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Effect of Pricing Policies and Regulation on the Petroleum Supply Chain Effectiveness: The Case of Total Ethiopia S.C.

By

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A research thesis submitted to Addis Ababa University School of Commerce in Partial Fulfillment of the requirements for the Award of the Master of Arts Degree in Logistics and Supply Chain Management

Advisor: Birhanu Denu (Ph.D.)

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DISCLAIMER

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DEDICATION

To my loving mother: Etaferahu Nigussie

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LIST OF ACRONYMS

ADO/AGO	Automotive Diesel Oil/Automotive Gas Oil
CAPEX	Capital Expenditure
CoDo	Company Owned Dealer operated
DoDo	Dealer Owned Dealer Operated
DV	Dependent Variable
EPSE	Ethiopian Petroleum Supply Enterprise
HFO	Heavy Fuel Oil
IV	Independent Variable
LFO	Light Fuel Oil
MGR	Motor Gasoline/Regular
MOT	Ministry of Trade
NPRDA	National Petroleum Reserve Depots Administration
OPEX	Operational Expenditure
SPSS	Statistical Package For Social Science
TESC	Total Ethiopia Share Company

ABSTRACT

The demand for petroleum products in Ethiopia have increased over the past decade in parallel with the country's growth rate. As the demand for petroleum products increase, the supply chain effectiveness have become an important issue on delivering the required level of performance. This research made its main objective to examine the effect of pricing policies and regulations on the petroleum supply chain effectiveness for the case of Total Ethiopia Share Company. The effects of pricing structure of fuel, marginal gain from fuel sales, and fuel transportation rate (the factors of petroleum pricing policies and regulation) on the petroleum supply chain effectiveness were analyzed. Explanatory research design was used to identify pricing policies and regulation factors and to examine the effect of pricing policies and regulation on the petroleum supply chain effectiveness. Descriptive and inferential statistics (correlation and multiple linear regression) were used to analyze the data gathered. Self-administered questionnaires and structured interviews were used to collect primary data and purposive sampling technique were implemented on selecting participants that have a direct involvement with the supply chain and 51 employees of Total Ethiopia S.C. were participated on the research. IBM SPSS Statistics software (version 26) were used to encode and analyze the primary data gathered through structured questionnaires. The reliability of the data were checked by using Cronbach's alpha coefficient value and the result of the analysis showed higher internal consistency reliability. According to the result obtained from the correlation analysis, all the factors of petroleum products pricing policies and regulations were positively correlated with the petroleum supply chain effectiveness. The model summery from multiple regression analysis of the surveyed data further showed that the value of R and R Square of the model explains more than half of the variance in the petroleum supply chain effectiveness. The multiple linear regression analysis on the survey data also revealed that marginal gain on fuel make the stronges, unique and statistically significant contribution to the prediction of petroleum supply chain effectiveness.

Keywords: Petroleum, Supply Chain Effectiveness, Pricing Structure, Marginal Gain, Transportation Rate

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the Study

Energy is one of the key elements facilitating the economic and social development of a country. Ethiopia, being the second most populated country in Africa, is highly dependent on the energies extracted from petroleum products as a major source of input for industries, power plants, machineries, locomotives, generators, airplanes, etc.

The petroleum industry in Ethiopia is monopolized by the federal government having different levels of authority and responsibility. The government office named Ethiopian Petroleum Supply Enterprise (EPSE) oversees the importation, distribution, and the management of national fuel depot of all the petroleum products consumed within the country. The products imported by the enterprise are categorized under two major classifications; refined petroleum products and steam coal. Gasoil (ADO/AGO), Gasoline (MGR), Jet A-1 or Kerosene, Heavy Fuel Oil (HFO), and Light Fuel Oil (LFO) fall under refined petroleum products category whereas standard steam coal and size steam coal is classified under the steam coal category.

The FDRE Ministry of Trade (MOT), on the other hand, is responsible for setting and regularizing the commercial pricing structure of the imported petroleum products by EPSE. The pricing structure includes Oil Company's base purchasing price at Ex-Djibouti Horizon depots, transportation tariffs, the company's margin, service station's margin, and selling price at pump. In addition, the MOT is also responsible for licensing potential oil companies to take part in the oil and petroleum industry. The oil companies, like Total Ethiopia S.C., are considered as the distributors of all the fuel imported by EPSE.

The profit margin, set by the MOT, of the petroleum products has been recorded to be the lowest margin in the world. According to the ministry of trade, the maximum profit margin for the oil companies operating in the Ethiopian soil was 0.1375 Birr/liter for gasoil before May 08, 2019. After several years of discussion, on May 08, 2019, the ministry of trade decided to increase the marginal gain from gasoil sales to 0.2768 Birr/liter. This figure is for gasoil only and thus the companies are forced to minimize operational costs (OPEX) and fixed asset expenses (CAPEX)

as much as possible so as to be able benefit from the small margin corresponded to the fuel sales and be competitive in the ever-demanding and aggressive market competition.

There are around eight hundred gas stations across the country out of which around 100 gas stations are located at the capital, Addis Ababa (Bekele, 2019). Nevertheless, the growing demand for petroleum products of the country cannot be fulfilled by only these stations and, thus, queueing can be witnessed in many gas stations of the capital. It has been also reported that the country is depriving from fuel shortages for several reasons; one of which is the small number of available fueling trucks to haul the petroleum demand of the country. The study investigates the related consequences of regularizing pricing rates of fuels on reaching out the demand of the country.

Logistics and transport efficiencies are inter-related with the profitability of businesses (Palgrave Studies of Sustainable Business in Africa, 2019). As the supply line covers on road transportation of the fuel with fueling trucks, the effectiveness of the petroleum supply chain is highly dependent on the efficiency and availability of the fueling cargos. As the transportation rate is also regulated by MOT, the study also gives insight about the effect of regulations of the pricing structure of fuel hauling trucks transportation rate on the petroleum supply chain.

The effectiveness of any supply chain, specifically in the petroleum market, is highly dependent upon the attractiveness of the general market which can be directly linked with the profitability of the sector in discuss. The study is focused on analyzing the effect of pricing policies and regulations on the petroleum supply chain effectiveness being a case study of an international oil and petrochemical company, Total Ethiopia S.C.

Background and Brief History of Total Ethiopia Share Company

Total Ethiopia S.C. was established in Ethiopia in 1950 under the name of TOTAL Mer Rouge and has been serving the country since then. TOTAL has also acquired Exxon - MOBIL facilities and business in Ethiopia in the year 2006 and has successfully consolidated its activities.

Total Ethiopia S.C. is an affiliate of the international TOTAL group and is engaged in marketing of fuels, lubricants, bitumen and other specialties products to its customers through its wide distribution service stations network numbering more than 170 throughout Ethiopia and directly to consumers.

TOTAL'S presence in Ethiopia and in other African countries as well is now strengthened by holding the 1st position in Africa's petroleum market share and is currently one of the leading supplier of petroleum products in Ethiopia.

Total Ethiopia S.C. is running four aviation depots, two lubricants warehouse and one bulk ground product depot in the country located at Dukem, Oromya. Out of these depots, Dukem depots is a first of its kind for the country with State-of-the-art technology commissioned in 2016 with storage capacity of more than 8 million liters. This Depot is constructed in compliance with both national and international standards ensuring operational safety and environmental requirements.

The company has a mission to be a leading petroleum company with the highest product quality and excellent services in Ethiopia, to focus on the fulfillment of customer satisfaction based on their needs, to promote the sustainable integration of our business activities and our communities.

1.2. Statement of the Problem

The supply chain of Ethiopian petroleum products, being the back bone of major energy sources, faces numerous difficulties given the complexity of its nature in comparison with the supply chain of other industries. As any other for-profit organizations, the petroleum companies based on the country's soil, faced several challenges when it comes to the pricing policies and regulations in related to the petroleum products distributed and sold for the demand of their customers.

The major difficulties that the supply chain for petroleum products faced is primarily concerned with the general profitability of the business. Running an oil company required high initial and working capitals with a high degree of experience in the industry sector. The government body, Ministry of Trade, regulates the fuel margins which is recorded to be the lowest in the world. The total revenue that the petroleum companies collected from product sales and the marginal gain from these sales is very insignificant (see figure 1.1. below). Inconsequence, the sector is left with no choice but to minimize their expenses and investments as much as possible so that they could survive the financial deficit these companies might face. As a result, opportunities that can contribute to the social and economic development of the country are being left out and avoided which will have a negative effect on the supply chain effectiveness of petroleum products in the country.

