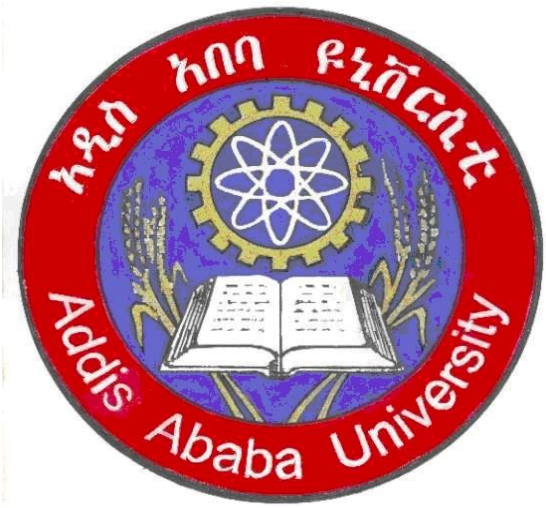

LIQUEFIED PETROLEUM GAS SUPPLY CHAIN MANAGEMENT CHALLENGES IN ETHIOPIA

By Berhan Abebe

A Thesis Submitted to Addis Ababa University, School of Commerce, for Partial Fulfilment of the Requirements for the Award of the Master of Arts Degree in the Department of Logistics and Supply Chain Management

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School of Commerce,

Department of Logistics and Supply Chain Management,

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DECLARATION

I, the undersigned, declare that this research on the title "Liquefied Petroleum Gas Supply Chain Management Challenges in Ethiopia" is my original work and has not been presented in any other university for fulfillment of a degree, and all resources used as a reference for the study have been properly acknowledged.

Declared by:

Name_____

Sign_____

Date_____

CERTIFICATION

This is to certify that the above declaration made by the candidate is correct to the best of my knowledge.

Confirmed by: Matiwos Ensermu (PhD) (Advisor)

Signature: _____ Date_____

Place and Date of Submission:
Addis Ababa University School of Commerce, June 2019

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Berhan Abebe

List of Abbreviations/Acronyms

CSA	Central Statistics Agency
EPSE	Ethiopian Petroleum Supply Enterprise
ERP	Enterprise Resource Planning
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
HTL	Horizon Terminal Limited
JIT	just-in-time
LPG	Liquefied Petroleum Gas
MT	Metric Tone
MOMPNG	Ministry of Mines, Petroleum and Natural Gas
MOT	Ministry of Trade
NGL	Natural Gas Liquids
NOC	National Oil Ethiopia
PESTEL	Political, Economic, Social, Technological, Environmental and Legal
SCI	Supply Chain Integration
SCM	Supply Chain Management
SCOR	Supply Chain Operation Reference
SHE	Safety, Health & Environment
UN	United Nation
WLPGA	World LPG Association
WAS	Wadi Alsundus

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Abstract

Supply chain management (SCM) has become a fundamental element to improve availability, efficiency and productivity of products and services in recent decades. The oil industry is involved in a global supply-chain that includes all logistics activities. The purpose of this paper is to review the challenges of Liquefied Petroleum Gas (LPG) supply chain management in Ethiopia by undertaken supply Chain management activities. When we see internationally, the human right to energy, entitles every individual to have access to adequate, affordable, reliable, safe and environmentally benign energy services for personal and domestic uses. It is also a convenient and portable energy source that is easy to transport and store as an alternative to electricity and environmentally friendly source of energy. However, the country is facing end to end supply chain challenges on accessibility, affordability and convenience of LPG supply chain with different reasons given for the problem. To tackle the real problems, data were collected from all target population, thorough questionnaire and interview. Further, related literatures were reviewed as a secondary source. And the research analyzed both primary and secondary data using qualitative and quantitative data analysis tools then reliability test was done by Cronbach's alpha using SPSS. The major challenges identified by the research are lack of warehouse, transport, foreign currency shortages, higher taxes, lack of collaboration and lack of policy and regulations. Finally, the research recommended that the government should give attention to the sector on administering port storage problems, formulating policies and approach members in the Supply chain to work collaboratively to solve their problems.

Key words: Supply chain management, Supply chain challenges

CHAPTER ONE: INTRODUCTION

Liquefied petroleum gas (LPG) is a fossil fuel. The term is widely used to describe two prominent members of a family of light hydrocarbons called “Natural Gas Liquids” (NGLs): propane (C3H8) and butane (C4H10). (Queen, 2015). It was first produced in 1910 by Dr. Walter Snelling, and the first commercial products appeared in 1912.

Liquefied Petroleum Gas (LPG) is a byproduct of the refinement of crude oil. LPG is also produced when Natural Gas (Methane) is extracted from the gas fields and 'dried'. LPG is prepared by refining petroleum or "wet" natural gas, and derived from fossil fuel sources, being manufactured during the refining of petroleum (crude oil), or extracted from petroleum or natural gas streams as they emerge from the ground. (Queen, 2015).

As many scholars in the energy sector believe, it is an important means to achieve sustainable development. Especially in the case of developing nations, its contribution is going to be paramount important since it can be the prime substitute for fuel wood at household’s level which in turn plays significant role in combating deforestation. LPG is environmental friendly energy source because of its less hazardous emissions to the atmosphere and it does not pose ground or water pollution hazards. (Taneja, 2018).

The current energy discourse frequently differentiates among "modern" and "traditional" fuels, assuming that there is a linkage between the income level of households and their fuel choice; this is generally referred to as the "energy ladder hypothesis". Petroleum products such as kerosene and LPG as well as electricity are considered to be modern fuels at the top of the energy ladder whereas traditional fuels such as wood fuels and agricultural waste end up at the bottom. Charcoal is often considered as a transition fuel, being that it is a marketable commodity with a higher level of convenience than traditional fuels. (Sepp, 2014)

In addition, traditional energy use increases the rate of deforestation and land degradation, which in turn can lead to excess soil erosion and loss of soil fertility. This further contributes to the decline of agricultural productivity and production, perpetuating the vicious cycle of rural poverty. Indoor air pollution associated with traditional fuel use is a major health concern, especially for women and children. Globally, two million people die

prematurely as a result of indoor air pollution. Chronic obstructive respiratory disease resulting from indoor air pollution kills one million people each year. Firewood produces a large amount of CO2 and other harmful gas which leads to many lungs and Respiratory problems which further can lead to TB. Particulate matter inhaled from indoor air pollution is the cause of 50% of pneumonia deaths among children under the age of five (WHO, 2010). LPG is categorized as a modern fuel, it has a better use than firewood, charcoal and agricultural waste. It produced less smoke, it has a high calorific value, it can be easily transported, and it has a higher heating value.

Global LPG production reached over 292 million metric tons per year in 2015 while global LPG consumption is over 284 metric tons per year. Natural gas constitutes the largest proportion, 62%, in the production of LPG while the rest is produced by the petrochemical refineries from crude oil. 44% of global consumption constitutes household consumption. The USA is the leading producer and exporter of LPG. (Sepp, 2014)

As per the Global Economy data, the average usage of LPG in 2012 was 40.95 thousand barrels per day. The highest value was in the USA, 1371 thousand barrels per day, and the lowest value was in Afghanistan 0 barrels per day. In the case of Africa, Egypt is the highest from Africa by 85 thousand barrels per day and Ethiopia is the 147th from the world by 200 barrels per day. (Sepp, 2014)

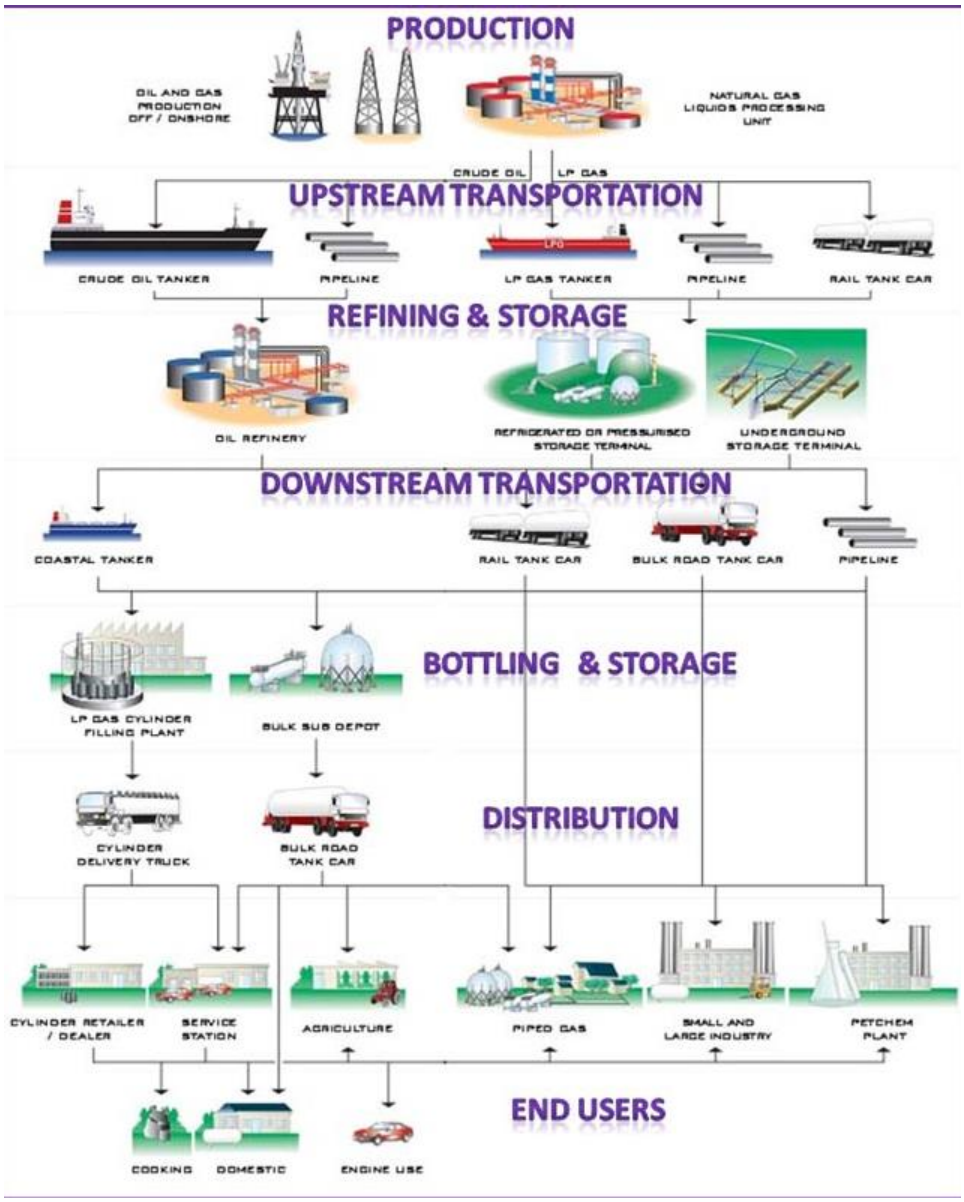
As per the study conducted by GIZ in February 2014, in 2010, the consumption of LPG in Africa is highly clustered in North African countries, comprising around 85% of Africa's total consumption. Although Nigeria is the largest LPG producer in Sub-Saharan Africa, annual per capita consumption is less than 1 kg whereas in countries like Algeria, Egypt, Tunisia, Libya and Morocco, users consume 45 kg of LPG per year. (Sepp, 2014)

This study mainly focuses on the supply chain of LPG. Thus, it is important to discuss the Petroleum and Gas supply chain can be divided into upstream and downstream process. Upstream process means receiving raw materials from suppliers before it goes for further manufacturing and downstream process means getting goods from manufacturing division and serving it to the targeted consumers (Chopra, 2010)

Supply chain of LPG has six main components. These are: The production process starts with oil and gas wells; Upstream Transportation - The mass quantities are transported by ship, rail and pipeline; Refining & Storage - The refining of the LPG, from oil, takes place

at oil refineries; Downstream Transportation - The fully processed LPG is transported to market by ship, rail, truck and pipeline; Bottling & Storage - The LPG is either used to fill LPG gas bottles or is stored in bulk LPG depots; Distribution - LPG cylinder delivery trucks and bulk LPG tankers are used to get the LPG to the end users and LPG End Users. see figure 1 below (Queen, 2015)

Figure 1 Typical LPG Supply Chain



Source: (WLPGA, 2015)

1.1 Background of the Study

Ethiopia does not have oil and gas production. What is common here is that white and black petroleum products are imported directly by the Ethiopian Petroleum Supply Enterprise (EPSE) through third party suppliers and LPG imported and distributed by individual companies. Thus, the study focuses on downstream sector of the supply chain, particularly in importing and distribution of LPG to customers.

LPG supply started in Ethiopia by four international Oil companies that had a monopolistic right over the Ethiopian oil market for 50 years: Mobil, Total, Agip and Shell. The last 12 years, however, other local Oil Companies started joining the Market: Yetebaberut Petroleum, National Oil Company of Ethiopia (NOC), TAF Oil, Dalol Oil, Gomeju can be listed as an example. (WAAS, 2018)

Currently, there are seven companies in the provision of LPG in Ethiopia; Nile Petroleum, Total Gas, Ghion Gaz, NOC, WAS Ethiopia, Iran Merfic and Alied Energy. Their major businesses in the LPG value chain are importation, storage and filling and distribution.

Nearly 83 million people living in Ethiopia, about 68.3 million people, or 82.4% of the population, live beyond city limits, and about 79% are employed in the agricultural sector. While Ethiopia is undergoing urbanization, the overwhelming majority of people still live in rural areas. Ethiopia's population is growing with an annual growth rate of 2.1%. (Beyene, 2018)

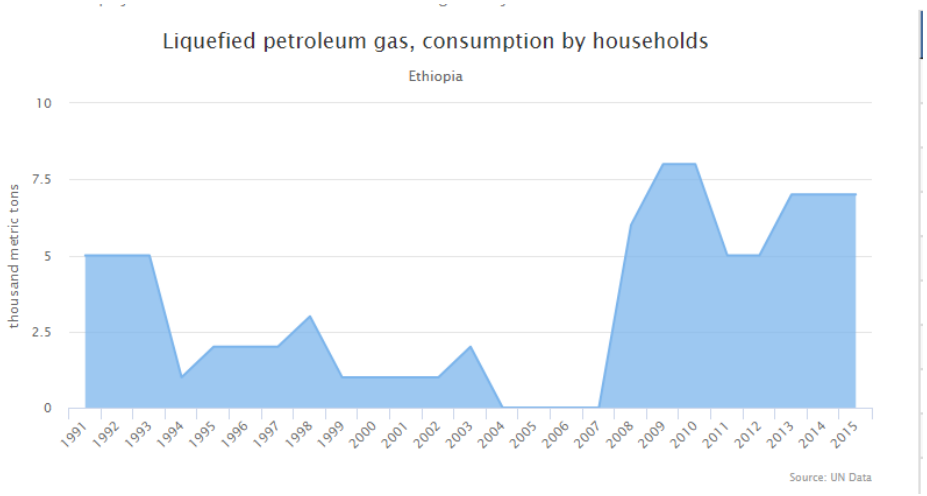


Figure 2 LPG Consumption by house hold Source UN DATA

Key players in the overall supply and distribution of fuel in Ethiopia and their key roles are listed below.

Ministry of Mines, Petroleum and Natural Gas (MoMPNG): Until recently time, the oversight of the oil and natural gas sector was split between ministries. The Ministry of Mines was responsible for upstream issues, including the allocation of exploration and production areas. The Ministry of Water, Resources, Irrigation and Energy was responsible for downstream activities related to the use of domestic and imported fuels.

International Oil Traders: They supply oil through an international open tender process.

Djibouti Horizon Terminal and Port of Sudan: Since Ethiopia is a land locked county and does not produce oil, it is necessary to use as intermediate storage terminal of the countries through which the oil is imported. Thus, LPG importers use intermediate storages at these two Ports.

