Disagree 3= ☐ Neutral 4= ☐ Agree 5= ☐ Highly agree

_____
_____

14. Have you encountered stock out while distributing fertilizers throughout the country?

1= ☐ Yes 2= ☐ No

15. If "Yes", how do you solve it?

_____
_____

16. How do you choose distributer of fertilizers to each region ?

_____
_____

17. How long is the lead time of fertilizers in Ethiopia ?

_____

18. What are the main challenges/bottlenecks in supply chain fertilizers in Ethiopia?

1= ☐ Demand estimation
2= ☐ Supplier's performance
3= ☐ Transportation
4= ☐ Customs clearance
5= ☐ Warehousing
6= ☐ Port handling
7= ☐ Foreign currency
8= ☐ Others, Specify _____

19. What is/are your suggestion to improve the supply chain of fertilizers in Ethiopia?

_____
_____
_____
_____

ANALYSIS OF SUPPLY CHAIN OF FERTILIZERS IN ETHIOPIA

INTERVIEW QUESTIONS FOR ESLSE (ETHIOPIAN SHIPPING AND LOGISTICS SERVICES ENTERPRISE)

I. General information

1. Age _____

2. Sex _____

3. Educational level _____

4. Department _____

5. Title and responsibility _____

II. Information related to fertilizers

1. What is the role of your company in fertilizers supply chain in Ethiopia?

_____

2. What are the main stakeholders involved in supply chain of fertilizers in Ethiopia?

_____
_____

3. How do you map the supply chain of fertilizers in Ethiopia?

4. What are the cost drivers in total cost of fertilizers until it reaches farmer's hand?

_____
_____

2. How do you choose transporter of fertilizers from Djibouti port to central warehouse and to respective warehouse of each region?

_____
_____
_____

6. Have you encountered a situation that vessel carrying fertilizers stranded at Djibouti port?

1= ☐ Yes 2= ☐ No

7. There is an efficient and effective fertilizers supply chain performance in Ethiopia.

1=☐ Highly disagree 2=☐ Disagree 3= ☐Neutral 4= ☐ Agree 5= ☐Highly agree

8. If your answer for question number “6” is “Yes”, what were the reasons and what measures taken to solve the problems?

_____
_____
_____
_____

9. How long is the lead time of fertilizers in Ethiopia ?

_____

10. What are the main challenges/bottlenecks in supply chain fertilizers in Ethiopia?

1= ☐ Demand estimation
2= ☐ Supplier’s performance
3= ☐ Transportation
4= ☐ Customs clearance
5= ☐ Warehousing
6= ☐ Port handling
7= ☐ Foreign currency
8= ☐ Others, Specify _____

11. What is/are your suggestion to improve the supply chain of fertilizers in Ethiopia?

_____
_____
_____
_____

INTERVIEW QUESTION FOR TRANSPORTERS

III. General information

1. Age _____

2. Sex _____

3. Educational level _____

4. Department _____

5. Title and responsibility _____

IV. Information related to fertilizers

1. What is the role of your company in fertilizers supply chain in Ethiopia?

_____

2. In which month of the year fertilizers transported from port to central warehouse?

1= Jan 2= Feb 3=Mar 4=Apr 5=May 6=Jun 7=Jul 8=Aug 9=Sep 10=Oct 11=Nov 12=Dec

3. How do you choose the type of truck to transport fertilizers from Djibouti port to central warehouse and also to respective warehouse of each region?

_____
_____

4. How do your trucks be assigned to transport the fertilizers from port to central warehouse? By your own choice or forced by government body?

_____

5. How many days it take to transport fertilizers from port to central warehouse starting from the day truck assigned for loading until offloading date ?

_____

6. Have you encountered queue or delay while transporting fertilizers throughout the country?

1= ☐ Yes 2= ☐ No

7. Do you use GPS tracking systems of your vehicles while transporting fertilizers from port to central warehouse?

1= ☐ Yes 2= ☐ No

8. If your answer for question number “7” is “No”, how our office track your trucks?

_____
_____

9. If your answer to question number “6” is “Yes”, in which area problem occurred? How the problem solved?

_____
_____
_____
_____

10. The transportation of fertilizers in Ethiopia is well planned and coordinated?

1=☐ Highly disagree 2=☐ Disagree 3=☐ Neutral 4=☐ Agree 5=☐ Highly agree

11. There is an efficient and effective fertilizers supply chain performance in Ethiopia.

1=☐ Highly disagree 2=☐ Disagree 3=☐ Neutral 4=☐ Agree 5=☐ Highly agree

12. How do you compare the transport rate and profit margin of fertilizers with other type of cargo?

1= ☐ Fertilizer’s is lower 3= ☐ Same rate applied

2= ☐ Fertilizer’s is higher 4= ☐ Can’t be compared

13. Do you believe there is transportation management problem in supply chain of fertilizers in Ethiopia?

1=☐ Highly disagree 2=☐ Disagree 3=☐ Neutral 4=☐ Agree 5=☐ Highly agree

14. What are the main challenges in supply chain fertilizers in Ethiopia?

1= ☐ Demand estimation
2= ☐ Supplier’s performance
3= ☐ Transportation
4= ☐ Customs clearance
5= ☐ Warehousing
6= ☐ Port handling
7= ☐ Foreign currency
8= ☐ Others, Specify _____

15. What is/are your suggestion to improve the supply chain of fertilizers in Ethiopia?

_____
_____

APPENDIX B: FARMERS PROFILE

Age of farmers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 30	44	14.7	14.7	14.7
	30-40	102	34.0	34.0	48.7
	40-50	104	34.7	34.7	83.3
	>50	50	16.7	16.7	100.0
	Total	300	100.0	100.0	

Sex of farmers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	241	80.3	80.3	80.3
	Female	59	19.7	19.7	100.0
	Total	300	100.0	100.0	

Educational level of farmers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Illiterate	97	32.3	32.3	32.3
	Primary level education	123	41.0	41.0	73.3
	Secondary level education	68	22.7	22.7	96.0
	Higher level education	12	4.0	4.0	100.0
	Total	300	100.0	100.0	

Estimated monthly income of farmers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 1000	127	42.3	42.3	42.3
	1000-5000	83	27.7	27.7	70.0
	5000-10000	63	21.0	21.0	91.0
	More than 10,000	27	9.0	9.0	100.0
	Total	300	100.0	100.0	

Marital status of farmers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Married	136	45.3	45.3	45.3
	Single	61	20.3	20.3	65.7
	Other	103	34.3	34.3	100.0
	Total	300	100.0	100.0	

Number of children

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	29	9.7	9.7	9.7
	1-5	86	28.7	28.7	38.3
	5-10	145	48.3	48.3	86.7
	Morethan 10	40	13.3	13.3	100.0
	Total	300	100.0	100.0	