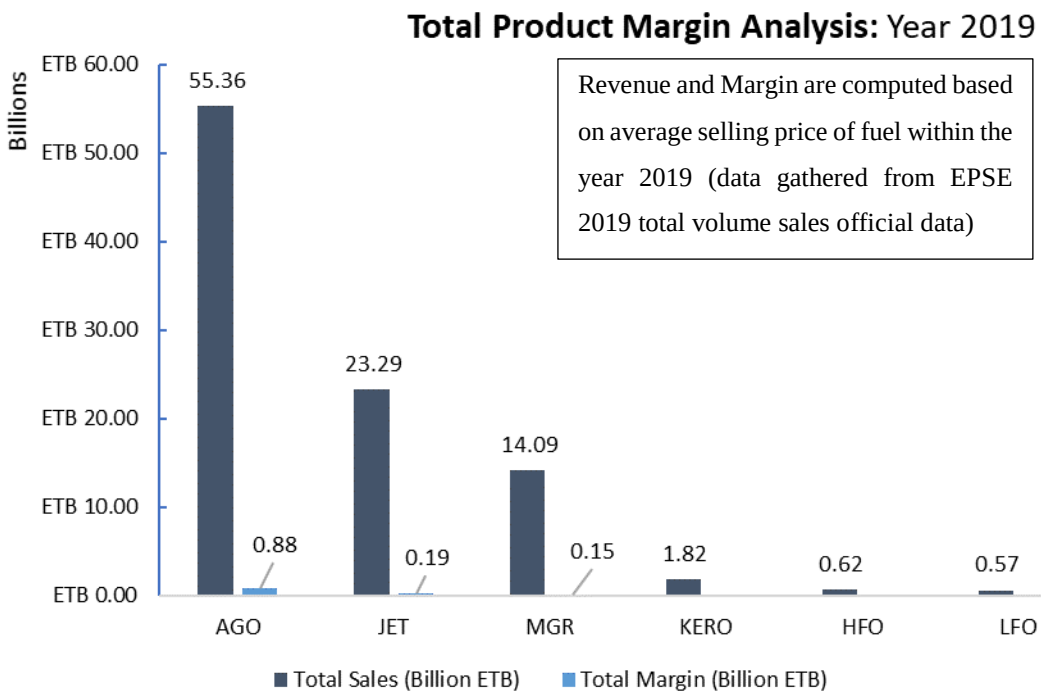
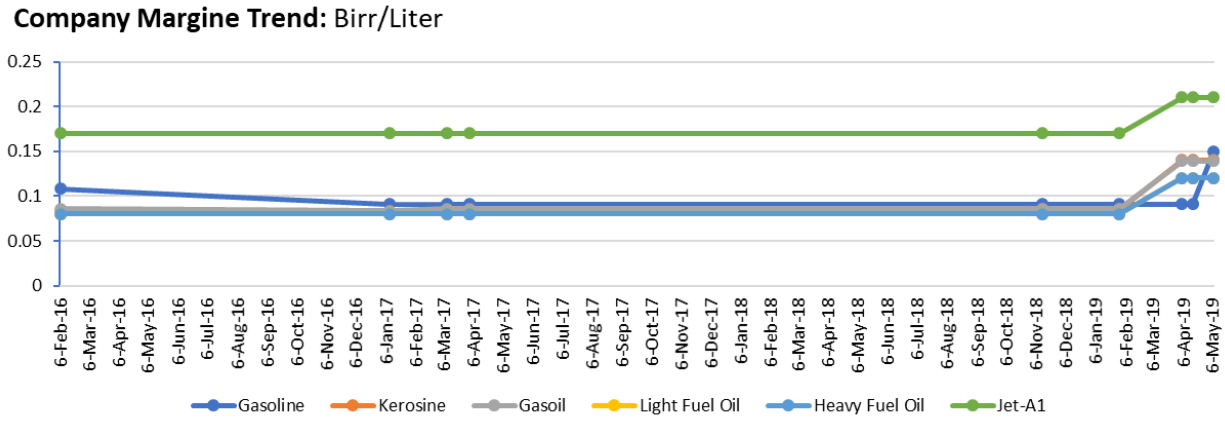
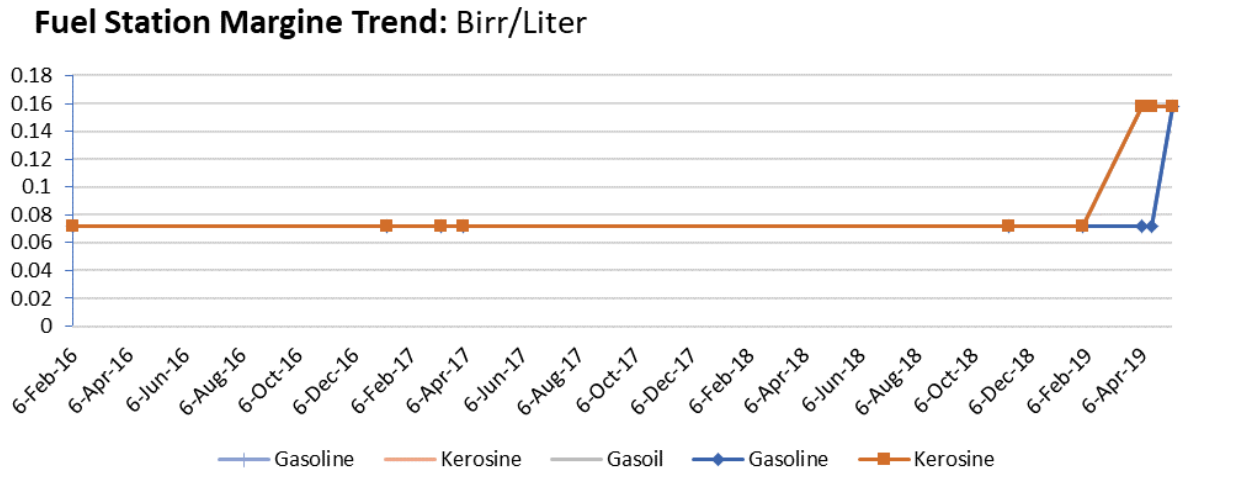


Figure 1-1: Petroleum products revenue and marginal gain (Researcher's own analysis, 2020)



* The data gathered is from the Ministry of Trade official price notification letters on the indicated effective dates on the figure above.

Figure 1-2 Petroleum company's unit marginal trend from Feb 2016 up to Jan 2020 (Researcher's own analysis, 2020)



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The data gathered is from the Ministry of Trade official price notification letters on the indicated effective dates on the figure above.

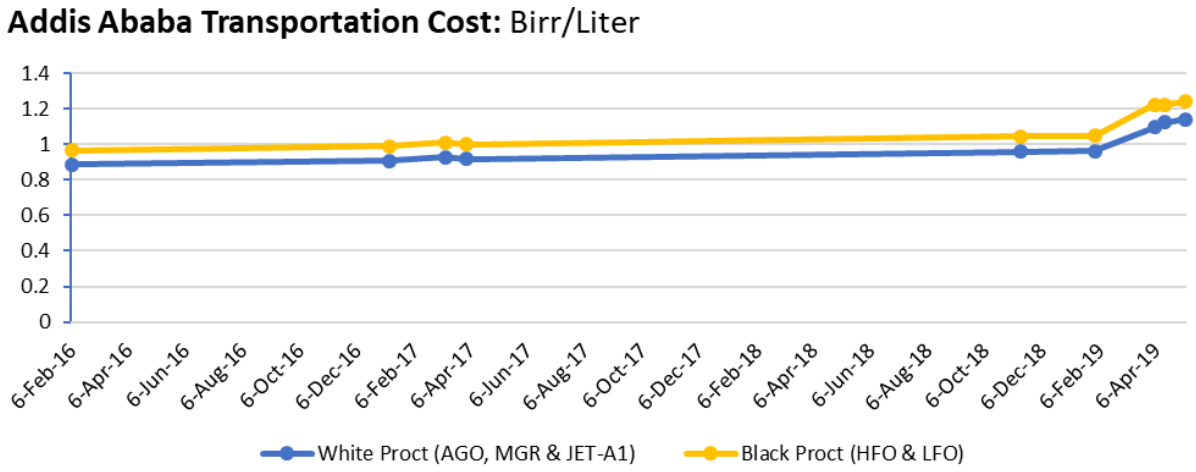
Figure 1-3 Fuel Stations unit marginal trend from Feb 2016 up to Jan 2020 (Researcher's own analysis, 2020)

The pricing structure of the petroleum products also influences the stagnant and unmatched number of gas stations when compared with the growing number of customers for petroleum products. Queueing for fuel in gas stations is directly related to the number of gas stations within the country and the ever-growing demand for petroleum products by the consumers. The aggregation of capital employed in a business usually related to the income and level of profitability (Branch, 2008). As the pricing structure for the petroleum companies in the country is prohibitive to invest more in the sector, the number of gas stations built has been dormant for several years. As a result, precious time has been wasted waiting in line for petroleum products. Furthermore, the fact that the marginal gain from fuel sales for both petroleum companies and fueling stations is left unrevised for the past several years, it has also contributed for the stagnant growth of fueling station (see Figure 1-3 and Figure 1-4 above).