Bulk Distribution Companies (LPG Brand Companies): These companies have been as bulk distributors. They distribute the product through their Retail Network and directly to commercial customers. At present, there are seven companies participating in the provision of LPG in Ethiopia; Nile Petroleum, TOTAL Gas, Ghion NOC, WAS Ethiopia, Iran Merfic and Allied Energy. Following is a glimpse over these companies.

a) NOC Ethiopia

National Oil Ethiopia (NOC) PLC is the first indigenous major oil marketer of petroleum products with a wide network of modern service stations strategically located across the country. It has started working since April 2004. Currently, it has high market share in the Industry. NOC is supplying various petroleum products including Fuels, Lubricants, LPG, Bitumen, Petroleum coke, Steam Coal and Chemicals. Its depot is located at Dukem.

b) NILE Ethiopia

Nile Ethiopia is a Sudanese company which has been working since 2008 in Ethiopia. They have a storage facility and Etanol Blending Plant at Sululta.

c) Ghion Gas

Ghion Gas is one of the sister companies of 'THE GHIONS'. It supplies LPG for industries, households, hotels, and hospitals, with different capacities of pressure containers. It started LPG Distribution by taking over the LPG business of

AGIP and Shell. Now, it is leading the LPG market. It has depot & refilling facility at Dukem.

d) TOTAL GAZ

TOTAL Ethiopia is established in 1950 with a wide Retail Station Network and general trade. It is a renowned company in the distribution of petroleum products in Ethiopia and quality service. TOTAL Ethiopia markets LPG under the brand name TOTAL GAZ. Its depots are located in Addis Ababa and Dukem.

e) Allied Energy

Allied Energy PLC is a petroleum company which is engaged in refilling LPG in bullet tanks anywhere convenient for the client. Allied Energy PLC uses a brand called SAFE GAS for its LPG business.

f) WADI EL-SUNDUS (WAS) PETROLEUM CO. LTD

WAS PETROLEUM CO. LTD is established by Sudanese investors. It is involved in the downstream oil business. Its depot is located at Gelean town. WAS is the LPG brand name for this company.

g) IRAN Merfin

Iran Marfin Gaz is a company owned by Iran Companies. It is established in 2002 with a depot & refueling facility at Burayu. Because of the sanction in Iran, they cannot perform with their full capacity.

Importers: Nile petroleum, Noc, Ghion, Total GAS, etc… the above distributors working as importer also.

Transporters and distributors: Oil companies distribute LPG using truck, to their regional depots, and then supply LPG to bulk customers by small road tankers. LPG is bottled in cylinders and distributed to retailers,

Retailers: They sell LPG to small customers, including households. The retail outlets may be Retail fuel stations, or commission agents of a marketer, or independent resellers who purchase and resell LPG in marketer-owned and branded cylinders.

1.2 Statement of the Problem

Studies available show that supply chain systems that can creatively and innovatively exploit the benefit of oil companies in improving performance up to 80 % depending on the extent of adherence to supply chain requirements needs to have clear performance strategy (Zahra Lotfi, 2013).

It's noteworthy that procurement efficiency and effectiveness cannot be achieved unless they are pursuant in tandem with the goals of supply chain performance. For instance, supply chain goals revolve around embracing the five rights i.e. right quality, right quantity, right source, right time and right price respectively so as to maintain stock level inventory often, with longer term strategy goal revolving around the ultimate customer satisfaction, controlling of shortages, competency in skills and timely delivery of oil products to retailers (Meyer, 2010).

As stated in the United Nations' Sustainable Energy for All Initiative, launched in 2011, Increasing household use of liquefied petroleum gas (LPG) is one of several pathways to meet the goal of universal access to clean cooking and heating solutions by 2030, sets as one of its three objectives universal access to modern energy services electricity and clean cooking and heating systems by 2030. About three billion people rely on solid biomass or coal for cooking and heating, and smoke from such fuel use is estimated to cause four deaths every minute. Particulate matter inhaled from indoor air pollution is the cause of 50% of pneumonia deaths among children under the age of five. (WHO, 2010).

In Ethiopia urban households rely on a wider range of cooking fuel sources, such as electricity, kerosene and charcoal, although most (63%) are still dependent on firewood. The availability of Liquefied Petroleum Gas (LPG) benefits by substituting for the use of traditional fuels like charcoal and fire wood as a fuel. This can help reduce deforestation because in Ethiopia approximately 90 percent of 24 million cubic meters of the nation's annual wood production is used for fuel and charcoal making. (WAAS, 2018)

Households in Addis Ababa consume more than half a million tons of wood in the form of fuelwood and charcoal, as well as about a hundred thousand tons of animal manure. (Asfaw & Demisse, 2012)

Currently, in Ethiopia LPG Supply interrupted and there is a problem, Reporter Newspaper interviewed Mr. Tadesse Tilahun, the Chief Executive Officer of National Oil Company (NOC) on July 2018 on his interview he stated that he is frustrated on LPG market this is the Question and his respond regarding LPG: (Reporter, 2018)

Reporter Newspaper *-currently local LPG markets in Ethiopia are being severely under-supplied and there is shortage of the product almost in every major town. In your view what is the problem with this largely unregulated LPG market?*

Mr. Tadesse Replies "*Sincerely, that is my frustration too. If you take Kenya, their annual consumption of LPG is more than 300,000 tons; the same is true for both Uganda and Tanzania. However, if you look at these countries' population, they don't come close to Ethiopia. Yes, in the past economic level of the country, the people were not that conducive to consume large amounts of LPG. But now that is changing. So, we need LPGs in our industries, homes, hospitals, hotels and the like. Perhaps one factor could be the fact that electricity is cheap in Ethiopia; but there are still many uses for LPG. So, my frustration is the local price of LPG is not at the level where it is affordable to the people. The only way prices could get down is when there is adequate supply of the product. So, what we are trying to do with the Port of Sudan is haul the LPG through heavy vessels so that the cost of transportation could be reduced, in turn damping the local selling price. In this regard, we have asked the port to give us sufficient surface to load our vehicles and in a timely manner. So, hopefully, in the next one year we will increase the supply of LPG sufficiently; perhaps get closer to the level of supply in Kenya and other Eastern African nations."*

LPG and electricity are alternative fuels in the country. Recently, as per the Addis Fortune November 3, 2018 publishing, the Ethiopian Electric Utility announced new electricity tariffs for residential customers. The tariff increase will be implemented in four different phases to ease the burden on customers. The phases will be rolled out over four years, this will be increasing the demand of the LPG.

Decisions related to energy consumption and fuel type are strongly influenced accessibility, affordability and the convenience of the fuel. These criteria are closely related to one other and also depend on household income. (Sepp, 2014)

Therefore, the main purpose of this research is to assess, if LPG is a best source of energy, why we are not using it and what are the gaps to use LPG instead of traditional fuels in Ethiopia? If there is structured supply chain of LPG in the country, the accessibility, affordability and the convenience of LPG will increase, and traditional fuel use will decrease.

1.4. Research Questions

The study tries to answer the following basic research questions.

1. What is the end to end challenges that affect the supply chain of LPG in the country?
2. Why supply of LPG is not accessible, affordable and disregarded?
3. What are the challenges for integrating & Collaborative between LPG companies?

1.5 Objectives of the Study

The main objective

The general objective of this study is to assess the LPG supply chain management challenges and identify the gaps.

The specific objectives

Based on the above main objective of the study and the problem statement, the study has the following specific objectives:

1. To examine end to end LPG supply chain Management activities and processes in Ethiopia
2. To examine how to make the supply of LPG accessible, affordable and create awareness
3. To examine challenges that affect the Integration of supply chain of LPG

1.6 Significance of the study

Study has not been done before to review the supply chain of LPG in Ethiopia. Therefore, this study will give an opportunity to better understand the strength and weakness of the supply chain and recommend actions for importers, distributers and Government policy makers that will help the supply chain more robust and make it the source of competitive advantage. In addition, currently, in Ethiopia LPG uses only for household and industries for cooking appliances; however, had there been a good supply chain in Ethiopia with enough supply, LPG would have many other uses including Auto gas.

Lastly, this study can also serve as reference for further studies and create awareness in the country at policy level and users' level.

1.7 Scope of the study

The goal of the study is to assess supply chain management challenges of LPG of the country and the research data collection area of this study is limited in Addis Ababa and it doesn't include Biogas and Natural gas.

Supply Management challenges evaluated with six major activities of logistics management, namely inventory management, supply, warehouse management, transportation management, customer response, and information flow management and how they are affected by the PESTEL Analysis of the country.

1.6 Limitation of the Study

The shortage of published materials regarding LPG supply chain in Ethiopia is one of the major challenges that one can face in securing relevant data, time constraint and inconvenient location of the retailers differentiated for collecting Data.

1.7 Organization of the Study

The paper is organized with five chapters. The first chapter covers the introduction part that addresses the background information, the research questions, the general and specific objectives of the research, the significance and scope of the research, and finally the limitations of the research. Following this introductory chapter, the second chapter comes to describe the basic and relevant literatures related to the challenges of LPG Supply Chain and that are done previously by other researchers. In the third chapter, the research report covers the type of research design used, the analysis of the data, the sampling techniques, and methods of data collection applied. Chapter Four includes further details of data presentation, analysis and discussion. Finally, findings, conclusion and recommendation are included in the fifth chapter.

CHAPTER TWO: RELATED LITERATURE REVIEW

This chapter will examine supply chain management, supply chain benefits and challenges, sustainable supply chain, logistic activities and Integration and coordination besides petroleum and LPG supply chain in Ethiopia. Here PESTEL analysis is applied by referring relevant literature, so as to have more insight on the issues. It includes theoretical framework, empirical literature review and conceptual framework of the study. Under this section, the researcher reviewed many literatures, reports and journals regarding the issue.

2.1. Theoretical Literature Review

2.1.1. Supply Chain Management

Supply Chain Management involves managing the flow of materials from suppliers to customers to reduce overall cost and increase responsiveness to customers. According to Nada, 2011 the network of entities that is involved in producing and delivering a finished product to the final customer is called a supply chain. The objective is to have everyone in the chain work together to reduce overall cost and improve quality and service delivery. Supply chain management requires a team approach, with functions such as marketing, purchasing, operations, and engineering all working together. This approach has been shown to result in more satisfied customers, meaning that everyone in the chain profits (Nada, 2011)

The basic objective of supply chain management is to "optimize performance of the chain to add as much value as possible for the least cost possible". In other words, it aims to link all the supply chain agents to jointly cooperate within the firm to maximize productivity in the supply chain and deliver the most benefits to all related parties. (Raed, 2006)

SCM define as a coordinated approach for managing the flow of goods from suppliers to ultimate customers, and that the goal is to meet customer service objectives while minimizing inventory and related costs. Kaminsky 2000 says that "Supply Chain Management is a set of approaches utilized to efficiently integrate suppliers, manufactures, warehouses and stores, so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time, in order to minimize system wide costs while satisfying service level requirements". (D & Kaminsky, 2000)

There are four main steps in SCM; namely: design, execution, control, and monitoring of supply chain activities in a way to meet the defined goals of a company. (Chima, 2007)

Supply Chain Management is a reverse of prior practices where manufacturers supplied product to customers. Now customers tell suppliers how and when they want their inventory delivered. The driver behind Supply Chain Management is to remove inefficiencies, excess costs and excess inventories from the supply pipeline, which extends from the customer back through his suppliers' supplier and so on back. (Business, 2010)

Supply Chain Management is to be efficient and cost effective across the entire system. Cost efficiency means consideration of the total system wide costs, from transportation and distribution to inventories of raw materials, work in process and finished goods and that the cost is minimized. Supply Chain Management is not simply about minimizing transportation cost and reducing inventories, but rather on taking a system approach to find improvement areas. (Pettersson, 2008)

2.1.2. Sustainable Supply Chain Management

Supply chain management is multi-disciplinary and can be approached from many different perspectives. Sustainability in itself is a complex multidimensional concept. (Kumar & Sankar, 2013). Sustainable supply chain management has been defined as "the strategic, transparent integration and achievement of an organization's social, environmental, and economic goals in the systemic coordination of key organizational business processes for improving the long-term economic performance of the individual company and its supply chains (Carter, 1995). It can also be defined simply as the managerial decisions and behaviors which are taken to ensure a supply chain performs well in the triple bottom line dimensions; with the end goal of the decisions and behaviors is to create a truly sustainable chain (Pettersson, 2008)

To achieve sustainable supply chain, no process can be managed in isolation. Thus, sustainability goals must be integrated strategically and communicated clearly in each of the processes, which will eventually affect the performance of the entire chain and its members.

2.1.3. Effective Supply Chain Management

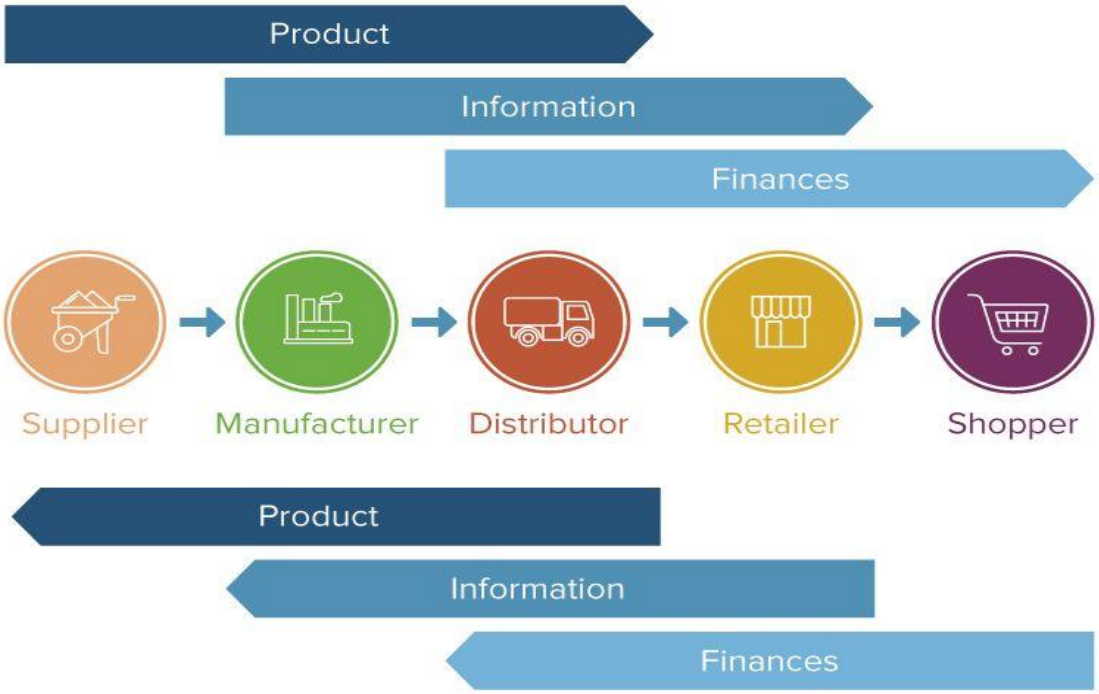
When there is effective supply chain management system in place, enterprises can comprehensively and continually assess their processes, identify and fill all the gaps, lower costs, competently evolve with ever-evolving supply chains, and enable quicker decision making. (Dempsey, 2017)

Some of tangible benefits of Good Supply Chain Management are cost reduction , Inventory reduction , Maintenance reduction , Productivity improvement ,Order management improvement, Transportation logistics cost reduction, On-time delivery improvement, Financial close cycle improvements, Cash management improvements , Personnel reduction and IT cost reduction. (Rajgopal, 2016)

Dan Dempsey stated that effective supply chain management using powerful SCM solutions will allow businesses to optimize the three key flows in the supply chain: product flow, information flow, and financial flow. (Dempsey, 2017)

The effective SCM requires not only the integration of material flows but also the integration of information flows in the supply chain (Frohlich & Westbrook, 2001; Trent & Monczka, 1998). Customers constantly demanding for real-time response and easy access to product and other supply chain content, information flow should be uninterrupted.

Another pinpoint for supply chain players is how to improve cash flow in the value chain. The unpredictability and variability of financial inflows and outflows can add more complexity to the inherently complex supply chain financial flow. Implementing supply chain management can help companies address all these cash flow challenges, allowing them to carefully evaluate their current processes, identify the weakest links that slowly down and hamper financial flow, and determine the right solutions to address the problems. (Dempsey, 2017)



Source: https://www.smartsheet.com

Figure 3 Supply Chain flow Process

2.1.4. Supply Chain Management Macro Level Analysis

There are two major areas of economics, and both are critical to those in the supply chain. Macroeconomics is big picture economics. It is the study of the economy taken together, including fiscal policy, gross domestic product, interest rates, unemployment and inflation. Macroeconomics decisions drive the overall economy. (Sadaghiani, 2014)

Microeconomics is focused on the decisions of companies, consumers and markets and includes supply and demand, production decisions, cost/price analysis, labor rates and the daily tradeoffs companies make every day to run their business. (Sadaghiani, 2014)

The performance of global supply chains is heavily impacted by changes within the macro economy: fluctuations in factors such as oil price, labor cost and currency exchange rates, can lead to advantages and disadvantages with a product that distributed globally. Therefore, building optimal and robust supply networks is critical for a product to remain competitive. (Ting, 2008)

The macro-environment consists of broad environmental factors that impact most of organization of sectors. The scope of supply chain has expanded a lot due to a number of changes from the related external environment, including the rising costs of manufacturing, shortened product life cycles and the globalization of market economies, etc. Thus "PESTEL" framework, which stands for Political, Economic, Social, Technological, Environmental and Legal factors that impact the macro environment and used to identify the factors that influence the sector of Supply chain. (Ting, 2008)

Political factor in PESTEL model refers to the governmental politics that can either directly or indirectly affect the environment. Economic factor includes interest rates, taxation, inflation, and economic related issues. Social part of the model referred to changes in social trends affecting the demand for a products and availability and willingness of individual to work. Technological factor is about creation of new technologies that can ease different process or improve the efficiency. Environmental factor deals with changes in environment such as climate change. Finally, legal factor is related to the legal environment in which a company or industry operates. (Gillespie, 2011)

Political Factor:

The activities and policies of governments have a big influence on the environment of Supply Chain management. Political factors are often related to the level of intervention and nature of intervention of the local and national government in the business and economic environment. Government policies and governance system plays a huge role in nature and objectives of the policies. (Ting, 2008)

Economic factors

There have been many changes in the worldwide market and economic enviromnet because of the increasing globalization, indlcuing rising costs of manufacturing and R&D; as well as the shortended product life cycle. Increases in global sourcing and inventory holding charges, both have raised the cost of the supply chain, thus the supply chain management has to consider not only the responsiveness but also the effiencry of the supply chain if they want to earn profit. (Gillespie, 2011)

Economic factors include taxation rate, economic performance of country name, the stage of economy of country name, exchange rate, consumer disposable income, interest rate, inflation rate, labor market conditions etc. (Bagchi, 2004)

Social factor

Each society and culture have its own way of doing business and acceptance of change. These social factors can not only help companies like "Supply Chain" to better understand the way of doing business but also in understanding the customer preferences in the market it operates in. Social factors include – demographics, attitude towards certain products and services, traditions, health and safety attitudes, societal roles and norms, culture, gender roles, acceptance of entrepreneurial spirit, and leisure interests.

These factors are especially important for marketers when targeting certain customers. In addition, they also say something about the local workforce and its willingness to work under certain conditions.

Technology Factor

Rapid market growth for supply chain planning tools such as ERP, SCOR, Slotting, etc. both simplify the supply chain and help optimize the many costs associated with a complex supply chain. Mastering the supply chain tools, which fit the actual operation process, can greatly help the supply chain to eliminate communication difficulties between different parts of supply chain and provide every part of Supply chain a comprehensive view of the process to avoid individual interest consideration. In this way, the overall cost can be reduced, efficiency can be promoted thus the performance of the supply chain will be improved. (Bagchi, 2004)

Technology is fast disrupting various industries and Innovation & Entrepreneurship is no different. Some of the technological factors that are impacting the firm are innovation in product offerings, innovation in customer services, access to mobile phones driving empowerment, access to greater information, supply chain disruption because of technology, population access to technology, rate of technology driven change. (Business, 2010)
Information technology, known as the back bone of the logistics operation, plays a control role in exploring more effective and efficient logistics solutions. The tremendous growth of the importance of IT is a testimony to the impact information can have on improving an organization. As the importance of information grows, so does the importance of IT in gathering and analyzing those data to make a decision. ERP, EDIs., tracking devices, GPS, RFID, management systems, routing systems are all tools that allow for a smooth operation. However, the choice of IT system needs to make the trade-off between the cost of information (a reduction in efficiency) and the responsiveness that information creates in the supply chain. (Chopra, 2010)

Environmental Factor

Supply chain has the responsibility to review any environmental report as well as identify which suppliers' products and services have the highest environmental impact. Over the last decade sustainability and environmental factors are becoming critical for businesses. Government and pressure groups are fast asking organizations to adhere to environmental standards. Some of the environmental factors are – laws regulating pollution, safe disposal of hazardous material, safe waste disposal, insurance policies, safe water treatment, climate change, increasing focus on sustainability, limiting carbon footprints etc. (Dawar, 2018)

Legal Factors

Legal plays a critical role in any country. Supply Chain management has to consider following legal factors before entering international market biasedness toward home players, copyrights law, data protection laws, system of justice, intellectual property rights protection, discrimination laws, time taken to deliver justice etc. The legal factors also impose laws and regulations for pollution, social protection, work protection, work regulation, competition regulation, anti-trust regulation, consumer protection, international trade like trade agreements between nations or embargoes to some countries, subsidies, the taxes like the excise rates for fuels and oil price or taxes and fees over profit to the energy companies. (Deveshwar & Rathee, 2010)

2.1.5. Supply Chain and Logistics

Logistics management is that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' requirements. (Maciek Nowak, 2015)

Logistics involves managing the flow of items, information, cash and ideas through the coordination of supply chain processes and through the strategic addition of place, period and pattern values. (Maciek Nowak, 2015)

Logistics is defined in the Council of Supply Chain Management Professionals as: The process of planning, implementing, and controlling procedures for the efficient and effective transportation and storage of goods including services, and related information from the point of origin to the Point of consumption for the purpose of conforming to customer requirements. (Ayenew, 2016)

Logistics is relatively new and young field of economics and human activity. Logistics covers activities such as information exchange, transport service, inventory management, warehousing, cargo handling and packaging. Every day logistics enterprise is considered as a complex process aimed at reducing overall costs. (Kondratjev, 2015)

The key supply chain processes identified by members of the Global Supply Chain Forum are customer service, inventory management, demand management, supply management, distribution management and transportation management. As Ayenew pointed out mentioning from Frazelle (2002) and Kent (2001) studies that logistics is comprised of five interdependent activities; these are customer service, inventory management, transportation, supply and warehousing. (Ayenew, 2016) Whereas, Bower (2005), identifies four major components of logistics; information management, inventory control, warehousing and transportation. On this research, not all aspects of logistics are being covered, but rather those major logistics activities are selected that are Inventory Management, Supply, Transportation, Warehouse Management, Customer Response and Information Flow Management.

Inventory Management

Frazelle (2002) indicated that the logistics of inventory management includes practices of forecasting, order quantity engineering, service level optimization, replenishment planning, and inventory deployment (Ayenew, 2016)

Inventory management deals with balancing the cost of maintaining additional products on hand against the risk of not having those items when the customer wants them (i.e. the cost of lost sales). This task has become more complex as firms have gradually lowered inventory levels. The challenge in this situation is to manage the rest of the logistics system to accommodate the lack of inventory so that customer service does not suffer. However, all of the interest in reducing inventories notwithstanding, the fact remains that inventory management is still necessary for serving customers in many markets (Dorn, 2017)

Basic inventory management system has several mutual advantages and disadvantages. System with a fixed size of the order requires constant regardless of the current stock in the warehouse. On the opposing, a system with a fixed interval of time between orders requiring only periodic monitoring the number of stocks. The need to keep pace with the stock system with a fixed size of the order can be seen as its main drawback. (Stock, 2001)

Supply Management

Procurement includes versatile activities, such as supplier selection, price and timing determination, quality control and others According to Frazelle (2002) cited by (Ayenew, 2016), the logistics of supply include developing and maintaining a Supplier Service Policy (SSP), sourcing, supplier integration, purchase order processing and buying and payment. He also mentioned that the world-class sourcing practices include Make buy analysis, total acquisition cost analysis, global sourcing, and electronic bid-based sourcing. (Frazzle, 2002)

Procuring and the strategic concepts of supply management are one of the foundations of supply chain management, since incoming material quality, delivery timing and purchase price are impacted by the buyer–supplier relationship and the capabilities of suppliers (Wisner Tan Leong, 2012).

Purchasing deals with the buying of goods and services that keep the organization functioning. Since these inputs can have a direct impact on both the cost and quality of the final product / service offered to the consumer, this activity is vital to the overall success of the logistics effort. In addition, the move away from local sourcing in favor of global buying has complicated this entire process dramatically in recent years. (Dorn, 2017)

Transportation Management

Transportation physically links the sources of supply chosen in sourcing with the customers we have decided to serve chosen as a part of the customer service policy. (Ayenew, 2016)

Transportation refers to the physical movement of goods from a point of origin to a point of consumption. It can involve raw materials being brought into the production process and/or finished goods being shipped out to the customer. Transportation has assumed a greater role in many logistics systems for two reasons. First, the liberalization of transportation laws in many countries has provided opportunities for knowledgeable managers to obtain better service at lower prices than they could in the past. Second, as inventory levels have dropped in response to the popularity of just-in-time (JIT) strategies, transportation is frequently used to offset the potentially damaging impact on customer service levels that would otherwise result from those inventory reductions. (Dorn, 2017)

Transportation is one of the key logistics functions associated with moving goods vehicle on a particular technology in the supply chain, consisting of logistics operations and functions, including forwarding, cargo handling, packaging, and transfer of ownership of the goods, risk insurance, customs procedures, and so on. From an economic point of view, transport is one of the defining elements of the production process. (Kondratjev, 2015)

Road transport is influenced by the following factors: distance transportation, cargo weight, volume and weight of the load carrying capacity of the vehicle, the total mileage, type of car, the area in which the shipment. Each tariff for transportation of goods by road does not take into account all the factors, and some of them, the most important in these conditions of carriage. In all cases, the fee for use of the car affects the area in which the shipment is done. (Kondratjev, 2015)

The goal for any business owner is to minimize transportation costs while also meeting demand. The objective of transportation as to link all pick-up and delivery-points within the response time requirements of the customer service policy and the limitations of the transportation infrastructure at the lowest possible cost. (Frazzle, 2002)

Warehouse Management

Warehouse management includes all planning and control procedures to operate the warehouse (Slack, 2001 in (Ayenew, 2016))

A warehousing process poses a significant component of a basic logistic process, which covers activities in the scope of supplies management, or arrangement of inlet and outlet, in other words inflows and outflows, of goods. (Kabus, 2016)

Storage and materials handling address the physical requirements of holding inventory. Storage encompasses the tasks necessary to manage whatever space is needed; materials handling is concerned with the movement of goods within that space. Thus, the former would consider issues related to warehouse number, size, layout, and design: the latter would focus on the systems needed to move goods into, though, and out of each facility. Obviously, an organization's inventory policies have a direct impact on their storage and handling needs. Thus, one result of the move to smaller inventories is the requirement for less storage space. (Dorn, 2017)

Moving the material flows in the supply chain is impossible without concentration in certain areas of necessary supplies, storage for dedicated storage. Movement through the warehouse due to the cost of labor and materials, which increases the cost of goods. In this regard, the problems associated with the operation of warehouses, have a significant impact on the rationalization of movement of material flows in the supply chain, the use of vehicles and distribution costs. (Pettersson, 2008)

A warehouse plays a crucial role in the supply chain, as the goods transported from the manufacturer to the final recipient are stored at least once. It means that in case of an ineffective warehouse operation, the whole supply chain may be paralyzed, e.g. as a result of lack of goods, delays, jams. All logistic actions within the scope of a warehouse should prevent it from posing a bottleneck of the supply chain. It is conditioned by a proper design of a warehouse, also its further operation in connection with other components of a logistic system. Parameters of particular warehouse zones should be defined and calculated precisely. Technologies of internal transport and storage, applied in the warehouse, should correspond to the specificity of operated goods. (Kabus, 2016)

Customer Management

Customer management is defined as the process of managing the relationship between an organization, its people and its customers over time. For sustained success, it is important for companies to align their customer strategy with the company's aims and objectives. The profitability of a firm depends on its ability to identify, grow and retain profitable customers. This can be achieved through combining a deep understanding of customer needs, behaviors and value, with the ability to engage specific customers in the optimal way at various touch points. In addition, this enables the company to optimize customer satisfaction and develop a relationship of trust with its customers. (Adriana SCRIO, 2013)

Customer service is a multi-dimensional and very important part of any organization's logistics effort. In a broad sense, it is the output of the entire logistics effort; that is, customer service and some resulting level of satisfaction are what the logistics system ultimately provides the buyer. However, many organizations do have a narrower functional view of customer service as something they actually perform. (Dorn, 2017)

Customer service is the chain of sales activities and meeting customer requirements, which begins with receiving the orders and ends with the delivery of the products to cus-

tomers, in some cases continuing with equipment maintenance services. The role of customer service is to provide time and place utilities in the transfer of goods and services between the manufacturer and the customer. In another form, the product has no value until it is in the hands of the customer. (Adriana SCRIO, 2013)

Information Flow Management

Information serves as the connection between the supply chain's various stages, allowing them to coordinate their actions and bring about many of the benefits of maximizing total supply chain profitability.

Information sharing serves as an essential approach for the survival of enterprises and enabler of supply chain integration. Nowadays, with the advancement in information and communication technology, information sharing has become more conceivable. Furthermore, information sharing in supply chains has become more efficient by the global introduction of long-term cooperation and coordination which leads ultimately to the improvement of companies' competitive advantages. There is a lack of information sharing within companies nowadays, which results in inefficiency of coordinating actions within the units in the company or organization. (Zahra Lotfi, 2013)

Information sharing means distributing useful information for systems, people or organizational units. To enhance the results of information sharing, organizations should answer four main questions: First we ask what to share, then whom to share it with, then how to share, and finally when to share. (Zahra Lotfi, 2013)

Coordination and integration in supply chain management (SCM) have long been the concerns of the academic community as well as the business world. To survive in today's economy, supply chain partners need to improve their competitive advantages by information sharing. (Zahra Lotfi, 2013)

2.1.6 Integration and Collaboration in the Supply Chain

Supply chain function is based on three fundamental pillars: integration, collaboration, and coordination. Fawcett and Magnan (2002) indicated that better words to describe integration are cooperation and collaboration. Chen et al. (2009) stated that integration is often equal to coordination and collaboration. Thus, integration, collaboration, and coordination are closely related. (Mushaluk & Chen, 2014)

Supply chain integration is an offshoot of supply chain management. Scholars has viewed supply chain management as all the activities involved from upstream suppliers to down-stream distributors and retailers to fulfill customer request (Chopra, 2010). Supply chain has always been about companies working together to achieve a purpose, these relation-ships have always involved some degree of collaboration to solve bottlenecks in the supply chain network and overcome bumps in demand and supply. (Anue & OZuru, 2014)

2.1.7 Benefits of Supply Chain Integration

Source : https://www.smartsheet.com/integrated-supply-chain-management-vertical-and-horizontal

Figure 4 SC integration Benefit

Supply chain integration is also degree to which an organization strategically collaborates with its supply chain partners and collaboratively manages intra and inter-organizational processes, in order to achieve effective and efficient flows of products and services, infor-mation, money and decisions, to provide maximum value to the customer. These partners either succeed as a whole in delivering superior value to the end customer or they do not. (Ayenew, 2016)

Research shows that unless the firm integrates information systems with its major supply chain partners to allow for more information and data sharing, the firm will hardly stay competitive in the market in the long run. A healthy and collaborative information system fosters the entire supply chain to be more responsive to opportunities and threats arising from customers and competitors. (Md. Akram Hossain, 2015)

Collaboration is defined as working together or with someone else for a special purpose or simply as working with someone. In the last instance, collaboration is simply defined as a synonym for working together. The other two definitions point out common objectives and efforts. Whereas coordination is mainly conducted by sending the right signals or sharing the right information and the same policies, collaboration indicates a joint, interactive process that results in joint decisions and activities. By that, it also indicates a higher degree of joint implementation and can be thought of as a teamwork effort. According to this interpretation, coordination alone excludes joint implementation and operational efforts. (Mushaluk & Chen, 2014)

Collaboration refers to the business practice that encourages individual organizations to share information and resources with each other for the benefit of all (Coyle et al., 2009). Collaboration is also defined as two or more companies sharing the responsibility of exchanging common planning, management, execution, and performance measurement information. It is difficult for supply chain improvements to only involve one firm, thus the need for effective relationships emerges. (Mushaluk & Chen, 2014)

2.1.8. Petroleum Industries Supply Chain and Its Challenges

Commodities such as oil, gas, and petrochemicals require specific modes of transportation such as pipelines, vessels or tankers, and railroads. These commodities are produced in specific and limited regions of the world, yet they are demanded all over the globe since they represent an essential source of energy and raw material for a large number of other industries. (Hussain R, 2006)

The supply chain of the petroleum industry is extremely complex compared to other industries. It is divided into two different, yet closely related, major segments: the upstream and downstream supply chains. The upstream supply chain involves the acquisition of crude oil, which is the specialty of the oil companies. The upstream process includes the exploration, forecasting, production, and logistics management of delivering crude oil from

remotely located oil wells to refineries. The downstream supply chain starts at the refinery, where the crude oil is manufactured into the consumable products that are the specialty of refineries and petrochemical companies. The downstream supply chain involves the process of forecasting, production, and the logistics management of delivering the crude oil derivatives to customers around the globe. Challenges and opportunities exist now in both the upstream and downstream supply chains. (Hussain R, 2006)

Supply chain management requires the company to integrate its decisions made within its chain of customers and petroleum industry exploration phase at the storage logistics, refinery operations, and products. As it can activities (exploration, or natural gas) and pipelines, retailers and in the petroleum in oil & gas industry decisions with those and suppliers. This process involves relationship management with their customers and suppliers. long-term strategic relationships most cases, there is a collaboration and gas company with its supplier's companies view their supply coordination systems as worthy necessary improvements over competitive advantages in the marketplace. Generally, oil & gas supply chain configuration and worthy of improvement. Making time allows the firm to gain marketplace. (Saad, et al., 2014)

The logistics network in the petroleum industry is highly inflexible, which arises from the production capabilities of crude oil suppliers, long transportation lead times, and the limitations of modes of transportation. Every point in the SC network, therefore, represents a major challenge (Asfaw, 2017).