High level of efficiency in the transportation of petroleum products is a key factor for the success of any supply chain effectiveness. In Ethiopian context, almost all the petroleum demand of the country is transported with fueling trucks from the port of Djibouti to its destination within the country. The supply line covers thousands of kilometers on the road hauling of the product from the point of origin to the point of demand passing through different road types and weather conditions. As the demand for petroleum products is primarily linked with the economic

development of the country, an even growth on the number of fuel hauling truck and their effectiveness is a paramount requirement for the effectiveness of the entire supply chain.

Nevertheless, fuel transportation is reported to be a bottleneck for the development and effectiveness of petroleum supply chain. The reason behind it is that the transport rate, which again is regulated by the Ministry of Trade, has been reported to be very low when compared to the operational costs required to manage the fuel cargo trucks. Moreover, as the case for petroleum companies and fuel stations, the transportation rate for hauling petroleum products is in almost a stagnant position for many years (see figure 1.4 below). The uneven growth of the transport rate and the ever-increasing economic devaluation in the country, puts fuel transporters in a critical position. Inconsequence, transporters are unwilling to invest in the fueling trucks for that the return on investment is very long that is directly linked with the deprived transport tariff for petroleum products.



* The data gathered is from the Ministry of Trade official price notification letters on the indicated effective dates on the figure above.

Figure 1-4 Djibouti to Addis Ababa transportation rate trend from Feb 2016 up to Jan 2020 (Researcher's own analysis, 2020)

Effective monitoring and controlling of cargos supported by technologies is paramount in preventing theft and adulteration of the product being transported. The petroleum supply chain in Ethiopia faces a major concern when it comes to adulteration, mainly caused due to poorly defined and managed fleet management, monitoring and tracking system. In consequence of the adulterations and theft of petroleum products, the county is losing tremendous amount of fuels which is imported by a scarce foreign currency. The poor monitoring and controlling of cargo

trucks is also a consequence of the low company margin of the products. The oil companies are reluctant to invest in the infrastructures that could help prevent such actions and saves the losses of such scarce resources of the country that contributes to the social and economic development of the country.

To improve the profitability of the industry and go into a new era of significant efficiency improvements, a more integrative supply chain is essential (Manzano, 2005). Different researches and studies conducted the assessment of the Ethiopian petroleum supply chain, the problems associated with it, quality issues, adulterations, factors that affect fuel supply chain management, etc. Nevertheless, the researcher found none of these researches to correlate the effects that the pricing structure of petroleum product in Ethiopia will have an impact on the supply chain effectiveness of the industry.

Therefore, this research assess the challenges posed to the effectiveness of the supply chain of petroleum products in Ethiopia by relating it with applicable policies and regulations associated with the pricing of the petroleum supply chain.

1.3. Research Questions

The study tried to answer the following three basic research questions.

I. What are the petroleum pricing policies and regulation factors that affect the effectiveness of the petroleum supply chain?
II. Which of the petroleum pricing policies and regulation factors contributes the most for the petroleum supply chain effectiveness?
III. What are the effects of pricing policies and regulations on the effectiveness of petroleum supply chain?

1.4. Research Objectives

1.4.1. General Objective

The main objective of this research is to analyze the effect of pricing policies and regulations on the petroleum supply chain effectiveness for the case of Total Ethiopia S.C.

1.4.2. Specific Objectives

The specific objectives of the research are:

I. To assess and identify major petroleum pricing policies and regulation factors that affect the effectiveness of petroleum supply chain effectiveness.
II. To identify the petroleum pricing policies and regulation factors that contributes the most for the petroleum supply chain effectiveness.
III. To assess and examine the effects of pricing policies and regulations on the effectiveness of petroleum supply chain.

1.5. Significance of the Study

It can be implied with high confidence that increasing the effectiveness of the petroleum supply chain will result in economic and social development of any country. In the context of Ethiopia, petroleum products are controlled and regulated by the government in a monopole structure. Having said that, this study will be of great importance in that it will identify the major effects of applicable policies and regulations in related to the pricing of petroleum products in the supply chain effectiveness for the cases of Total Ethiopia S.C.

In addition, the study will provide a reference point for concerned government and non-government bodies who might be interested on the petroleum supply chain effectiveness in related to the pricing policies and regulations in the Ethiopian context.

Finally, the study will be used as a reference for future studies that will be conducted on Ethiopia's petroleum supply chain effectiveness which bases their study on the effects of the country's pricing policies and the effectiveness of petroleum products supply chain.

1.6. Scope and Limitation of the Study

1.6.1. Scope of the Study

This study is limited to only applicable pricing policies and regulations related to the supply chain of petroleum products applicable in Ethiopia during the time phrase that this research was conducted. Moreover, the study is delimited only in Total Ethiopia S.C. case and assess the effect of applicable pricing policies and regulations on the effectiveness of the supply chain of gasoil, gasoline, heavy fuel oil, light fuel oil and Jet A-1/kerosene (generally termed as petroleum

products in this research). Lastly, only three pricing policies and regulation factors were considered within this research.

1.6.2. Limitations of the Study

Unavailability of prior research studies on the topic and lack of reliable secondary data are the core limitations of the study. As the study was conducted in a very tight schedules to collect, analyze and discuss the survey data, time constrains is the second limitation of the research conducted. Finally, due to the sensitivity of data information, accessing some of the data were difficult.

1.7. Organization of the Study

The research consists of five chapters, a reference and annexes. The first chapter discussed the background of the study, problem statement, research questions, its objectives, the significance of the research, and the scope and limitation of the research. The second chapter deals with the review of related literature and further presents the conceptual framework that served as a base line for providing a solution for the basic research questions. Chapter three addressed research methodology used by the researcher incorporating the research design, research approaches used, instruments, sampling methods and data analysis techniques that are used to reach to a conclusion. Reliability, validity and ethical considerations are also part of this chapter. Chapter four is the result and discussion of the research. The Final chapter, the fifth chapter, gives summery, conclusions and recommendations from the research findings.

CHAPTER TWO

2. RELATED LITERATURE REVIEW

2.1. Theoretical Review

2.1.1. The Concept of Supply Chain

Supply chain is defined by many authors and publications in different ways having a different perspective and approach. Even though the definitions across the different authors and publications differs in its context, they are complementary of one another. The following selected authors defined supply chain (SC) as follows:

- A supply chain consists of all stages involved, directly or indirectly, in fulfilling a customer request. A supply chain not only includes the manufacturers and suppliers, but also includes transporters, warehouses, retailers, and customers themselves (Sunil & Meindl, 2006).
- A supply chain (SC) is a network of organizations and processes wherein a number of various enterprises (suppliers, manufacturers, distributors and retailers) collaborate (cooperate and coordinate) along the entire value chain to acquire raw materials, to convert these raw materials into specified final products, and to deliver these final products to customers (Ivanov, Tsipoulanidis, & Schönberger, 2019).
- The supply chain comprises the flow of all information, products, materials and funds between the different stages of creating and selling a product (Palgrave Studies of Sustainable Business in Africa, 2019).
- The supply chain is defined as a part of a network that supplies a specific product from raw material to final customer – it is a whole commercial chain embedded in the network with a common objective of efficiency and effectiveness (Borgström, 2014).

For the purpose of this research, the author will implicate the definition from Sunil & Meindl (2016) which can be easily adopted to the supply chain for petroleum products in Ethiopian context.

2.1.2. Overview of the Petroleum Products Supply Chain

To understand on how the pricing structure of petroleum products affects the supply chain effectiveness, it is paramount important to clearly identify and characterize its supply chain. The

global petroleum industry is usually divided between the upstream and the downstream activities. The first part covers the exploration, production and transportation of crude oil and gas to the point of transformation into final products (mainly refineries). The downstream activities deal with the processing of crude oil in refineries, the distribution and the marketing activities of all the oil derived products (Manzano, 2005). The Ethiopian petroleum industry is categorized under the downstream marketing and services sector as the fuel requirements of the country is imported from the upstream countries (oil producing companies) and further marketed to the end users.

Cheng'e (2010) categorize the petroleum industry supply chain into six major sections, which all interacts to make the supply chain successful. According to Cheng'e (2010), the six sections of petroleum supply chain are exploration and production of crude oil, transportation, crude oil storage, refinery, product pipeline and retail storage terminals, and product distribution.