Fuel is so easily ignited, it must be handled with great care. It is one of the most hazardous substances that we use. It requires a special precaution at the time of storage, loading, discharging, transporting, and usage. Shatina, Zulkifli & Norlena (2014) mentioned that from a health, safety and environmental perspective, there is a continuous concern for safety in Oil & Gas operations. (Melaku, 2017)

2.1.9. PESTEL Analysis Affects Petroleum Industry

PESTEL analysis is used by organizations for identifying the factors of external environment of the market that could influence the organization and the entire industry. PESTEL analysis is formed by six macro-environment group of factors: political, economic, social, technological, environmental and legal factors.

Macro-environmental factors are less influenced by companies than micro-environmental factors (customers, employee, suppliers, shareholders, media and competitors), but companies of oil industry can have bigger influence of macro-environment than companies from other industries. This fact is resulted because of the need for energy resources for political, economic, social, technological, environmental and legal activities. (Essay, November 2018)

The importance of knowing the macro-environment on an industry such as important like petroleum industry is crucial in the modern economy, because these factors represent the opportunities and threats of this economic sector. Many specialists think that the change from fossil fuels to the renewable resources would resolve many of the problems and threats that the oil industry has. So, the transition from oil to renewable resources should be faster, omitting many variables upstream and downstream of this industry. If a change of the principal energy resources will be made, it will be required to take caution steps, because this could make a shortage of the energy resources that could destabilize the entire world social-economic-system. For changing main energy resource will be necessary to reconvert many equipment and machinery, training the human resource, make social campaign to encourage the people to use new fuel, invest in new research about efficiency of the new fuel, the environment impact, search for new reserves and make new regulation for the use of this resource. (Essay, November 2018)

2.1.10. LPG - Its Uses and Benefits

LPG is a mixture largely of propane and butane. At atmospheric pressure, Propane is a gas above –42 degrees Celsius (C) and butane is a gas above –0.5°° C. The ratio of propane to butane in LPG varies from market to market. Unlike natural gas which rises, LPG settles near the ground if leaked, increasing chances of explosion. LPG is spiked with an odorant to make leak detection easier. (Kojima, 2011)

At room temperature, LPG is a colorless and odorless non-toxic gas. Under modest pressure or cooler conditions, it transforms into a liquid state and can thus be easily stored and transported in cylinders. For safety reasons, an LPG cylinder is only filled with 80% liquid while the remaining 20% contains gaseous LPG. Propane vapor one of LPG's gases is more than one and a half times heavier than air and can accumulate above the ground.

A foul-smelling odorant (typically ethyl mercaptan) is added to help detect leaks and thus reduce the risk of explosion. (Sepp, 2014)

Gaseous propane and butane take up about 250 times as much space as in the liquid state. To conserve space, LPG is pressurized in metal containers at ambient temperature or else refrigerated to transport and store as a liquid. The need to keep LPG pressurized or refrigerated and associated metal management add considerably to the supply cost of LPG. (Sepp, 2014)

LPG can bring about a significant reduction in indoor air pollution since it reduces health-adverse exposures by more than 90 % in comparison to open fires or traditional stoves. LPG substantially reduces pollutants such as Sulphur oxide (Sox), nitrous oxide (NOx) and particulate matter due to its more complete combustion compared to solid fuels. From an environmental point of view, LPG usage has contributed to reductions of greenhouse gas emissions in many countries where most inhabitants still use wood or charcoal fuels that generally did not originate from sustainable forest operations and were burnt in traditional, inefficient cook stoves. For instance, households that cook with charcoal emit 5 to 16 times more greenhouse gases per meal than those using LPG. Substitution through LPG can considerably reduce overall wood fuel consumption in a country or region. Just 45kg of LPG are sufficient for replacing the thermal energy of 1 tonne of wood used to produce charcoal with traditional kiln and stove technologies. Moreover, an entire hectare of savannah forest is needed for the sustainable wood production of 1 tonne of firewood. (Sepp, 2014)

Switching to LPG from traditional fuels, which is particularly well-suited to domestic cooking, would improve greatly the quality of people's lives and bring far-reaching social, economic and environmental benefits. (ElGAS, 2018)

The LPG supply chain is a means through which LPG is delivered to consumers. LPG supply begins with the producers the oil and gas industry. LPG marketers may be oil or gas company affiliates or independent businesses whose scale of operation may range from local to multinational. LPG moves from the point of production to the ultimate user in a sophisticated transportation and distribution system (ElGAS, 2018).

There are international standards in the installation of LPG, for example the following table shows the distance requirement of installation of LPG but is tightened by regulations of the concerned country (ElGAS, 2018)

Table 1 Cylinder Installation Standard Example

These distance requirements can be tightened by regulations of the concerned country

Distances in relation to cylinder walls	= to or < than 50 kg	50 kg and = to or < than 260 kg	> 260 kg
Openings in the residential building	1 m	2 m	3 m
Openings in another residential bldg or premises	2 m	3 m	3 m
Sewer, air hole or cellar entrance	2 m	3 m	3 m
Open fire butane cylinders propane cylinders	 1 m 3 m	 none 3 m	 none 5 m
Combustible materials butane cylinders propane cylinders	 1 m 3 m	 none 3 m	 none 5 m
Property line (propane)	3 m	3 m	3 m
Public thoroughfare	3 m	3 m	3 m
Electric appliances butane cylinders propane cylinders	 2 m 3 m	 none 3 m	 none 5 m
Overhead electric lines	3 m	5 m	7.5 m
ERP	3 m	5 m	7.5 m

Source: (ElGAS, 2018)

2.1.11 Supply Chain review in Ethiopia

It is known that the goal of any supply chain management is to provide maximum customer service and satisfaction at the lowest cost possible. In Ethiopia the supply chain of coordination activities ranges from selecting and procuring quality fuel from supply source to product distribution at retail outlets. It is advisable to examine the fuel supply chain of the country because of a number of reasons. Fuels that are produced by the refineries and imported to the country at port usually comply with legislation (Tegegne, 2015). The key and distinguished activities in the downstream petroleum sector supply chain of Ethiopia can be classified to importation, storage, transportation, distribution and marketing.

In Ethiopia the major transportation challenges are having no access to sea (Land-locked country) and back ward transport infrastructure. Due to this the deliver process was expensive and challenging. This hinders the firms' competitiveness of the country. (Ayenew, 2016)

2.1.12 PESTEL analysis of LPG in Ethiopia

LPG functions in a dynamic environment where it is influenced by increasing environmental activism among consumers, technological changes, regulatory framework, collective social trends, increasing regulatory framework for environmental factors, consumer spending behavior, government decisions, and ever-evolving legal system. (Dawar, 2018)

Political Factors

Political factors represented by the influence on the national level, regional level or international level. In Ethiopia LPG is imported from other country and using neighbor's port so it affected by the international and local political factors. Ethiopia is a land locked county and does not have a port, so for import LPG the companies using neighboring countries port.

A powerful influence over the production of oil and the price is made by instable situation from the Middle East, where every conflict could disturb oil production and transport, resulting in the rising of oil price. (Asfaw, 2017)

Many countries including Ethiopia agreed and signed an agreement to reduce emission of gaseous pollutants. Kyoto protocol, Montreal protocol, Stockholm convention, Copenhagen Summit, South Africa Summit and Paris Agreement are some of the multilateral agreements that Ethiopia has taken the lead and signed at the forefront. Accordingly, Ethiopian environmental policy has been crafted to address the environmental issues including pollution various legislation including proclamations, regulation and standard guidelines have also been developed. (Gulilat, 2018)

Economic Factors

Economic factors include taxation rate, economic performance of country the stage of economy of country, exchange rate, consumer disposable income, interest rate, inflation rate, labor market conditions.

Unless exempted by law, items imported into Ethiopia are subject to a number of taxes. Government levies five kinds of taxes on import items. These taxes are assigned priority levels and are calculated in a sequential order. These taxes, in their sequential order, are customs duty, excise tax, VAT, surtax and withholding tax. Taxes on imported goods are collected by the Ethiopian Revenues and Customs Authority (Authority, n.d.)).

In the investment Incentives and investment areas reserved for domestic investor's council of Ministers Regulation no. 270/2012 on the section of Investment areas and income tax

exception no. 13 stated Importation of LPG and bitumen not eligible for income tax exemption.

As per CSA the annual inflation rate rises to 11.1% in March 2019 from 10.9% in February 2019, hitting its highest level since October 2018. In contrast, inflation picked up for housing, water, electricity, gas and other fuels such as charcoal and firewood (8.9% vs 8.1%). Monthly, consumer prices went up 2.2 percent compared to a 1.4 percent rise in the previous month. Inflation Rate in Ethiopia averaged 16.08 percent from 2006 until 2019, this also affect the price of LPG.

As per the World Bank report Ethiopia's economy experienced strong, broad-based growth averaging 10.3% a year from 2006/07 to 2016/17, compared to a regional average of 5.4%. Industry, mainly construction, and services accounted for most of the growth. (Business, 2010)

Foreign Exchange reserves maintained by the government of Ethiopia remain at low-levels, a longstanding challenge for those seeking to import. All transactions must be carried out through authorized dealers under the control of the National Bank of Ethiopia. There are no free trade zones in Ethiopia. (Business, 2010)

Currently Foreign exchange shortages due to weak export performance and high demand for foreign currency affect the market. Currently the exchange rate of foreign currency is 1 USD is around Birr 28.50 to 29.00(NBE, 2019)

Social Factors

Social factors include – culture, acceptance of entrepreneurial spirit, attitude towards certain products and services, traditions, gender roles, demographics, health & safety attitudes, societal roles and norms, and leisure interests.

By 2030, the population of Ethiopia is expected to increase to 134 million of which 21% are projected to reside in urban areas, putting more pressure on the demand for fuels. (WAAS, 2018)

Addis Ababa is experiencing a higher population growth due to higher rate of urbanization and rural to urban migration. The city has a population of 2.7 million with a growth rate of 2.1%. The increasing population derived a change in land use from natural to build environment. (Gulilat, 2018)

Ethiopia's health policy was issued in 1993, with the aim of giving special attention to women and children, to neglected regions and segments of the population, and to victims of man-made disasters. The priority areas of the policy are in the field of Information Education and communication (IEC) of health towards health issues, epidemics, and diseases that are related to poor living conditions and exposure with severe environments. (Gulilat, 2018)

Ethiopia's environmental policy: Ethiopia has adopted the Constitution in 1995. This Constitution provides the basic and comprehensive principles and guidelines for environmental protection and management. Among other things the Constitutes states that everyone has the right to live in a clean and healthy environment and the government will make every effort to provide such an environment. (Gulilat, 2018)

Impacts of air pollution in Addis Ababa- The most serious impact of urban air pollution is damage to human health. People living in urban areas are exposed to air pollution which seriously affect their health. In Addis Ababa, poor people and children in the central urban areas are the most damaged group of society by air pollution. The children and old people also have difficulty in coping with air pollution Exposure to air pollution may cause various diseases. Long time exposure to air pollutions causes respiratory disease, throat inflammation, cardiovascular disease, chest pain, and congestion According to Addis Ababa City Health Biro health management information system report acute upper respiratory infections, acute bronchitis, asthma, chronic obstructive pulmonary disease (COPD), pneumonia, and other unspecified district or region-specific respiratory diseases are increasingly recorded in the last five years. The prevalence of these respiratory diseases is alertly increasing from time to time. (Gulilat, 2018)

Technological Factors

Technology in customer services, access to mobile phones driving empowerment, access to greater information, population access to technology.

Ethiopian government is making huge efforts to use Information and Communication Technology (ICT) as a tool in its strategies of eradicating poverty. It has been also considered ICT as a vital aid to solve the poverty issues with the effective application of the technology. This is because ICT benefits the poor by providing information that is critical for poverty reduction.

Environmental Factors

Environmental factors are laws regulating pollution, safe disposal of hazardous material, safe waste disposal, insurance policies, safe water treatment, climate change, increasing focus on sustainability, limiting carbon footprints etc.

Switching from traditional fuels and coal to LPG can bring considerable health and environmental benefits at the local, regional and global levels. Indoor air pollution, which affects mainly women and children, is greatly reduced. Many regions in Ethiopia are affected by deforestation and a high degree of desertification. Greenhouse effect, warming, rising of atmospheric temperature, loss of biodiversity, air, water and soil pollution, soil degradation, reduction of surface water and fresh water problem, an increase number of crop failures, wind and ice damage to crops, erosion, industrial pollution, hazardous chemicals and pesticides, coastal and marine pollution and general climate change etc. are major environmental problems of Ethiopia like most African countries. (Beyene, 2018)

Legal Factors

Legal factors include copyrights law, data protection laws, time taken to deliver justice, intellectual property rights protection, biasedness toward home players, discrimination laws etc. The main environmental law, the Environmental Policy of Ethiopia, serves as a framework for environmental legislation at lower levels of government, especially regional policies. Regions are permitted to develop their own environmental policy, as long as it meets the standards established by the federal environmental policy. In theory, regional policies may support more stringent environmental standards, but may not set lower standards than the federal law – and indeed in many cases regional policies have been simply "cut and pasted" from the national policy, such that most written environmental policies are similar across regions. In practice, however, some regions are relatively less active than others in terms of environmental law enforcement, particularly with regards to regulating the environmental impacts of development activities (e.g., requiring Environmental Impact Assessments for proposed industrial expansion). (Beyene, 2018)

The Ethiopian Petroleum Supply Enterprise, established in 1995, was the sole entity established to meet the country's demand for petroleum, with the exception of liquefied petroleum gas (LPG), bitumen products, and lubricants. (Fortune 2015)

2.2 Empirical Review of Literature

This section reviews literature from studies carried out in relation to LPG supply chain.

The first review is on the research done on December 2011 by Houston International Business Corp. Energy and Environmental Policy Consultants with World Bank on the "Review the Experience of 20 Developing Countries.

This study was undertaken as part of a larger study examining how liquefied petroleum gas (LPG) can contribute to reducing household energy poverty in developing countries. The study takes 20 developing countries from around the world and assesses the legal framework, industry and market structures and practices, supply arrangements and infrastructure, and pricing policies. (Matthews & Zeissig, 2011)

In the regulatory framework for LPG part it revised the downstream petroleum laws and general regulations in many of the developing countries reviewed are incomplete and often antiquated. Only about half of the countries have promulgated special regulations for LPG, but most have issued at least some national standards and/or formally adopted international or regional standards for quality control and protection of occupational health, safety and the environment (HSE). (Matthews & Zeissig, 2011)

LPG has well defined specifications in the international markets. The appliances for use in households as well as the facilities and equipment for transport, storage and distribution are relatively simple and similar around the world. As such, it is not necessary for developing countries to re-create their own HSE standards and technical specifications for LPG and the chain of supply. (Matthews & Zeissig, 2011)

In most of the countries the main quality, safety and environmental issues of the LPG chain of supply are subject to similar, basic rules according to international norms and practices, they have been either formally adopted and incorporated into national legislation or are used as a matter of fact by regulators and operators. Whether those rules are really applied and enforced depends more on the institutional structures and capacities of the government than on the completeness and sophistication of the regulatory framework, and on the characteristics of the suppliers and distributors in the country. The standardization laws in many jurisdictions specifically allow the formal adoption of foreign norms as an alternative to the writing of national standards. Nicaragua, Madagascar, Tanzania and Uganda have recently promulgated modern laws for the downstream petroleum sector that mandate the formal adoption of international. Most other countries have

adopted at least some foreign standards or include references in their national standards. (Matthews & Zeissig, 2011)

In countries where the legislation and/or standardization are incomplete, as in Afghanistan, the Dominican Republic, Fiji, Senegal, Thailand and Vietnam, international standards are often applied by the regulators and the industry as a matter of fact.Whether those rules are applied and enforced in practice depends more on the institutional structures and capacities of the government than on the completeness and sophistication of the regulatory framework. The subsidiaries of major international oil companies and well-organized local operators, privately or state-owned, tend to apply the basic standards regardless of the mandates and efficiency of the applicable legislation. (Matthews & Zeissig, 2011)

In the Supply arrangements and infrastructure section stated that several of the countries that are dependent on imported supply have limited storage but are planning to expand in order to improve the economies of scale in both marine transport and receiving/storage terminal operations. (Matthews & Zeissig, 2011)

Pakistan has private sector terminal operators engaged in receiving, storing and onward shipping product for third parties for set fees. The regulatory authority in Pakistan, supported by an association of LPG distributors, encourages ―hospitality arrangements‖ among land-based LPG storage facilities whereby operators would trade off storage capacity in one area in return for access to the other company's storage in another region. These hospitality agreements are registered with the regulatory authority. Both of these measures minimize duplication of infrastructure, improve efficiency and enhance potential for lowering costs. (Matthews & Zeissig, 2011)

In the LPG Supply/Distribution Chain part, they stated that the Commercial participants in the LPG supply chain include the following actors:

1. Producers sell LPG at the refinery or natural gas processing plant gate.
2. Traders and marketers buy LPG in bulk from producers or from overseas markets, store it in large primary terminals, and sell it to other marketers, distributors, retailers, and final consumers.