Traditionally, the oil supply chain is divided into three parts: the upstream component, which is focused on producing or purchasing crude and getting it to the refinery (Röthlisberger, 2005). Röthlisberger (2005) further stated that the refining process is itself considered a separate component, both for its complexity as well as because it is the linchpin where the crude from various production sites comes together and from where the refined products diverge on their way to the end consumer. Crude oil is extracted and transported to a refinery, typically by ship or pipeline and once refined, petroleum products of the required amount and quality are transported to storage facilities close to the final markets. Transport modes from refineries to secondary storage include marine tankers, pipelines, road tankers, rail, and barges. The downstream part of the business, finally, is focused on moving the refined products from the refineries to terminals and on to the wholesalers or retail outlets such as gas stations. (The World Bank, 2010).

The petroleum industry can be characterized as a typical supply chain, which is defined as a complex structure of supply facilities linked together in order to serve end customers (Kazemi, 2016). Kazemi (2016) further stated that the oil supply chain is vertically integrated, covering activities from exploration to transformation in refineries and product distribution with a large logistic network. As illustrated from figure 2-1, the global supply chain for petroleum products involves exploration, oil refinery, oil depots (storage), transport, and distribution (gas station & retail).

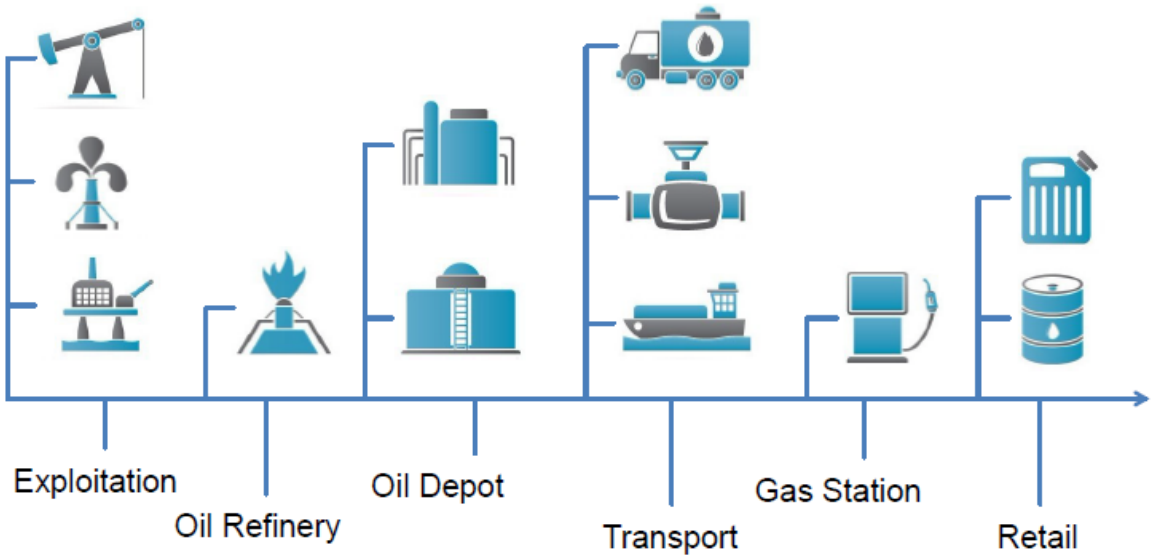


Figure 2-1: Overview of the global supply chain for petroleum products (adapted from (Röthlisberger, 2005))

2.1.3. Downstream Petroleum Supply Chain – Ethiopian Context

The Ethiopian Petroleum supply chain structure is characterized by a complex and tightly controlled government regulations. The importation of petroleum products is monopolized by the government body, Ethiopian Petroleum Supply Enterprise (EPSE) and the regulation of prices are overseen by FDRE Ministry of Trade (MOT). The petroleum supply chain, for Ethiopian context, starts with EPSE importing all the requirements of petroleum products and availing for further distribution at ports.

A number of characteristics can be established for the sales channels according to product groups. Gasoline, Gasoil and Kerosene is marketed through retail outlets, with the direct involvement of the customer (Röthlisberger, 2005). In the Ethiopian petroleum supply chain, the products imported by EPSE are distributed to the petroleum companies, licensed to distribute and sale bulk fuels under the rules and regulations of FDRE, at the port of Djibouti. Based on the product types and business structure of these companies, the products purchased from EPSE will be transported mainly via road fuel tankers to the different distribution channels.

Oil marketing companies usually act as the wholesale distributors. Wholesale marketing involves the acquisition from the bulk supply link of petroleum products of the quality and in the volume appropriate to the market. Products are delivered by road tanker to the oil marketing companies' affiliated (branded) retail service stations, as well as to bulk consuming consumers such as power generation plants, industries, large commercial customers, government agencies, and transport fleet operators such as trucking companies and bus operators (The World Bank, 2010). In Ethiopian markets, oil marketing companies deliver petroleum products to independent retailers under supply contract sales arrangements. Some of the petroleum companies in Ethiopia and EPSE owns and operates fuel storing and distribution depots within the country. Products transported by road tankers are also distributed to these depots for temporary storage and further distribution on conditional bases. Figure 2-2 illustrates the supply chain of petroleum products in Ethiopia.

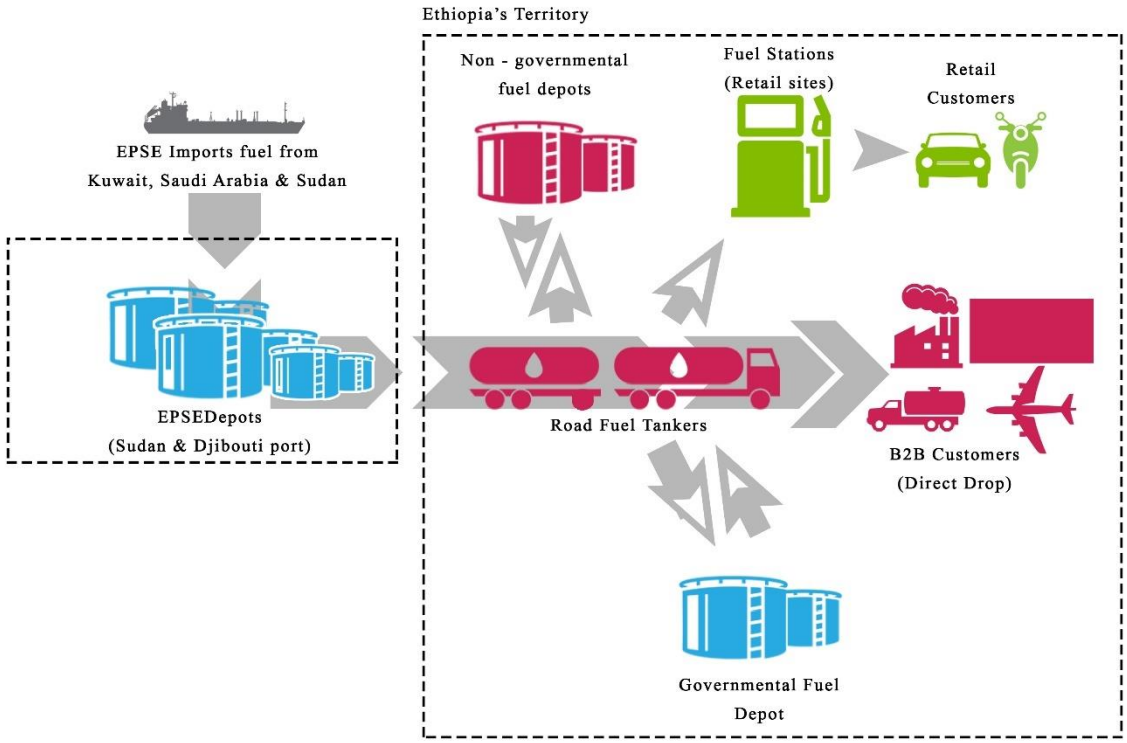


Figure 2-2: Researcher's illustration of the Ethiopian Petroleum Supply Chain, 2020

2.1.4. Participants of the Ethiopian Petroleum Supply Chain

Petroleum supply chain, in its nature, is wide and complex in that it involves numerous parties and stakeholders. In global terms, the supply chain for petroleum products is divided into two major segments; downstream (exploration, production and refining) and upstream (retails and marketing). As Ethiopia imports all the petroleum requirements of the country, the petroleum supply chain mainly involves the upstream activities. The major participants of the Ethiopian Petroleum Supply Chain are Ethiopian Petroleum Supply Enterprise (EPSE), licensed petroleum companies or distribution companies, fuel station owners/operators, bulk fuel transporters, customers and Ministry of Trade (MOT).