3. Transporters and distributor's truck, rail, or pipe bulk LPG to their regional depots where it is stored in large pressure vessels, and then supply LPG to bulk customers by small road tankers. LPG is bottled in cylinders and distributed to retailers.
4. Retailers sell LPG to small customers, including households. The retail outlets may be retail branches or commission agents of a marketer, or independent resellers who purchase and resell LPG in marketer-owned and branded cylinders.
5. The final consumers include:
    (a) Large bulk clients such as industry which use LPG as fuel, petrochemical plants which use LPG as feedstock
    (b) Small bulk clients such as commercial, agricultural and larger residential consumers

Households using LPG cylinders for cooking and other energy uses such as water and space heating.

The study lists out factors driving LPG growth in developing countries as follows: the general drivers of LPG growth in developing countries will continue to be economic and population growth but the rate of growth in different countries and regions will depend on a number of more specific factors influencing both the availability of and demand for LPG these are Disposable cash income of consumers, Price of LPG relative to the prices of other fuels, Rules governing trade and investment, such as licensing of distribution and repatriation of profits, and the rate of taxation of corporate profits, Control of wholesale and retail prices and margins, Regulations concerning industry operational and safety standards, and how rigorously they are enforced, Initial start-up costs to household consumers (cylinder, regulator and cooker),Reliability of LPG supply compared with other fuels, Ready availability of LPG through sales outlets in close proximity to consuming households and the stability of the political and legal system and the regulatory regime. (Matthews & Zeissig, 2011)

In the impact of government policies on LPG use section as with other sectors, government policies and measures can facilitate LPG market development. An environment that encourages private sector entrepreneurship and financing can catalyze LPG market take-off and establish a virtuous circle of growing market potential, competition, investment and availability. And Government support can take various forms: like Measures to make the regulatory and business environment favorable to investment in bulk transport and distribution infrastructure, Liberalization of LPG importation, wholesaling and retailing,

Measures to make LPG more affordable and competitive, Fiscal measures like Subsides - Direct subsidies to the fuel itself and to the utilization equipment are the most common form of direct support to LPG. Many developing countries have subsidized LPG, either directly from their Treasuries or cross-subsidies from taxes on other fuels such as premium gasoline. Although some of these subsidy programs have been positive in that they were time-bound and provided to build a market, others have been detrimental to the particular country's finances and energy sector and support to micro-credit for poor household consumers. (Matthews & Zeissig, 2011)

Finally, the study recommended the following to policymakers the conditions for developing a successful LPG industry are not much different from those for any other fuel. Experience has shown that the following principles can provide a practical basis for effective policies aimed at expanding modern energy services to households: The provision of energy services should be competitive. Competition allows consumers to choose among fuels and among suppliers. Healthy competition in the presence of monitoring and enforcement of regulations and standards promotes service quality and drives down costs, the market should set prices. All controls over pricing should be removed once competition is established. Taxes should not undermine consumption or distort the market inadvertently. Any differentials in tax rates among different household fuels should be justified by legitimate social or environmental arguments. Given the benefits of LPG over traditional fuels and kerosene, excise taxes on LPG should be kept to a minimum so as not to harm its competitiveness and discourage its use. Subsidies should be targeted, transparent, practical and temporary. Subsidies should normally be aimed at rural households and the urban poor and regarded as a temporary measure to support switching from traditional fuels. (Matthews & Zeissig, 2011)

Barriers to market entry should be removed. Laws and regulations that impede trade and investment, including restrictions on repatriation of profits, should be removed. Barriers to switching to modern fuels should be addressed. Support could be provided to LPG company credit programs and to micro-credit organizations to lower the cost of cylinder, appurtenances and cooker.

Awareness about comparative fuel costs and attributes should be promoted. Governments should disseminate information and raise awareness among households about the costs and practical benefits of modern fuels compared with traditional fuels. (Matthews & Zeissig, 2011)

The Second study reviewed by this research is **"Multiple-Household Fuel Use a balanced choice between firewood, charcoal and LPG"** published by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH by author Steve Sepp, ECO Consulting Group in 2014. It has four chapters. These are Household Fuel Use, Firewood, Charcoal and LPG.

In the "Household Fuel Choice" part it is stated that evidence that has been gathered in many countries does not support the notion that a transition from wood-based energy to fuels such as LPG follows any regularized pattern. Decisions related to energy consumption and fuel type are strongly influenced by accessibility, affordability and the convenience of the fuel. These criteria are closely related to one other and also depend on household income. (Sepp, 2014)

Accessibility is often not achieved in the case of LPG. In most countries, access to LPG is limited to urban areas and LPG supply shortages is a frequent occurrence in rural areas. Additionally, due to the low cost of wood fuel and lack of awareness, increased LPG use is currently not viable for most rural areas in developing countries. (Sepp, 2014)

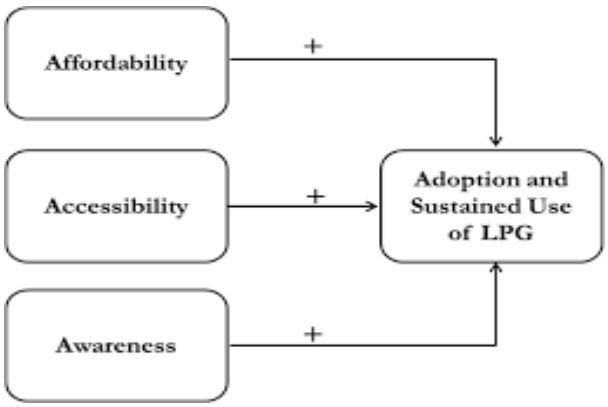
Affordability is still a substantial barrier for many households who want to use LPG. Evidence shows that subsidies have benefitted wealthier urban users more than low- income users as the former are in a better position to afford the high initial costs associated with LPG. This is reportedly the case for most countries in which LPG is being subsidized.

Convenience is one of the main reasons why the use of LPG has been growing world- wide. LPG heats quickly and provides much greater efficiency than even the most improved biomass stoves. LPG stoves can also be controlled more precisely to match the user's requirements and can save time for cooking and cleaning the kitchen. Additionally, LPG can be transported, stored and used virtually anywhere. (Sepp, 2014)

In "What are the Challenges of LPG" part it is stated that the main challenges for broader dissemination of LPG are its limited accessibility and affordability for its users. Furthermore, a lack of awareness of LPG as well as fear of accidents exist. The development of governmental policies and regulations to create incentives for increasing LPG use are therefore advisable to support LPG uptake. (Sepp, 2014)

Further, possible government interventions include designing favorable taxes/duties, industrial safety provisions and stronger enforcement procedures. This will also create incentives for distribution companies to develop commercial LPG infrastructure and ensure

regular supply on a broad basis with close proximity to households. Affordability could be further improved by providing microcredit or loans for the sake of lowering upfront payments or by following Kenya's example of installing structures that allow poorer households to purchase small amounts of LPG, much in the same way they purchase kerosene or charcoal. (Sepp, 2014)



The third empirical review is made on the "**Guidelines for Good Business Practices in the LPG Industry"** written by The World LPG Association on April 2015. In the guidelines the role of Government and Industries clearly stated as follows:

The Role of Government

Government plays a vital role for the LPG industry. Two essential areas of government involvement are the elimination of bad practices/bad operators and providing a competitive business climate. (WLPGA, 2015)

A. **Elimination of Bad Practices**

Within the market framework just mentioned there is a clear role for a partnership between industry and government. While industry works to provide a sustainable modern energy supply, government should be aware of, and work to rectify, some of the more egregious practices of unscrupulous operators including: (WLPGA, 2015)

1. Poorly designed and constructed LPG storage facilities

   This is one of the more capital-intensive investments in the LPG industry. Poorly designed plants and other facilities can result in unfair competition due to lower capital outlay by unscrupulous operators, and greater safety risk to employees, customers and the general public.

2. Inadequate training of staff

   Inadequately trained staff leads to a high-risk environment, operational errors, and endangerment of customers and the general public.

3. Allowing unauthorized premises/personnel to operate

   LPG plants contain hazardous goods. It is essential they operate in accordance with approved procedures adapted and suited to their environment. Unauthorized operation can lead to inequitable competition, the encouragement of bad practices by others, sub-standard equipment in service, danger to the general public and governments being deprived of legitimate revenue. (WLPGA, 2015)

4. Use of unsafe containers (LPG cylinders and tanks)

   LPG containers when constructed to established codes are durable and have a long useful life. When no longer safely usable, they should be made unserviceable. The use of unsafe containers results in unfair competition, a serious risk to the general public, and possible litigation for reputable manufacturers.

5. Illegal filling (decanting) of cylinders

   One of the more destructive practices in the LPG industry is the illegal filling (pirate filling) of cylinders by someone other than the cylinder owner. This dangerous practice can result in:

   a. no control over the condition of the cylinder
   b. no control over the quality or quantity of the product in the cylinder
   c. serious risk of damage or injury to those handling including the customer
   d. inequitable and often unsustainable competition

6. Unauthorized acquisition, reworking, and repainting of cylinders (WLPGA, 2015)

   This practice involves one company stealing the cylinder of another company, repainting it with the brand of that other company, and then re-introducing it into the market. This can result in:

   a. no control over the cylinder condition
   b. serious risk exposure to those handling the cylinder, including the customer
   c. inequitable competition
   d. loss of assets of the legitimate owner.

7. Under-filling of cylinders and containers (WLPGA, 2015)

   LPG is sold by weight in cylinders, and by weight or volumetric meter in larger containers. Under-filling can be a deliberate act or one of negligence. The customer is entitled to receive all the product purchased.

8. Over-filling of cylinders and containers

   The over-filling of cylinders and containers is unlikely to be done deliberately but poorly calibrated filling equipment might lead to this. Over filled cylinders and containers is a dangerous practice that increases the probability of an uncontrolled loss of product.

9. Poor maintenance of trucks, plants and containers

   Whether an operator chooses to have attractive equipment is a matter of choice. Maintenance of that equipment is not a matter of choice. Poorly maintained equipment can lead to leakage of product, unsafe cylinders, unsafe trucks on the road and hazardous plant conditions. All these conditions will result in risk to employees, personnel and the general public. (WLPGA, 2015)

B. Provide Competitive Business Climate (WLPGA, 2015)

LPG has a unique role for both developing and developed economies. It is often the first, and sometimes the only, modern form of energy available. In developing countries, the first use is frequently for cooking. Here, LPG displaces wood, charcoal, kerosene and animal waste. Because LPG is a clean burning and portable fuel it:

a. Brings the benefit of modern energy to many, without the need for costly infrastructure in transmission lines or pipelines
b. Saves precious trees and forests, frequently the only source of fuel for many
c. Improves the air quality of homes to which children and the elderly are particularly exposed and sensitive

However, LPG is used for more than just cooking. Over 1500 uses have been identified in the residential, commercial, industrial, agricultural, chemical and automotive markets. For the LPG industry to fulfill its role, it must operate within a framework of 'good business practices'. It also must rely on the establishment and enforcement of sound governmental practices that: (WLPGA, 2015)

i. ensure common rules for all participants in the market equally applied and enforced
ii. clearly defines the rights and responsibilities for all participants including the customer
iii. offer those with investments an opportunity for a fair and reasonable financial return on those investments
iv. provides an avenue of redress for those aggrieved by 'bad practices'

For private business to bring the benefit of LPG to those wanting or needing its products and services there must be a 'level playing field' where the rules are the same for all players. Only then will business take the risk of investment, provide jobs, and contribute to the economic welfare of the communities in which it operates. (WLPGA, 2015)

A business climate that favours some over others, either by lack of enforcement or inequitable enforcement of regulations, will ultimately prove a disincentive to the legitimate operators and encourage a drop-in industry standard and inevitably a drop-in industry competition. (WLPGA, 2015)

The Role of Industry

It is not only government that has responsibilities. It is important to note that WLPGA views the bad practices discussed in this document as an industry issue, and is not relying on government to determine how the industry should operate. During its nearly 100 years of existence, the LPG industry in cooperation with government and international organizations has consistently developed standards of practices that, in many countries, have been incorporated into government regulations. The LPG industry works continuously to evolve these standards in response to new technologies, new applications and other new challenges. The LPG industry is also accountable, and accepts its responsibilities, for: (WLPGA, 2015)

a. Providing a safe, dependable energy to its customers
b. Providing training for its staff
c. Operating its plants, transportation and equipment in a safe manner
d. Treating employees, contractors and customers fairly
e. Operating its business ethically
f. Cooperating with local and national officials

Other study is observed in 2012, which was compiled by Leah Nyaguthii Njogu on the Challenges Facing the Implementation of Liquidized Petroleum Gas Supply Chain Strategies in Kenya. It focuses on identifying problems affecting implementation of LPG supply chain strategies. (WLPGA, 2015)

2.3 Conceptual Framework of the Study

Conceptual framework is a hypothesized model that identifies the concepts under the study and explains graphically the general construction of the variables to be studied and the relationships amongst them. It expresses the independent variable which influences the dependent variable. A dependent variable is a variable that is a consequence of another while and independent variable is that which is antecedent to the dependent variable or that which makes it change. An intervening variable is something that impacts the relationship between an independent and a dependent variable. Usually, the intervening variable is caused by the independent variable, and is itself a cause of the dependent variable (Kasomo, 2006)

The relationship of the conceptual framework is described, and the implication is mentioned here under**.**

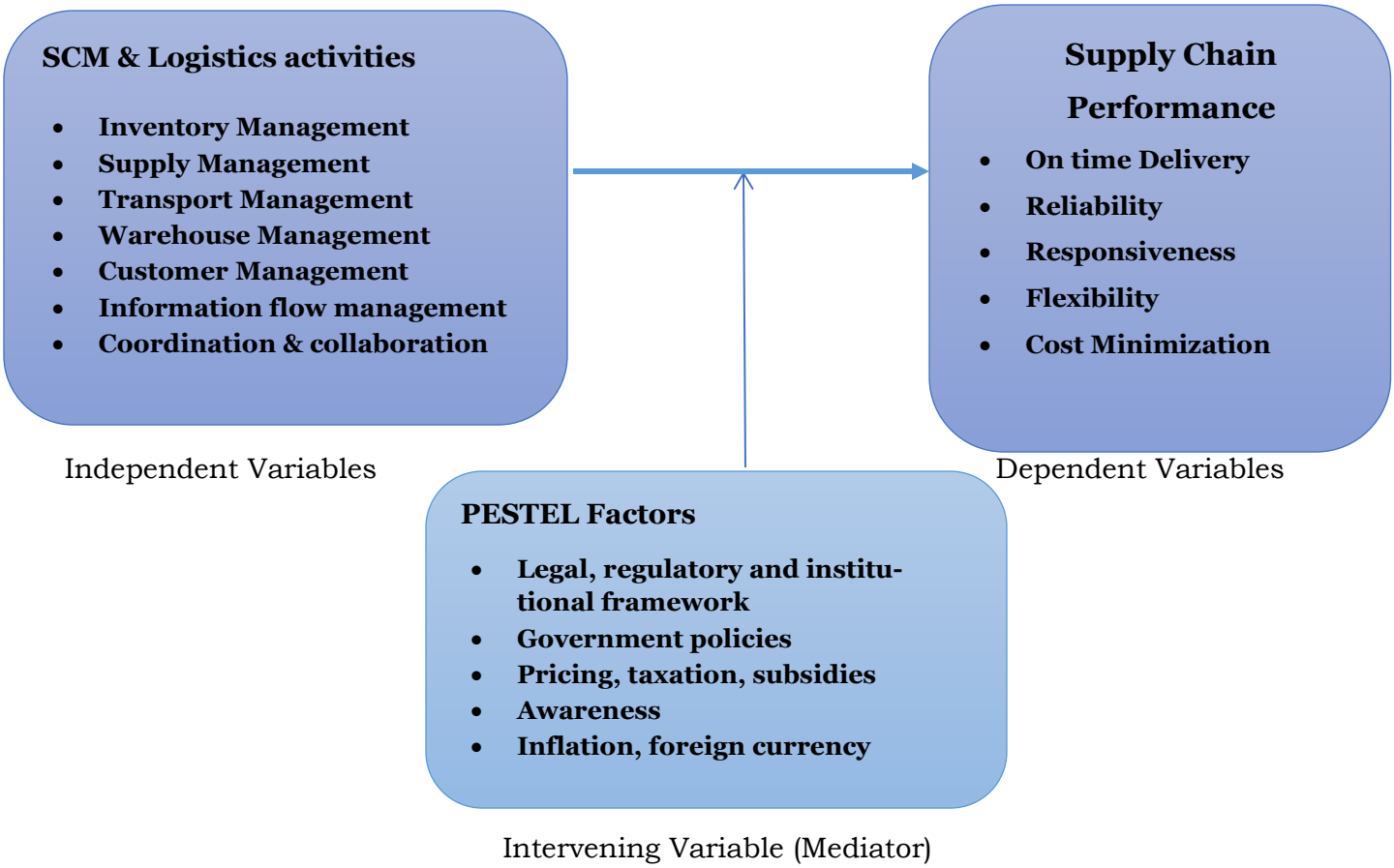


Figure 5 conceptual framework of the Study

Source: Developed by the researcher for this research purpose by Adapting from AURA, 2019

CHAPTER THREE
METHODOLOGY OF THE STUDY

The research showed how a Supply chain can better overcome the LPG supply challenges. The objective of this research is to identify and examines the challenges of LPG supply chain in Ethiopia. This part describes the methodologies that are used in this study: the choice of particular research designs, sampling techniques, sources of data and data collection tools along with an appropriate explanation combined with each approach.
To address the general objective and to fill the knowledge gap, adequate data from both quantitative (survey questionnaire) and qualitative (in-depth interview) sources were used, and converge data collect from both sources at the same time to get a comprehensive analysis of the research problem and interpret the overall result.