2.1.4.1. Ethiopian Petroleum Supply Enterprise (EPSE)

Ethiopian Petroleum Supply Enterprise is stablished under the Council of Ministers regulation number 265/2012. According to this regulation, EPSE has the following objectives in general (Council of Minsters, 2012):

- To supply petroleum to distribution companies by importing clean products and by importing and processing crude oil on the basis of assessment of the country's demand,
- To forecast, maintain and administer the required national petroleum reserve and based on instructions of the government, supply petroleum products from the reserve,
- To build its own petroleum depots within the country and, as may be necessary, in neighboring countries, and to invest in companies operating petroleum depot facilities,
- To engage in any other related activities necessary for the attainment of its objectives.

According to the Ethiopian Petroleum Supply Enterprise official report (2020), the quantity purchased for petroleum products has been increased from 2.5 million metric tons in 2013/14 to 3.4 million metric tons in 2016/17 which has a value of 37.27 billon ETB. The data shows that the demand of the country for petroleum products increased by 33.5% within the 4 years period with an arithmetic average growth of around 8.37% increase per year.

Figure 2-3: Ethiopian Import data for petroleum products (Ethiopian Petroleum Supply Enterprise, 2020)

EPSE purchases Petroleum products from Kuwait, Saudi Arabia and Sudan and transported via vessels and deliver it to Djibouti port and Sudan Khartoum Port where the government of Ethiopian depots are located. Companies will, then, purchases these petroleum products from EPSE at Ex-Djibouti and Ex-Sudan Khartoum depots and distribute the products through the use of road fuel tanker trucks to their fueling stations and B2B customer sites within the countries territory (Asfaw, 2017).

According to FDRE Proclamation No. 82/1997, NPRDA's administration duties include to plan the amount of National Petroleum Reserve to be stored in Depots, effect then purchase of same upon approval and ensure that they are kept safe; and on urgent petroleum shortage, subject to directives of the minister, distribute petroleum from the storage are one of the main mandates (FDRE House of People Representatives, 1997). Accordingly, EPSE currently is entitled of 12 National Petroleum Reserve Depots Administrations (NPRDA) located at Mekele, Awash, Harar, Combolcha, Shashamane, Wollita, Nekemte, Agaro, Gambella, Bahirdar, Gondar and Sululta, out of which Awash depot is the largest of them all.

2.1.4.2. Petroleum Companies (Petroleum Distribution Companies)

The products imported by EPSE are distributed to the different petroleum companies which further deliver these products using road fuel tankers to the end users. Currently, more than 28 petroleum distribution companies are licensed under the Ministry of Trade to operate fuel distribution and associated services within the country. Total Ethiopia S.C. (TESC), National Oil Ethiopia (NOC), Libya Oil Ethiopia (Oilibya) and Yetebaberut Beherawi Petroleum (YBP) are the major players in the industry by having an aggregate market share of 85.1% in the petroleum industry in Ethiopia (see figure 2-4 below).

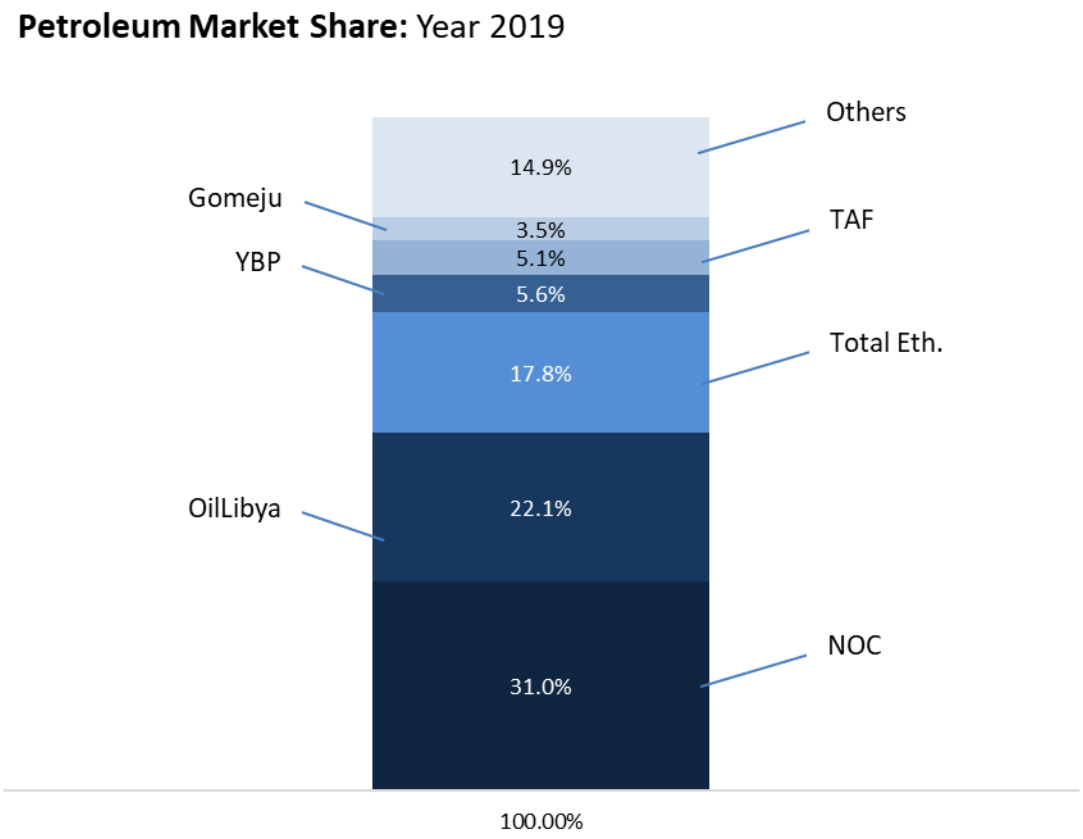


Figure 2-4: Market Share of major Petroleum Distributing Companies for Petroleum Products (Ethiopian Petroleum Supply Enterprise, 2020)

The downstream segment has two different customers: wholesale customers such as power plants, some manufacturing plants, airlines, shipping companies, etc.; and retail customers who use the fuels for heating and transportation (Kazemi, 2016). In the same way, Ethiopian petroleum distribution companies has two different customers, wholesale customers (B2B & B2C) and retail

customers (using their fuel stations). For the case of B2B and B2C customers, petroleum products are delivered in bulk using road fuel tanks and cards (coupons) under predefined sales agreement and stipulated conditions. The different petroleum products supplied by these companies are Gasoil (AGO), Gasoline (Benzine/MGR), Kerosene (Kero), Jet A-1, Heavy Fuel Oil (HFO) and Light Fuel Oil (LFO) as per the needs and requirements of their customers. Table 2.1, below, shows petroleum products distributed by these companies and their respective applications.

Product Description	Major Applications	Distribution Means
Gasoil (AGO)	Transportation Diesel Generator Diesel Boiler	Direct drop (B2B) Retail stations
Gasoline (MGR)	Transportation	Direct drop (B2B) Retail stations
Kersene (Kero)	Paint thinner in paint industries House cooking	Direct drop (B2B) Retail stations
Heavy Fuel Oil (HFO)	Power generation Industry Marine fuel	Direct drop (B2B)
Light Fuel Oil (LFO)	Power generation Industry	Direct drop (B2B)
Jet A-1	Air transportation	Direct drop (B2B)

Table 2:1: Petroleum products, applications and distribution means (adapted from Manzano, (2005) with modifications to match Ethiopian Petroleum Supply case)

2.1.4.3. Branded Fuel Stations (Retail Stations)

Ethiopia, with a population of more than 100 million and more than 800,000 registered vehicles, only has around 800 fuel stations throughout the country. Branded fuel stations are a means through which petroleum distributing companies sale their products to final consumers of the products. Depending on the ownership structure of physical asset on the stations and the management of the operation on the ground, fuel stations in Ethiopia are categorized into two categories.

- *CoDo (Company Owned Dealer operated):* These are the fuel stations where oil company is the owner of the gas station assets, but the operations are delegated to another entity through contracted arrangement (Asfaw, 2017). And

- *DoDo (Dealer Owned Dealer Operated):* Here the oil company may just decide to offer the brand and operate the gas stations through franchises (Asfaw, 2017).

2.1.4.4. Road Tanker Fuel Transporters

Although transportation by truck is the most expensive transportation method, it is also the most flexible (Cheng'e, 2010). Thus, the petroleum products, purchased by petroleum companies from EPSE, are transported several kilometers to the different parts of the country through road fuel tankers passing through different road conditions and environments. Petroleum companies outsources their fuel transportation demand to third-party transporters.