Therefore, the study has used quantitative survey research questionnaire and in-depth interview data gathering instruments together with documentary analysis. In addition, the study used concurrent mixed approach during the study.

3.1 Research Approach

The research approach applied in this study is using qualitative and quantitative data jointly in order to identify the problems of the Downstream LPG supply chain network of Ethiopia based on theoretical facts.

In mixed method approach, the researcher bases the inquiry on the assumption that collecting diverse types of data best provides on understanding of a research problem, as a mixed method. It focuses on collecting, analyzing, and mixing both quantitative and qualitative data in a single study or series of studies. Its central premise is that the use of quantitative and qualitative approaches, in combination, provides a better understanding of research problems than either approach alone. (Creswell, 2011)

The mixed approach to research is chosen over the other approach as the research believes that it provides a better understanding of the research problem. Quantitative method was used for data collected through close ended questionnaire, qualitative method was employed to collect information by interview that can describe and support the information obtained through quantitative.

3.2 Research Design

According to Wiersma and Jurs (2009) a research design is a plan, structure of investigation conceived so as to obtain answer to research questions and to control variances. (Wiersma, 2009).

This study intends to identify how a supply chain can better overcome the LPG supply challenges in Ethiopia, so as to identify and examines the challenges of LPG supply chain based on SCM principles and philosophies and that are supposed to be effective parameters just to evaluate the external factors that affect the chain. Therefore, this research looks like explanatory research type, which helps use of both qualitative and quantitative data analysis.

3.3 Method of Data Collection

Data for the research consisted of two parts, primary and secondary data sources. Data were utilized through Questionnaires, interview, and by reviewing related literatures.

The primary data conducted in the form of personal interviews with importers and distributing companies and an official from Ministry of Mining and Energy. Questionnaires distributed to Retailers. As secondary data; books, articles, journals, magazines, and broachers were reviewed.

Questionnaire: In the first part, close ended questionnaire with a 5-point Likert scales and in the second part by listing the Macro level challenges that given chances to respondents to select from each category on what they observe as a challenge in their operations were included in the questionnaire. The questionnaire was prepared in two formats, i.e., for Distributers and Retailers.

Interview: In order to obtain enough information, the researcher used personal interview with importers, distributers and officials.

3.4 Population and Sample

The population means the total units from which the sample is to be taken. It may be infinite or finite. A finite population is the one in which the quantity of things is limited, while an infinite population is the one in which quantity of things cannot be measurable.

For this research, the information gathered through questionnaire from retailers and by interviewing distributor companies' representatives and an official from Ministry of mining and energy.

NOC and TOTAL are using their fuel retail stations in Addis Ababa as a retail shop and Ghion is using 16 Libya Oil Ethiopia's fuel retail stations in addition to their main individual retailers. Allied is using Shoa Shopping center previously, but now, in addition to their retailers, it is using Nadia Supermarket as a retailer and all of them use Main Retailers in the city.

Table 2 Population & sampling

Partners in the Chain	**Population**	**Sample**	**Method**
Importers or Distributer Companies	7	7	Interview / questionnaire
Government Officers	1	1	Interview
LPG Retailers in Detail			
Retail Stations	**Population**	**Sample**	
TOTAL Ethiopia Retail Stations	20	17	
Ghion Gas Retailers & OiLibya Retail Stations for Ghion Gas	26	20	
NOC Retail Stations	21	18	
Retailers with Alayid, Nile, Iran Gaz, WAS and other companies' cylinders	15	13	
Total	82	68	

The sample size of retailers is determined using sample size calculator which pre-defined formula is posted on https://www.surveysystem.com/sscalc.htm. The parameters used in determining the sample size were population size which is 82, confidence level of 95% and confidence interval of 5%.

3.5 Data Analysis Techniques

The research analyzed both primary and secondary data using qualitative and quantitative data analysis tools. As determined in the data collection tool for this study, data were collected in both questionnaire and interview format. Accordingly, the collected data were analyzed quantitatively and qualitatively. For quantitative data analysis, statistical tools like: mean and standard deviation were applied by using SPSS. Qualitative data analysis tools were applied for the data collected from interviewing individuals using open-ended questions.

3.6 Reliability Test Result

Reliability refers to the consistency, stability, or dependability of the data. Cronbach's alpha is the most common measure of internal consistency or reliability. when we have multiple Likert questions in a questionnaire that form a scale, it is commonly used. One way to ensure measurement error is kept to a minimum is to determine properties of the measurement that give us confidence that it is doing its job properly.

Cronbach's alpha reliability coefficient normally ranges between 0 and 1. The closer the Cronbach's alpha coefficient is to 1.0 the greater the internal consistency of the items in the scale and a value greater than 0.7 is acceptable (George & Mallery, 2003).

The reliability of the items in the questionnaires tested by Cronbach's alpha using SPSS and found reliable. Therefore, the expected scales used in this study demonstrate high reliability. The following table shows the SPSS result of the Cronbach Alpha.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Stand-ardized Items	N of Items
.851	.839	19

Source: (own survey, 2019)

Table 3 Cronbach's Alpha result

3.7 Ethical consideration

This research is conducted on data collected from Importers, Distributor, Retailers and Ministry of Mines and Energy official. All the research participants included in this study were duly informed about the purpose of the study and their willingness and agreement was secured before the beginning of filling in the questionnaire and conducting inter-view. Regarding the right to privacy of the respondents, the study maintained the con-fidentiality of the identity of each participant. In all cases, names are kept confidential in the study and replaced by collective names like "the respondents", "the participants", "the interviewees" etc.

CHAPTER FOUR:
RESULTS, DISCUSSION AND INTERPRETATION

This chapter holds the presentation and analysis of data gathered from the field to describe them clearly with consistent pattern. The data obtained from the primary source using interviews, the structured questionnaires and the secondary data are presented here.

The researcher collected data through questionnaire, and then the responses were measured on a 5-point scale as shown below: and by choosing the challenges from the list 1 – Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 – Strongly Agree. Accordingly, scores have been classified as positive scores and negative scores, i.e. Agree, Strongly Agree and Neutral were grouped into Positive Reponses and Disagree and Strongly Disagree were grouped into Negative responses.

In Addition to the Likert scale to identify the challenges that affect the Supply Chain of LPG data collected by choosing from the list of challenging factors.

4.1. Demographic profile of the Respondents

As per the demographic profile of the respondents, people who has long experience it can be taken as they have a good knowledge and understanding about the area they are working. The experience of respondents in the LPG Industry is summarized in the table below:

Table 4 Respondents Work Experience

	Year of Experience			
	Less than 3 years	**Between 3 to 8 years**	**Between 8 to 15 years**	**More than 15 years**
Number of Respondents	7	29	15	11
Percentage (%)	11%	47%	24%	18%

(Researcher field survey)

4.2. Challenges that affect Supply Chain of LPG

As we understood from the literature review, the overall objective of Supply Chain Management is to contribute to improvement in the supply of the product. SCM Logistics is the process of planning, implementing, and controlling procedures for the efficient and effective transportation and storage of goods including services, inventory managements, and related information from the point of origin to the Point of consumption.

To analyze the challenges that affect the Supply Chain of LPG from End to end we start by considering the import process of LPG, one can observe that it has the same import process with that of other goods in Ethiopia, which initially requires applying for foreign currency approval from The National Bank. After getting approval, the importer must obtain a bank permit to arrange mode of payment. The supply contract will be made between the Importer and the Supplier independently. The existing foreign currency shortage of the country, which might take more than three months; however, made LPG importing process sluggish.

It is known that Ethiopia is a land locked county that does not have a port. Consequently, the companies import LPG using Sudan Port or Djibouti Port. Each importer makes LPG purchase independently. Cost of LPG at port is CP + Premium cost. The CP (contract price) is fixed as showed in table 3 as a sample; yet, it is subject for revision every month. Thus, Saudi Aramco Company, a Saudi Arabian Oil Company based in Dhahran, makes LPG selling price revision and announces the revised price every month as shown below, in addition, the premium price is based on the loading. It includes the cost of freight, vessel, storage and sales margin. The freight cost of the shipment is based on the loading capacity of the vessel, regardless of the quantity loaded in the vessel.

Table 5 Armaco LPG price list

SAUDI ARAMCO LPG PRICES PER METRIC TONNE (MT)

YEAR	MONTH	PROPANE US$ (A$)	BUTANE US$ (A$)
2019	April	515 (727)	535 (755)
2019	March	490 (682)	520 (724)
2019	February	440 (622)	470 (665)
2019	January	430 (610)	420 (596)
2018	December	445 (608)	415 (567)
2018	November	540 (757)	525 (736)
2018	October	655 (907)	655 (907)

Source: http://3mgas.vn/news/saudi-aramco-lpg-prices-per-metric-tonne-mt-n147.html

In Ethiopia for the last five years, LPG is being purchased (supplied) from seven countries: Sudan, Kenya, Saudi Arabia, Oman, China, Kenya and United Arab Emirates (UAE). It is mainly supplied from Saudi Arabia and Sudan. Saudi Arabia had dominated the market as a main sources of LPG imports via Djibouti port; however, for the last two years, Sudan has taken the lead for supplying LPG. The following data is compiled from Ethiopian Ministry of Revenue Imported Goods Data base.

Table 6 LPG Import

Year	Saudi Arabia	Sudan	United Arab Emirates	China	Kenya	Oman	Total per year
2014	6,866,000.00	265,000.00	100,000.00	87.2			7,231,087.20
2015	7,257,670.00	1,500,000.00	552,000.00				9,309,670.00
2016	6,005,000.00	2,900,000.00	736,000.00				9,641,000.00
2017	3,006,000.00	3,923,060.00	368,000.00		22,000.00	2,000,000.00	9,319,060.00
2018		2,000,000.00					2,000,000.00

Compiled by the researcher for this research purpose (April 2019)

Whilst this, it is worth mentioning about pricing of LPG in Ethiopia. The price of LPG in Ethiopia is not regulated. Suppliers add up their profit margin to their cost and sell the product at whatever price they feel is appropriate. The cost-plus profit margin pricing is not always the case. Other factors or events happening at the time of sale seem to affect the price regardless of the cost. During the Foreign Currency shortage crisis, traders who secured hard currency were able to charge high prices even though the price of LPG in the international market was very low at the time. That is why one of the reasons the existing LPG price in Ethiopia ranges from Birr 420 to Birr 595 for 12kg cylinder.

As mentioned in the theoretical framework, the performance of global supply chains is heavily impacted by changes within the macro economy: fluctuations in factors such as oil price, labor cost and currency exchange rates, which can lead to being advantageous or disadvantageous with a product that is distributed globally. Therefore, building optimal and robust supply networks is critical for a product to remain competitive

4.2.1 Storages Capacities (Warehouses) at the Ports

Interviews conducted with top management members of some of the leading LPG importers expressed that product storage problem is a significant problem in the LPG business. They also indicated that mainly the small storage capacity that Ethiopia has

at Djibouti port coupled with the vessels' capacity which are highly incompatible with this storage, necessitate product shortage problem.

To make this clear, let us observe one example on how LPG storage is used at Djibouti Port imposes product shortage. When a small vessel with a capacity from 3,000 to 5,500 MT that carried LPG arrives at Djibouti Port, the importer is required to use intermediate storage terminal. The cumulative storage capacity of Horizon Terminal that is dedicated for Ethiopia at Djibouti has only 650 MT. This shows there is no enough storage at the Terminal as the loading is less than the capacity of the vessel. As a result, this situation increases the fright cost of the gas; and necessitates delay on delivery. When importers order more than the capacity of the storage, companies will pay additional demurrage cost for the vessel. This is the main cause of the price variance and thus, the players in the industry are not able to deliver the product timely and as needed.

In the interviews, it is revealed that importers are incurring unnecessary logistics cost (storage cost, demurrage cost, etc.) when delivery is made via Djibouti Port due to small storage capacity that is incompatible with loading capacity of the vessel.

In the case of Sudan port, unlike Djibouti Port, there is enough storage, which is around 15,000 MT; thus, importers can bring the gas by big vessel. Subsequently, this will decrease the freight cost.

As we have seen in the theoretical review, if there is an ineffective warehouse operation, the whole supply chain may be paralyzed, e.g lack of goods, delays, jams. All logistic actions within the scope of a warehouse should prevent it from posing a bottleneck of the supply chain.

4.2.2. Lead Time and Transportation Cost from Port

To import fuel via Djibouti, the lead-time is short as the distance is only 927 km from Addis Ababa. It takes a maximum of four days for the product to reach Addis Ababa from Djibouti. Besides, the transport cost is cheaper when it is compared to the import made via Sudan. In the case of Sudan, the distance from Addis Ababa to Port Sudan is around 2000 Km and it takes around 7 days to reach Addis Ababa. The transport cost from Sudan to Addis Ababa is almost double when compared to the transport cost of Djibouti to Addis Ababa.

4.2.3. Transporting the LPG from Port to Local Depots

To transport the imported LPG from terminals to local depots, importers use special tracks dedicated for LPG transportation, which is two tank trailers or one single tanker. As per the data from the LPG importing companies in Ethiopia, there is no enough LPG tracks in the country and even the existing trucks are old. The total trucks available in the country are shown on the below table:

Table 7 companies LPG Truck

Company	No. of trucks
Ghion Gas	20
NOC	8
Iran Murfic	4
Total Gaz	2 (exclusive 3rd party contract)

Researcher field survey

When LPG importers bring the product from Sudan, they use trucks of Sudan companies. Accordingly, transport payment will be made by foreign currency. For LPG to be brought from Djibouti, importers use the trucks quantified on the above table only.

In the theoretical review an attempt was made to show transport is vital for any business to minimize transportation costs while meeting demand. The objective of transportation is to link all pick-ups and delivery-points within the response time requirements of the customer service policy and the limitations of the transportation infrastructure at the lowest possible cost.

4.2.4 Local Storage Capacity of the Companies

The study showed that all LPG importing companies have their own storage depot and refilling facility. The imported gas is transported and stored in their respective local depots in the country.

The average consumption of the country is assumed to be around 9,000 MT per year.

Table 8 Companies local Storage capacity

Company	Storage Location	Storage Capacities
Ghion Gas	Dukem	300 MT
NOC	Dukem	170 MT
Iran Gaz Murfic	Burayu	120 MT
TOTAL Gaz	Dukem	70 MT
Nile Petroleum	Sululta	230 MT
WAS Petroleum	Gelan	100 MT
Allied Energy	Rented from Nile	
Total storage capacity in the country		**990 MT**

(Researcher field survey)

The imported gas stored in the depot, will be refilled to the cylinders. The companies import their own cylinders, then it either sold or leases it to the customer. Once the customer buys or lease the cylinder, the customer exchanges an empty cylinder for a full one, paying only for the gas. The company is responsible for filling and supplying safely maintained cylinders. It is common to have the owner's investment secured through a system of refundable deposits or guarantees in cash. The companies have cylinders from 3kg to 52 kg and for bulk users the gas will be distributed to customer sites by mini bulk tanks using Bobtail vehicles.

4.2.5 Inventory Management

Since there is a storage capacity shortage at port and locally, there is no adequate inventory system to hold. Hence, based on the interview conducted, it is learnt that companies sometimes get difficulty in determining quantity to be ordered when stock depletes. The current foreign currency shortage which has extensive que i.e. that might take more than three months, could neither help companies to avoid stock out situation nor dictate them to import more product since the storage capacities at port and locally do not allow this.

4.2.6 Political Factors

In the quantitative data analysis, from part two of the questionnaire the respondents were asked to choose from the list of the problems on the political factors that affect the LPG supply. The result reflected that there is a gap in some of areas and measures have to be taken to close the gap. The highest rated factor was 'Government officials are not supportive' = 34% (n=69) followed by 'Government relationship with neighboring countries = 26% while the lowest rated factors is 'Investment policies' = 3% (n=69).

		Responses		Percent of Cases
		N	Percent	
PF[a]	civil unrest in the imported countries	10	8.5%	14.9%
	Government Relationship with neighboring countries	30	25.6%	44.8%
	International Crude oil Price	19	16.2%	28.4%
	Gov't officials are not supportive	40	34.2%	59.7%
	Lengthy bureaucratic procedures	14	12.0%	20.9%
	Investment Policies	4	3.4%	6.0%
Total		117	100.0%	174.6%

Table 9 Political factors

This particular response reveals that there is lack of awareness in the Government side regarding LPG as depicted in chapter 2, saying the activities and policies of governments have a big influence on the environment of Supply Chain management.

4.2.7 Economic Factors

In the second factor respondents were asked to choose from the list of the problems on the economic factors that affect the LPG supply. The result shows there are problems in the economic factors like foreign currency shortage~~s~~, high taxation rate. The highest rated factor was 'Foreign currency shortage'= 28% (n=69) followed by 'high taxation on accessories of LPG ' 26% while the low rated factors is 'credit facilities' = 14% (n=69).

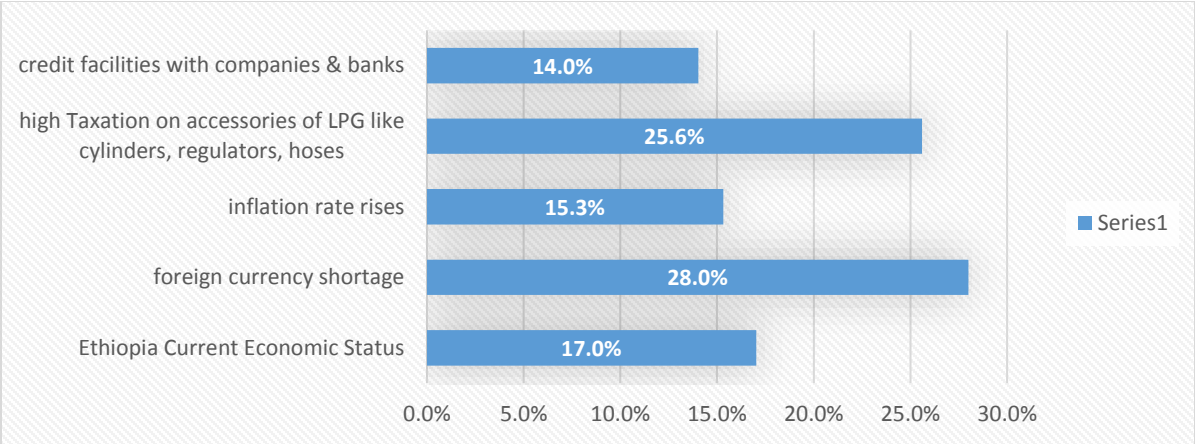


Figure 6 Economic factors

Foreign currency availability is the major issue so 28 % of the respondents choose as the main challenge and accessories taxes also another challenging factor selected by the respondents. As we see in the empirical analysis, the price of LPG is affected by taxes, subsidies and market distribution costs. This also the same with the interview result reviewed above. So, the result implies that the Government has to make effort in easing up the foreign currency shortage and lowering taxation rate to close the gap.

4.3. Supply of LPG not accessible, affordable and disregarded

As we seen in the literature review part, decisions related to energy consumption and fuel type are strongly influenced by accessibility, affordability and the convenience of the fuel. These criteria are closely related to one other and also depend on household income. Response from the LPG retailers reviewed:

4.3.1. Customer Management

During the survey respondents (retailers) asked to rate the factors of Customer Service handling and how to handle their customers. The rating was a five-point Likert scale. The result shows there is a gap in some of areas and there should be a lot to be done to close the gap. The highest rated factor was 'Customer has up to date information about the product' =3.65 (n=62) while the lowest rated factors were 'Customer informed out of stock situation' = 2.29 (n=62) followed by 'Customer served in promised date' = 2.73 (n=62).

Descriptive Statistics

	N	Mean	Std. Deviation
Customer has up to date Information about the product	62	3.65	.770
Customer served in promised date satisfied with the Supply	62	2.73	.853
Evaluate complaints of the customers	62	2.90	.863
Customer informed out of stock situation	62	2.29	.755
Valid N (listwise)	62		

Table 10 Customer management result

Based on the response taken from the respondents, to serve customers on promised time and to inform them out of stock situation depend on the data they get from distributing companies.

The other point detected here is that customers are dependable on the cylinder bottles they have. Companies also control the market by injecting high number of cylinder bottles to customers. Companies with high cylinder population in the market monopolize the market and make customer rely on them only. On the other hand, supply interruption affects customers as they have no alternative except waiting for the product to come or buying other company's cylinder. As we reviewed in the theoretical part, for sustained success, it is important for companies to align their customer strategy with the company's aims and objectives. The profitability of a firm depends on its ability to identify, grow and retain profitable customers. This can be achieved through combining a deep understanding of customer needs, behaviors and value, with the ability to engage specific customers in the optimal way at various touch points.

4.3.2 Supply Management

Regarding Supply management, Retailers asked to rate the factors of supply management and their relationship with their Distributers. The rating was a five-point Likert scale. The highest rated factor 'Depend on few supplier' =4.0645 (n=62) while the lowest rated factors was 'Solve problem jointly with Supplier' = 2.5484 (n=62)

Descriptive Statistics

	N	Mean	Std. Deviation
Depend on Few Supplier	62	4.0645	.50800
Solve problem jointly with Supplier	62	2.5484	.82338
Effective Communication on supply activity and development	62	2.9194	.98010
Valid N (listwise)	62		

Table 11 Supply management SPSS data

None of the respondents disagreed with the factor 'Depend on few supplier' because there are only seven brands of LPG cylinders with same number of suppliers, so they have depended on few suppliers. However, some of the companies have communication problems with the retailers and they do not solve problems jointly. As pointed out in the Literature Review, supplier relationship inputs have a direct impact on both the cost and quality of the final product/service offered to the consumer. This activity is vital to the overall success of the logistics effort.

4.3.3 Cylinder Inventory Management

In addition, respondents were questioned to rate the factors of Inventory management and how to handle their inventory. The rating was a five-point Likert scale. The result shows that almost all factors were rated low; displaying that there is a gap in the inventory management system. The highest rated factor was 'Inventory managed based on real demand" =3.1129 (n=62) while the lowest rated factors was 'Minimizing inventory cost' = 2.7258 (n=62).

Descriptive Statistics

	N	Mean	Std. Deviation
Inventory is based on real customer demand	62	3.1129	.72666
The inventory model used targets on minimizing total inventory costs	62	2.7258	.72811
Transparent info with Customer & supply for Inv. management	62	2.7419	.82850
Valid N (listwise)	62		

Table 12 Inventory management result

The companies import their own cylinders, then they either sell or lease them to customers. The retailers collect empty cylinders from customers and exchange full ones from the companies. According to the result, the highest rated factor was 'Inventory managed based on real demand' because Distributors stock the highly demanded cylinders or the more injected cylinders. Nevertheless, to manage their inventory, they do not get enough information from the competitor companies for fear that, if the retailers know each company's stock status, they are going to hide/hoard the product and control the market.

Again, as explained in the theoretical part, Inventory management deals with balancing the cost of maintaining additional products on hand against the risk of not having those items when the customer wants them. This task has become more complex as firms have gradually lowered inventory levels. As per the above analysis managing the inventory is challenging because of the situation of the distributing companies' logistics system and lack of inventory information sharing.

4.3.4 Cylinder Warehouse management

Respondents were also requested to rate the factors of Warehouse management and how to store the products safely. The rating was a five-point Likert scale. The result shows that they have a storage with good safety standard and easy for loading and unloading activities. The highest rated factor was 'Easy for loading & unloading activities" = 4.0161 (n=62) while the lowest rated factor was 'Warehouse is done as per the safety standard' = 2.7258 (n=62).

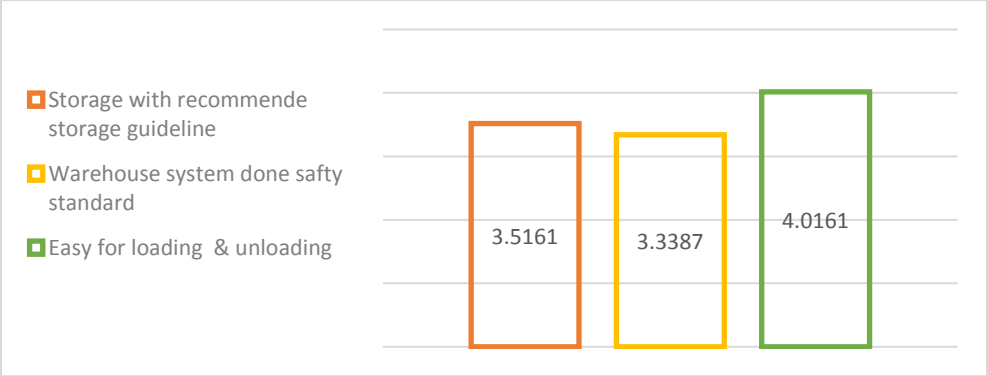


Figure 7 Means of Warehouse Management

As can be noticed, most of the retailers' sites are near to the main roads and the fueling stations are convenient for car parking. So, it is easy to load and unload the cylinders.

In fuel retail stations cylinders are stored/kept in open air spaces which are safe but some shops store cylinders inside the houses, thus the result shows lower rate that is Warehouse done as per safety standards.

4.3.5 Social Factors

Regarding the Social issue, list of the problems was forwarded to respondents supply to choose from them on the Social factors that affect the LPG. Thus, the highest rated factor was 'Distractive believes of the popn.' = 28.6% (n=69) followed by 'high population rate' = 22.8% while the lowest rated factors is 'Society's educational level' = 12.9% (n=69)

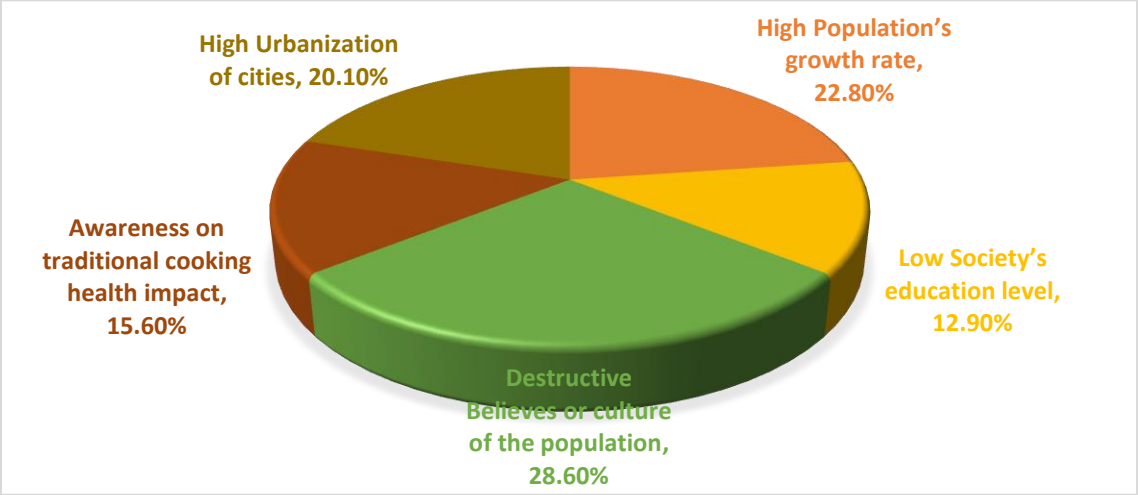


Figure 8 Social factor

The result depicted that there are problems in the Social factors that the public are not flexible to adapt new technologies and have poor knowledge on traditional fuels health impact. As observed on our culture, the society does not easily change its life style.

In the literature review, the researcher tried to point out that each society and culture has its own way of doing business and acceptance of change. So, on can deduce that the Ethiopian culture and tradition have effect on the supply chain.

4.3.6 Pricing Relative to Alternatives

When we come to affordability, respondents were asked to choose which energy is affordable and choosier. The highest rated factor was 'Electricity' = 44% (n=69) followed by 'traditional fuel' 32% while the lowest rated factors is 'LPG' = 24% (n=69).

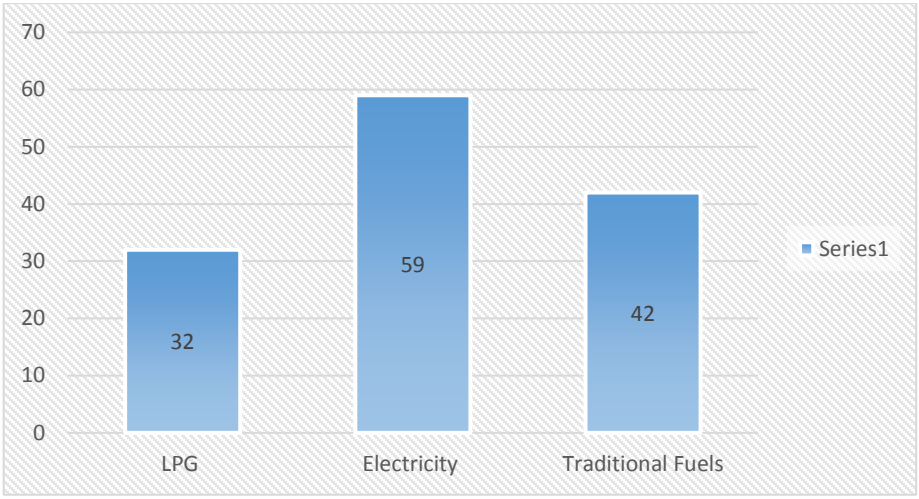


Figure 9 Price factor

The result shows that respondents found other energy sources' price are affordable specially electricity which helps for clean cooking. Traditional fuels though are not healthy, price wise they are cheaper. The LPG price; however, is high when compared to others.

As assessed in the Empirical Review, affordability is still a substantial barrier for many households who want to use LPG. Evidence shows that subsidies have benefitted wealthier urban users more than low- income users as the former are in a better position to afford the high initial costs associated with LPG. This is reportedly the case for most countries in which LPG is being subsidized.

4.3.7. Legal Factors

Similarly, respondents were questioned to choose which legal factor makes the Supply chain effective and required for Ethiopia SCM. The highest rated factor was 'Downstream LPG Governing Laws & regulations' = 29% (n=69) followed by 'SHE policies' = 27% while the lowest rated factors is 'property rights law on cylinders' = 21% (n=69)

$LF Frequencies

		Responses		Percent of Cases
		N	Percent	
LEGAL FACTOR[a]	the downstream LPG laws and regulations	59	29.4%	89.4%
	Safety, health and Environmental policies	55	27.4%	83.3%
	Property rights law- Cylinder patent	41	20.4%	62.1%
	Customer protection legislation	46	22.9%	69.7%
Total		201	100.0%	304.5%

Table 13 Legal factors

The analysis illustrates that there is lack of laws and regulation and SHE policies. In the empirical review on the Government responsibility part, a business climate that favors some over others, either by lack of enforcement or inequitable enforcement of regulations, will ultimately prove a disincentive to the legitimate operators and encourage a drop-in industry standard and inevitably a drop-in industry competition.

Legal, Regulatory and Institutional Framework

As per the interview from the government and the company representatives, the downstream petroleum laws and general regulations of Ethiopia are incomplete as they do not included LPG., Typically, they do not even contain specific provisions for LPG. Moreover, the international standards for quality control and protection of safety, health and environmental (SHE) is not adopted to the national level officially. MoT gives the license for LPG investment and the MoMPNG gives Accreditation Certificate; however, LPG Supply and distribution is not controlled by a specific government office, i.e., there is no institutional framework to control the supply chain of LPG in Ethiopia, EPSE established to meet the country's demand for petroleum, with the exception of liquefied petroleum gas. Finally, there is no Subsidy policy and LPG is not illegible for Income tax exemption.

4.4. Challenges of Supply Chain Integration of LPG companies

As review in the Literature, information serves as the connection between the supply chain's various stages, allowing them to coordinate their actions and bring about many of the benefits of maximizing total supply chain profitability.

Supply chain integration is also degree to which an organization strategically collaborates with its supply chain partners and collaboratively manages intra and inter-organizational processes, in order to achieve effective and efficient flows of products and services, information, money and decisions, to provide maximum value to the customer. These partners either succeed as a whole in delivering superior value to the end customer or they do not.