2.1.4.5. Ministry of Trade (MOT)

The Ministry of Trade was re-established in August 1995 under proclamation No 4/1995 issued to provide for the definition of powers and duties of the executive organs of the Federal Democratic Republic of Ethiopia (FDRE). The Ministry was again reorganized with a proclamation No 619/2003 issued to amend the reorganization of the executive organs of the Federal Democratic Republic Ethiopia Proclamation No 256/2001 (Ministry of Trade, 2020). Under these proclamation, the Ministry of Trade, in specifically for petroleum products, have the power and responsibility to:

- Provide commercial registration and business licensing services for distribution companies and fuel stations in accordance with the relevant laws and control the use of business licenses for unauthorized purposes;
- Undertake and submit to the council of Ministers price studies relating to basic commodities and services (including petroleum products) that have to be under price control and upon approval follow up the implementation of same;
- Control the qualities of import fuel, prohibit the importation and exportation of goods (including fuel) that do not conform with the required standards and work in collaboration with the concerned organs;
- Control the compliance of goods and services with the requirements of mandatory Ethiopia standards and take measure against those found to be below the standards set for them;

Accordingly, MOT has the mandate and authority to provide required business licenses, determines and regulates the price structure of petroleum products including transportation rate, and control the quality of imported petroleum products by EPSE.

2.1.5. Overview of Effectiveness Supply Chain

2.1.5.1. Effectiveness Defined

Organizational effectiveness is defined as an external standard "of how well an organization is meeting the demands of the various groups and organizations that are concerned with its activities" (Borgström, 2014). Thus, demands are the targets within which an organization should meet or exceed in that it be effective in operation given external standards that are measurable. Effectiveness, by its definition, is a qualitative measure in which an evaluator (usually external) sets predefined criteria for is evaluation.

Agami, Saleh, & Rasmy (2012) defined effectiveness from the customer view approach as the extent to which customer's requirements are met. In this definition, the customer requirements and the extent to which an organization meets or exceeds these requirements are the measures of effectiveness. According to the definition, in simple words, one can say an organization is effective based on how well the customer's requirements are met.

Effectiveness is the extent to which goals are accomplished (Pettersson, 2008). The Cambridge English dictionary (2020) defines effectiveness as the ability to be successful and produce the intended results, the quality of being successful in achieving what is wanted.

2.1.5.2. Characteristics of an Effective Supply Chain

Supply chain performance effectiveness helps to provide many direct and indirect benefits for suppliers and manufacturing companies where it represents the ability to invent and produce solutions that add more value to (customers) than existing offers, also effectiveness adds great important for both manufacturing companies , supplier network and other parties (Ibrahim & Hamid, 2012). The supply chain encompasses every effort involved in producing and delivering a final product, from the supplier's supplier to the customer's customer and encompasses five basic processes; plan, source, make, deliver and return, broadly define these efforts, which include managing supply and demand, sourcing raw materials and parts, manufacturing and assembly,

warehousing and inventory tracking, order entry and order management, distribution across all channels, and delivery to the customer (Sillanpää, 2015).

Borgström (2014) characterizes effective supply chain in a resource dependent perspective; as an extension of open system theory having a definite outcome under the four measurement matrixes of resources namely flow of products, production facility, dynamic relationship and indirect relationships. Accordingly, an effective supply chain is one that fit in product range and cash generated, able to deliver goods in the right time and ability to solve problems, and fit in relationship derived from a lead user position.

Tan et al. (2002) and Tan (2002), cited in Lopes de Sousa Jabbour, Filho, Viana, & Jabbour (2014, Pg. 19-20) identified 24 effective supply chain practices from previous studies and formed six supply chain practices emerged; supply chain integration, information sharing, supply chain characteristics, customer service management, geographical proximity; and JIT capability. The supply chain will then be analyzed against the six practices on a predefined matrix to measure the effectivness of the supply chain.

(Ibrahim & Hamid, 2012) uses two underlying approaches to the concept of effectiveness in organization theory, namely external and internal approaches to measure the supply chain effectivness. According to the authors, external approach to organizational effectiveness, the most widely used effectiveness criterion of a goal-attainment model, defines organizational effectiveness as the accomplishment of a set of organizational goals and objectives. The internal approach to organizational effectiveness, on the other hand, is based on a well managed system and competent internal processes. Ibrahim & Hamid (2012) further discussed that for an organization to be said to have a well managed system, its members should be highly integrated, information flows should be smooth, and employees achieve good performance, enjoy job satisfaction and are committed to the organization effectiveness.

2.1.6. Petroleum Pricing Control Mechanisms

Pricing policies can have large effects on supply chain effectiveness (The World Bank, 2010). In countries with price controls, the first question is whether the government is setting price ceilings or price levels, and where along the supply chain they should be set (ex-refinery, landed cost, wholesale, ex-depot, retail) (Kojima, 2013).

Mechanism	Advantages	Potential problems
Price ceilings	There is scope for price competition. Divergence from ceilings suggests emerging competition. There is less need to get the prices "exactly right" than controlling price levels.	If price ceilings are too high, there is little incentive to improve efficiency. If they are too low, fuel business may cease to be financially viable.
Price levels	Greater control.	There is no scope for price competition. If price levels are set too high, there is little incentive to improve efficiency, and if set too low, fuel business may cease to be financially viable.
Control at retail	Easy for consumers to check compliance.	More assumptions are needed to calculate prices than controlling retail prices. Compliance is more difficult to monitor because the number of points to be checked is the largest at retail.
Control at wholesale or elsewhere upstream of retail	More transparent because of greater correlation with benchmark international prices, easier to monitor compliance because there are fewer points of sale.	If competition is inadequate, margins could grow and retail prices could be markedly higher than otherwise. If upstream prices are set too low, oil companies may try to recover losses by increasing retail prices to compensate.
Uniform prices	Sense of national unity: one country, one price. Easy for consumers to check compliance.	Freight equalization introduces additional scope for inefficiency as well as corruption. The size of cross-subsidization could become very large, to the point of making the cost of compliance unacceptably high.

Mechanism	Advantages	Potential problems
Pricing by location	Costs are better reflected.	Consumers in remote areas may compare themselves to those in major cities and feel a sense of injustice. If costs of serving remote areas are too high, some remote areas may not be served.

Table 2:2: Types of Price Control adopted from Kojima (2013, pp. 8-9)

2.1.7. Understanding the Elements of Petroleum Pricing in Ethiopia

Ministry of Trade (MOT) examines fuel prices every month and adjusts them, although the price revision and examination are not done regularly. Government stopped the policy of subsidizing petroleum fuels in 2008 and set domestic prices higher than import costs beginning in Oct 2008 to repay the debt accumulated in the Oil Stabilization Fund (Kojima, 2013). Currently, the country uses a government regularized pricing structure.

According to the World Bank (2010), a system of price control consists of two basic elements;

- The price buildup structure, starting with import-parity landed costs and adding storage, transportation, margins, and other costs
- The adjustment mechanism comprising short-term adjustment parameters, and the frequency of and the trigger for adjusting prices

Ethiopian petroleum pricing elements basically contains five elements; company's purchasing cost from EPSE (landing cost or base price), transportation rate, company's margin, fuel station's margin and retailing price.

A. Landing Cost (Base Price)

Landed cost or base prices, in countries with price control, is hypothetical import parity price corresponding to the landed cost used to calculate retail prices (The World Bank, 2010). In Ethiopian context, the landing cost is the aggregate of Ex-Djibouti price, Djibouti to Dewele transportation cost, EPSE's margin, excise tax (30%), VAT (15%), road fund, municipality tax, and stabilization fund.

B. Transportation Rate

The prices of fuel are different from one location to another as the price structure is made to adjust itself according to distance from Ex-Djibouti or Ex-Sudan to the delivery location. Transportation cost is calculated by multiplying the transportation rate per kilometer and the quantity of petroleum product loaded by the road fuel tanker. The transportation rate, as stipulated by MOT, is determined by the road condition (paved or graveled), delivery means (truck only or truck-trailer) and the product type (white product or black product). Please see table 2:3.

Transportation Rate (Cents per liter per kilometer)			
Product Type	**Mode of Transport**	**Road Condition**	
		Paved	**Gravel**
White Product	Truck	0.166560000	0.202760000
	Truck Trailer	0.123160000	0.143610000
Black Product	Truck	0.181550400	0.221008400
	Truck Trailer	0.134244400	0.156534900

Table 2:3: Petroleum Products Transportation Rate (Source: FDRE Ministry of Trade Fuel Price Build Up Data, effective as of May 08, 2019)

C. Company's Margin

The margin of petroleum companies per liter is determined by the Ministry of Trade. This element of the price buildup for the petroleum products simply the allowed marginal gain of petroleum distributing companies in Ethiopia. For the case of direct sales (B2B sales), the company margin also takes up and adds the fuel station's margin.

D. Fuel Station's Margin

Simply put, fuel station's margin is the maximum margin that the fuel stations can get from the retailing of petroleum products to their consumers.

E. Selling Price (Retailing Price)

The selling price of fuel is the sum result of landing cost, transportation cost to the retailing location, company's margin, and fuel station's margin. Ministry of Trade provides a revised and updated selling prices of petroleum products at the different cities of the country, available to all customers.

2.2. Empirical Review of Related Literatures

Masami Kojima (2013) studied the experience of 65 developing countries since mid-2009 which is published by Oil, Gas, and Mining Unit of the World Bank. According to (Kojima, 2013, p. 17), fuel shortages are far more common when fuel suppliers cannot fully recover costs with reasonable returns and cut back on fuel acquisition and sales, or when they decide to pursue higher-return opportunities elsewhere, such as exports, diversion, and out-smuggling. The report cited different ways of adulterations that includes addition of kerosene to gasoline, fuel smuggling, fuel tourism (where drivers in other countries cross the border to refuel to exploit differences in taxes and subsidies) and selling the same product at different prices.

Yakob Asfaw (2017) researched the challenges of Supply Chain Management in the Petroleum Supplier Company for the case of Total Ethiopia S.C. In his researcher, the author cited that the transportation management activity of Total Ethiopia S.C. has suffered from a lot of challenges like lack of efficiency in the system, does not ensure on time delivery of products to customers, the use of third party transporters will lead to high supply chain costs, and the safety requirement creates delay in delivery (Asfaw, 2017, p. 54).

Martha Belhu (2019) conducted a study on the effect of outsourcing logistic activities on logistics performance of Total Ethiopia. The possibility of facing inefficient management of outsourced activities was the major challenge that Total Ethiopia face due to outsourcing its freight forwarding activities. The study also cited that the possibility of facing inefficient management of outsourced activities was the major challenge Total Ethiopia face due to outsourcing its freight forwarding activities (Belhu, 2019, pp. 42-44).

Getachew Sibhat (2018) assesses factors that affect fuel supply chain management and tried to correlate their relationship with fuel supply chain performance in the capital of Ethiopia, Addis Ababa. It is cited that after the government stopped to monitor fuel inventories to reimburse or charge retailers for fluctuating revenues amid widespread corruption, dealers working on tiny margins have hoarded fuel towards the end of the month in anticipation of price increases, which has worsened shortages (Sibhat, 2018, p. 3). The study also suggested that improving fuel supply chain breaks cost in consequence the industry became responsive and increase service reliability (Sibhat, 2018, p. 45).

Joel Jeffreys Barua (2010) researched challenges facing supply chain management in the oil marketing companies in Kenya. The research cited that the road tanker charges are dependent mainly on the tanker operating and maintenance costs of fuel used by the tankers and the status of the roads is one of the challenges posed to the transportation of petroleum products (Barua, 2010, p. 27 & 28). This costs are mainly influenced by the price. One of the research findings is that oil marketing companies and the government of Kenya are not close enough to engage in the improvement of policy issues, infrastructural improvement and maintenance and bring about equity in the open tendering systems on supply (Barua, 2010, p. 38).

Peter I. Ozo-Eson (2013) on his study for the pricing of petroleum products in Nigeria stated the different reasons behind regulating petroleum pricing. The author cited that the first reason for regulating petroleum products is as a protection for consumers against oligopolistic and monopolistic exploitation by few and major companies dominating the industry. As second reason for why petroleum products prices are widely regulated, the author correlates it has to the nature of the products themselves and the important role they play in the economy and the lives of citizens. The author furthermore cited that an unregulated price regime could lead to very high prices of the products, which the economy and, particularly, the poor may not be able to bear. As an additional reason for the need to regulate price is that to avoid extreme volatilities in the prices of petroleum products (Ozo-Eson, 2014, pp. 4-8).

2.3. Conceptual Framework

From available literatures, the researcher adopted the following conceptual framework to suit for the nature of the study, that is, the effect of pricing policies and regulation on the petroleum supply chain effectiveness: the case of Total Ethiopia S.C. On the under shown diagram, the effects of pricing policies and regulation of petroleum products are referred as independent variables whereas the petroleum supply chain effectiveness is termed dependent variable.

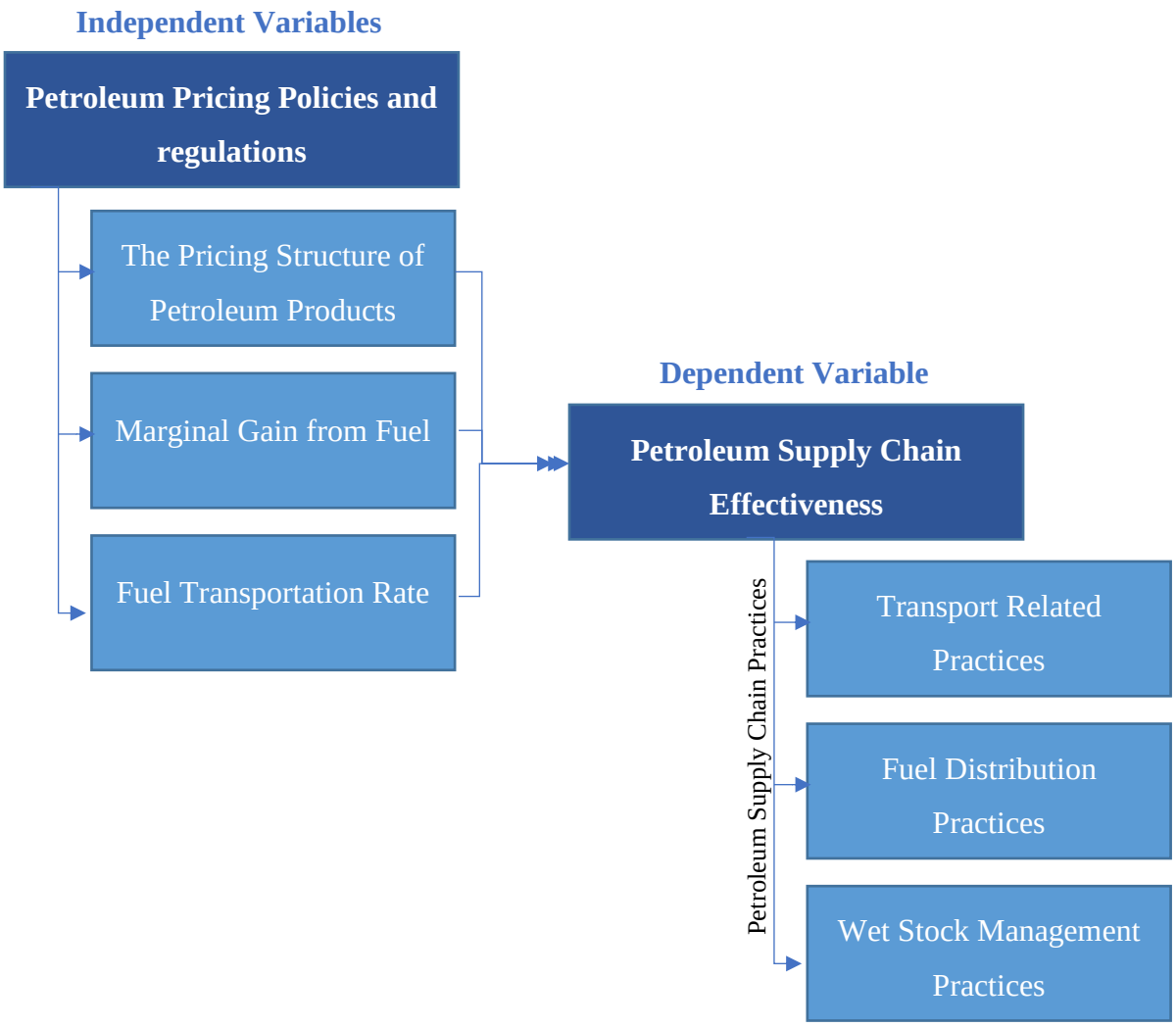


Figure 2-5: Researcher's conceptual framework, 2020

2.4. Identified Literature Gap

Many researches have made their study by centering their focus on the supply chain of the petroleum supply chain. Most of them tried to discover the challenges faced by the petroleum supply chain in Ethiopia as well as the different developing countries supply chain. Some of the international studies, like the reports from World Bank (2010), provides a good insight about the relationship of the price policies by relating it with the macro and micro economic growth of the country.