4.4.1 Information Flow Management

The respondents were asked to rate the factors of Information integration within the members in the Supply chain and coordination and collaboration that leads to improved performance. The rating was a five-point Likert scale. The result exposed that there is

a gap in all the areas and a lot has to be done to close these gaps. High rated factor was 'Clearly define role & responsibility between members' = 2.7419 (n=62). This result is still low; but when it is compared with the others, it is the highest and the lowest is 'Consider as a partner" 2.3387 (n=62) followed by 'Evaluate the relationship with members =2.5161 (n=62). This shows there is gap in integration and collaboration. To reduce the gap in the industry, the companies need to work hard on practicing integration and collaboration.

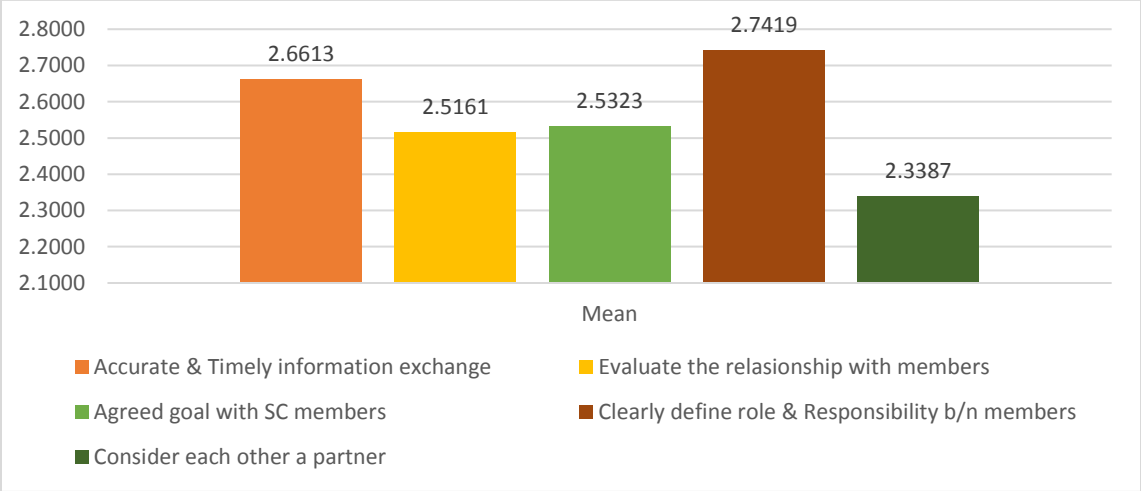


Figure 10 Means of Information Sharing

As we can see in the other variables also there is an information gap between the companies and retailers the lowest rate is 'They have not seen each other as a partner'. On the contrary, the data we got from the Distributers and Importers on this issue reveal that Distributers and Retailers have the feeling that they are like partners so that they don't worry in sharing the right information with each other. Consequently, this needs further review as to which result is correct. No doubt, information sharing serves as an essential approach for the survival of enterprises and enabler of supply chain integration.

As per the literature coordination and integration in supply chain have long been the concerns of the academic community as well as the business world. To survive in today's economy, supply chain partners need to improve their competitive advantages by information sharing.

4.4.2. Integration and Collaboration between the chain members

Importing companies have three types of customers. These are: Retail customers, Bulk users and other distributing companies.

Retail Customers: They are individuals or fuel stations who purchase LPG cylinders from the Company, sell to the end customers, collect the empty cylinders from the customers, and exchange them with filled cylinders. The distribution companies deliver the product to the customer's sites using delivery trucks as per their orders. Usually, customers use 3kg, 6Kg, 15 kg, and 22 kg cylinders for home usage.

Bulk customers: They purchase LPG for their own consumption. They sign a contract agreement with the Companies for the supply of LPG in bulk for a limited duration. The companies deliver the product to the customers' sites using Bobtail or bulk delivery trucks. These types of customers have bulk storage tanks in their respective sites. 52 kg cylinders will be provided for those who don't have storage tanks in their sites for bulk use. These customers include mainly hospitals, hotels, textile companies and steel companies.

Distributing companies: – These companies sometimes import LPG from overseas; but with reasons such as the current foreign currency shortage, product shortage, etc. Few companies buy from local importers. At present, only two companies, i.e., NOC and Nile petroleum work as importer and distributer at the same time.

There is also collaboration with other companies for refill service and storage sharing. For instance, NOC shares Iran Merfin's storage in additions to its own and Allied uses Nile's storage and refilling facilities. However, there is no system that allow them to work together to solve problems and achieve the purpose as observed in theoretical review. Supply chain has always been about companies working together to achieve a purpose, these relationships have always involved some degree of collaboration to solve bottlenecks in the supply chain network and overcome bumps in demand and supply.

4.5 Results from the Analysis

All LPG suppliers importing from abroad, are affected by the foreign currency shortage and import processes. In addition, the price is depending on international Contract price set by ARMACO and Suppliers premium price.

Storages at port, which are incompatible with some vessels is another factor affecting the premium price of LPG, i.e., it has a big impact on the local price and delivery time of LPG.

Sudan port has large storage capacity than Djibouti, however, the distance from Port Sudan to Addis Ababa compare to Djibouti to Addis is double, and the lead time is high while the road transport is cheaper than the fright cost.

Transport companies are not interested to involve in the business of transporting LPG, so also the importing companies themselves. That is why importing companies are using neighboring countries (Sudan) trucks to transport LPG from port to storage. This also contributes to the increase in the cost of the product.

Delivery time and accessibility are one of the critical factors, which are mostly associated with financial strength and insufficient storage facilities/capacities in respective company's depot. When compared to the population, the overall storage capacity from all the companies are around 990 mt only.

Customers do not get information on time and are not aware of how to use the product securely. The quantity of the refilled LPG in cylinders are not controlled, so that the filled cylinder KG accuracy depends on the refilling company. There is no controlling mechanism and thus, customers are not secured, this practice is open for fraud.

The number of suppliers or distributing companies are limited in the country; which created a room of monopolistic power in the LPG business making the customer reliant on them.

The study also exposed that the price of LPG is more expensive than the price of electric power and other traditional fuels.

In addition, there is neither a government agency assigned to take the responsibility of the overall LPG Supply chain activities. Nor subsidy and incentive programs in the government policies for this business.

So far, attention was not given to increase awareness of the society on LPG gas, and many people has no information about the health effect of the traditional fuels.

LPG safety, legal, regulatory requirements and standards are also the critical challenges discovered in the study. Cylinder and Gas quality is not checked or controlled by the Government and there is no standard set for it.

Further, information sharing in supply chains factor found to be not efficient. There exists disorganized information sharing system.

Lack of collaborating and Integration between companies is the factor that revealed importing companies do not solve their problem together.

Absence of policy in this industry creates arguments between the LPG importing companies and the retailers; for example, in the survey most of the retailers complained about Ghion Gas because it plays as importer, distributer and retailer which is against the conventional trade policy.

The other disagreement is that occurs between LPG importing/distributing companies is a company refills other companies' cylinder bottles, without a collaborative agreement between companies. For instance, during the LPG shortage time, companies complain NOC refills other companies' cylinders unlawfully; conversely, the retailers highly support this act because during shortage time there can get LPG at NOC Company. NOC rather than imposing the public to buy it's cylinder bottle to get the gas, it serves the public by refilling LPG in any type of cylinder bottles to make the market stable.

CHAPTER FIVE:
SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of the Findings

The findings of the study indicated that there is a challenge in the end to end supply chain of LPG by supply interruption, absence of integration and collaboration between the main importing companies, absence of information exchange system and controlling policies and standards. The problems areas are summarized as follows:

Storage capacities are insufficient to compensate demand fluctuations, Supply routes are far and there is inconvenient port facility in addition to these there are limited bulk LPG trucks for transporting the gas

Shortage of foreign currency which leads to inconsistency in the supply of LPG which causes price elasticity and reduces consumer confidence on LPG as an alternative energy source.

Because of limited storage capacity at port, importers will be obliged to distribute the imported LPG to various ports which makes its price expensive.

There is a lack of awareness because of these health and environmental benefits of LPG are not known.

LPG has high initial costs compared to other fuels. Because of the cheap price of electricity, the public prefer using electricity instead of LPG. The price of accessories is not fair because of the high taxation rate levied on accessories of LPG.

Absence of regulation leads to security risks in LPG filling and usage, creating a room for fraud during refilling like competitors filling each other's cylinders and discouraging potential investors.

5.2 Conclusion

There is a serious shortage of storage capacity at Djibouti port. Based on this finding one can infer that the players in the industry are not able to fulfill the basic requirement which is acquiring enough storage at Djibouti Port.

In addition to this, locally the storage capacity of the respective companies is not enough and there are no sufficient LPG trucks in the country, this critical problem of the industry well noticed in the study.

Absence of foreign currency is worsening the challenges of LPG supply, currently, it takes more than three months to get approval for Foreign Currency, until companies get the next foreign currency approval, they face stock depletion. This also leads to LPG shortage or supply interruption for example, during 2018, there was a high shortage of product and customers were forced to buy 12 kg cylinder with exaggerated price, i.e. from Birr 1500 to Birr 2000 while at the normal situation the price is from 420 to 550.

Also, there is high tax rate on the accessories and initial investment on equipment. This affects the business and also a barrier for the new entrants which eventually discourages increasing the capacity of the existing companies.

Besides, there is no support provided by the government and there is no defined safety standard set to reduce environmental degradation and health problem of the public.

Regarding the LPG SHE regulation, there is none in national level and it is not adopted from international standards of safety and environment too. As a matter of fact, International standards are applied by some companies, but without having a formal legal basis.

Furthermore, there is poor control system and lack of policy since one can observe the quantity and the quality of the gas in the cylinder. It is neither verified nor controlled by external body. It is depending on the company's discretion which definitely created unhealthy competition between companies.

Even though the Government set environmental policies to decrease dependency on traditional fuel by addressing the alternative energy by setting immediate, short term and long-term strategies, LPG is not included as an alternative energy in all the three stages. This shows the government has not given due attention to the LPG. However,

in the Ethiopian Constitution, it is clearly indicated that everyone has the right to live in a clean and healthy environment and the government will make every effort to provide such an environment. The reality is against this statement, i.e., the public is still using more traditional fuels that pollute air and damage human health.

In addition, there is also lack of awareness in the LPG usage as most people have wrong assumption of about this product instead of its use for clean cooking and health.

The outcome of the study shows that there are supply chain problems on LPG in Ethiopia such as LPG supply interruption, warehouse, inventory and transport management, and absence of policy and standards, absence of information sharing, and integration between SC members. Based on the analysis, one can understand that companies do not follow a collaborative approach in addressing the overall supply chain problems as a system.

The other important factor is lack of information and experience sharing amongst the LPG stakeholders. Thus, the researcher deduced that LPG importer could not make solutions for some problems they encounter and similarly unable to make improvements in the business, therefore they should collaborate to solve the challenges of the supply chain.

Last but not least, the study specified that there is incompatibility between the demand growth in the country and the logistics resource deployed to support the supply chain process. These constraints cumulatively have been obstructing smooth flow of LPG to the end customers.

5.3 Recommendations

To make LPG supply accessible, affordable and convenient, the researcher recommends the following actions:

1. Since little attention has been given to the administration of LPG storage at Djibouti port and infrastructures, the Government must make intervention on product shortage problem and investigate the possibilities of using Asseb and Mesewa, with respect to the available transport infrastructure and geographical proximities and availability of terminals.

2. To reduce the adverse problem of public health and environmental impacts caused by using traditional fuels, such as rate of deforestation, land degradation and pollution; the government ought to make subsidy on LPG price. Previously, there was a subsidy on Kerosene. Currently, the subsidy of kerosene is stopped since February 2017. Thus, this shows that there is a possibility, to shift the subsidy on Kerosene to LPG.
3. To enhance the LPG supply affordable and reliable, the government has to reduce tax or make tax free import of LPG accessories like stove, hose, cylinder bottles, and other related equipment. This can ultimately make the government beneficiary from the sector as a result of the growing economy.
4. Develop standards at the national level on LPG and introduce good practices of other countries on quality and safety standards of LPG, cylinders, valves and other items
5. The members in the Supply chain have to collaborate and integrate to solve problems together for instance, strengthening national storage capacity and transportation facilities, so that members import LPG together using big vessel.
6. Further, it is understandable that with the absence of LPG policy and standards, LPG business will continue to be flimsy in exercising fair trade and playing a greater role in the Ethiopian economy. Thus, the key to effective growth of this business requires the support of the government, i.e, the government has to incorporate all the above listed recommendations in designing its short- and long-term policy or plan.

5.4 Directions for further research

This study examined the supply chain management challenges of LPG. Other similar countries experience comparison are not included in this study; which need to be studied in the future. In addition, further study has to be done on the cylinder supply and standards. Study on the advantages of LPG supply by pipe should be carried out.

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ANNEX

Questionnaire

Dear Participant of the Questionnaire,

You will find attached a questionnaire that helps to examine various features of LPG Supply chain in Ethiopia.

Your participation highly supporting the success of the study. All responses will be kept confidential. No attempt will be made to identify individual respondent.

There are no right or wrong answers to the following questions.

If you have no enough information to complete the questionnaire by yourself, please assign someone, who is familiar with LPG supply chain practices.

Completing the questionnaire will take about 15-20 minutes. Thus, you are kindly requested to have your utmost patience in spending your time to complete this questionnaire, as your contribution has great value to the study.

Please place a heavy cross ("X") in the boxes you want to mark. Please do not use ticks or any other type of mark.

Thank you for taking part in this survey.

With Regards,

Berhan Abebe

AAU, School of Commerce

LSCM Department

Questionnaire to Evaluate the Supply Chain of LPG in Ethiopia

Please refer to the following definitions when completing the questionnaire:

"LPG": Liquified Petroleum Gas

Name of your organization _____

How long are you working in this area? _____

How many customers do you have?

a. Less than 200 b. Between 200 and 500 c. more than 500

Customer Service	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1. Your customers have full and up to date information about the product.					
2. Your customers are satisfied with the supply of LPG and orders are served in the promised date.					
3. Your organisation frequently evaluates the formal and informal complaints of the customers.					
4. Your organization keeps customers informed about outstanding orders status and out of stock situations timely.					
SUPPLY MANAGEMENT	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
5. Your organization relies on few dependable suppliers.					
6. Your organization regularly solves problems jointly with its suppliers.					
7. You have effective communications with suppliers on supply activities and product development.					
Inventory Management	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
8. The inventory model used to determine the quantity ordered is based on real demand analysis.					
9. The inventory model used targets on minimizing total inventory costs (like holding, ordering, and stock out).					
10. The organization has transparent information sharing platform that serves to know about each other's inventory status with your suppliers.					

Transport Management	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
11. The transportation system of your organization is reliable like timely delivery of orders, safe and secured delivery of orders with correct documentation.					
12. There is adequate transportation to convey LPG on time from ports to the country.					
Warehouse Management	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
13. We have product storage according to the recommended storage guidelines.					
14. The design of the warehouse system is properly done as per the required safety standard.					
15. The design of the warehouse is easy and convenient to load and unload products.					
Information Sharing, Collaboration & Integration	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
16. Information exchange between members and customers is timely, accurate and complete.					
17. Your organization periodically evaluates the importance of its relationship with its customers, suppliers and members of the supply chain.					
18. Supply chain members have common, and agreed to goals for supply chain management					
19. Supply chain members clearly define roles and responsibilities of each other cooperatively.					
20. Supply chain members consider each other as partners.					

If you have additional comments on the challenges of LPG supply chain, please provide: _____

Any other comments relevant to the study, please forward: _____

_____

The following questions are to identify the challenges that affect the Supply Chain of LPG

Please mark X on factors that affect the supply chain of LPG

Which Political Factors affect the Supply Chain of LPG:

- Civil unrest in the imported countries ○
- Government Relationship with neighboring Countries ○
- International Crude oil Price ○
- Higher officials/Gov't officials are not supported ○
- Lengthy bureaucratic procedures ○
- Investment policies ○

Which Economic Factors affect the SC of LPG

- the current economy status ○
- foreign currency shortage ○
- Inflation rate rises ○
- high Taxation on accessories of LPG like cylinders, regulators, hoses ○
- no credit facilities with companies & Banks ○

Which Social Factor affect the SC of LPG

- High Population's growth rate ○
- Low Society's education level ○
- Destructive Believes or culture of the population ○
- Awareness on Traditional Cooking health impact ○
- High Urbanization of cities ○

Which Energy source is affordable, Pricing Relative to Alternatives ○

- LPG ○
- Household Electric ○
- Traditional Fuels ○

choose which legal factor makes the Supply chain effective and required for Ethiopia SCM.

- Downstream LPG laws & Regulations ○
- Lack of Safety, health and Environmental policies ○
- Property rights- Cylinder patent ○
- Lack of Customer protection legislation ○