Despite the many efforts made by researchers, the researcher founds none to correlate the effects that the pricing policies and regulation of petroleum products will have on the petroleum supply chain effectiveness for Ethiopia's case (in general) and for Total Ethiopia S.C. case (in specific). In consequence, the researcher is motivated and, thus conducted this research to analyze the effects that pricing policies and regulations will have on the effectiveness of petroleum supply chain by taking Total Ethiopia S.C. as a case company for the research.

CHAPTER THREE

3. METHODOLOGY

3.1. Description of the Study Area

This study is focused on the effects that are caused due to applicable rules and regulations related to petroleum products' pricing structure and their respective effect on the effectiveness of the petroleum supply chain for Total Ethiopia S.C. case. Total Ethiopia S.C. is an affiliate of the TOTAL oil and Petroleum Company operating under the rules and regulations of FDRE since 1950. The company is one of the leading oil and petroleum companies in Ethiopia having a strong brand with a reputable image. The study, therefore, assessed the pricing policies and regulation of petroleum products and their effects on the effectiveness of the petroleum supply chain for the case of Total Ethiopia S.C.

3.2. Research Design

According to Akhtar (2016) explanatory research design is used to formulate a problem for specific investigations having a goal to identify any causal links between the factors or variables that pertain to the research problem. Explanatory research design aims on explaining things and providing evidence to support or contradict an explanation or predictions. Thus, explanatory research design (sometimes referred to as analytical study) is used in this research to identify petroleum pricing policies and regulation factors and to analyze the effect of pricing policies and regulation on the petroleum supply chain effectiveness. Self-administered questionnaires and structured interviews were employed to collect the required primary data.

3.3. Research Approach

Mixed methods research approach is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e. g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration (Schoonenboom & Burke, 2017). Mixed methods would appear to provide a realistic link between quantitative and qualitative studies, and indeed, those who conduct them (Almalki, 2016). Hence, the researcher have used mixed research approach to analyze the effect of pricing policies and regulations on the petroleum supply chain effectiveness.

3.4. Population, Sampling Strategy and Sample Size

3.4.1. Population of the study

The research conducted bases its focus on the effects that the pricing policies and regulations of petroleum products will have on the supply chain effectiveness for the case of Total Ethiopia S.C. Thus, the targeted population of the research was those employees that are directly involved in the petroleum supply chain of Total Ethiopia S.C. working under the company's various departments.

Specifically employees working as territory managers, dispatchers, fleet manager, mass balance control manager, stock controllers, fleet safety manager, fleet inspectors, customer service representatives, depot manager, maintenance engineers, controlling and reporting, chief accountant, general account units, purchasing officers, business developers, and corporate affairs are the main target population of the research. In accordance with the company's structure during the time that this research was conducted, the total number of employees was 161.

3.4.2. Sampling Strategy and Sample Size

There is no one best sampling strategy because which is best will depend on the context in which researchers are working and the nature of their research objectives (Palys, 2008). Purposive sampling technique, also called judgment sampling, is the deliberate choice of a participant due to the qualities the participant possesses and it is a nonrandom technique that does not need underlying theories or a set number of participants (Etikan, Musa, & Alkassim , 2016). Etikan, Musa, & Alkassim (2016) further stated that purposive sampling technique involves identification and selection of individuals or groups of individuals that are proficient and well-informed with a phenomenon of interest. Palys (2008, p. 697) cited that criterion based kind of purposive sampling involves searching for cases or individuals who meet a certain criterion, for example, that they have a certain disease or have had a particular life experience. Accordingly, criterion based purposive sampling was used to determine the sample population. The criteria for selecting the sample population is defined as "Total Ethiopia S.C. employees that are directly involved in the petroleum supply chain".

The sample population for the study, thus, assumes all employees of the case company working as territory managers, dispatchers, fleet manager, mass balance control manager, stock controllers, fleet safety manager, fleet inspectors, customer service representatives, depot manager,

maintenance engineers, controlling and reporting, chief accountant, general account units, purchasing officers, business developers, and corporate affairs. These employees are responsible for the logistics activities, sales and marketing activities, petroleum distribution through fuel stations and B2B sales, depot and wet stock management activities, finance, purchasing and legal requirements of the company. According to the case company's organizational structure, during the time phrase that this research was conducted, the number of employees that are related to the aforementioned positions were 51 (see Table 3.1. below).

These employees are expressly considered in this research as they are the stake holders of the petroleum supply chain and in that they are proficient and well-infirmed on the subject studied. Moreover, they possess the know-how, experience, and understanding of the nature of the petroleum supply chain. Given the small size of these employees, the researcher took all of the sample population to participate on the research. As a result, the sample size of the research was determined to be 51 (fifty one).

Targeted Sample Population Segment	**Number of Employees**
Territory managers	21
Dispatchers	3
Fleet manager	1
Mass balance control manager	1
Stock controllers	2
Fleet safety manager	1
Fleet inspectors	3
Customer service representatives	3
Depot manager	1
Maintenance engineers	3
Controlling and reporting	3
Chief accountant	1
General account units	2
Purchasing officers	3
Business developers	2
Corporate affairs	1
Total	**51**

*Source: Total Ethiopia S.C. business directory (2020)

Table 3:1 Summery of Sample Population and Sample Size determined

Participants on the structured interview were selected from managers of Total Ethiopia S.C. of the four core departments and sub-departments. The selection process is based on a direct involvement with the supply chain of petroleum products. Therefore, the participants on the interview were:

- The Dispatch Manager from Transport and Supply department,
- The Retail Area Sales Manager from Network Sales department,
- The Consumer Sales Manager from Specialties and B2B department and
- The Dukem Depot Manager from Depots, Warehouses & Engineering department have been selected for interview.

3.4.3. Data source and Types

The researcher used both primary and secondary source of data to undertake its investigation.

Primary data were gathered from the target population by making use of self-administered questionnaires and structured interviews.

Secondary data were collected from relevant literatures, reputable journals, relevant text books, Total Ethiopia S.C. related documents, Federal Negarit Gazeta in relation to petroleum products and petroleum transportation declarations, policies and regulations from the Ministry of Trade and Ethiopian Petroleum Supply Enterprise official web site. The secondary data source also includes relevant articles in reliable newspapers, related researches, journals, articles, and internet sources.

3.4.4. Data Collection Methods

Self-administered questionnaires and structured interviews were used as a main instrument for primary data collection. Self-administered questionnaires have been distributed to the employees of Total Ethiopia S.C. within the targeted population to gather primary data based on the scope and objectives of the research. Structured interviews were used to gather detail answers to complex questions and it was administered to selected department managers of Total Ethiopia S.C. based on their level of involvement in the supply chain.

The questionnaire developed to test the variables of the study have been administered with a non-comparative scaling techniques. Likert scales were used to obtain non-comparative information. Thus, respondents were required to indicate their degree of agreement or disagreement with each series of statements about specific attributes.

Federal Negarit Gazeta were used to gather proclamations relevant to the research topic. As a secondary source of data, rules and regulations from the Ministry of Trade and Ethiopian Petroleum Supply Enterprise have been used to strengthen the relevancy of the data gathered. Other secondary data from relevant articles in reliable newspapers, related researches, journals, articles, and internet sources were also used to support an argument, define terms and collect data input relevant to the research objective.

3.5. Data Analysis

The data gathered from self-administered questionnaires were collected and has been encoded by using IBM SPSS statistics software (version 26). The data gathered from structured interviews were analyzed and presented by using qualitative research technique based on the conversations, with the emphasis on researcher (interviewer) asking questions and listening, and participants (interviewees) answering.

The data from questionnaire survey, which were carefully encoded in IBM SPSS (Statistical Package for Social Scientists), were analyzed by making use of descriptive and inferential statistics that are discussed in the following section.

3.5.1. Descriptive Statistics

The survey data gathered from collected questionnaires were first codded with a unique ID of the respondents and then the data are entered into IBM SPSS software carefully and as complete as possible. Then, the researcher used descriptive statistics (IBM SPSS DESCRIPTIVE) to analyze the result with frequency, percent, valid percent, cumulative percent, mean, and standard deviation for the survey data result. The researcher further presents the output of the result obtained from IBM SPSS DESCRIPTIVE analysis in a tabulated format.

3.5.2. Inferential Statistics

IBM SPSS CORRELATION and IBM SPSS MULTIPLE REGRESSION have been used to analyze the correlation and multiple linear regression of the survey data.

I. Correlation

Correlation analysis is used to describe the strength and direction of the linear relationship between two variables (Pallant, 2003). The most widely used measure of dependency between two variables

is termed as the Pearson product-Moment Correlation Coefficient or Pearson's Correlation coefficient, "r", which attempts to find the best fit from the dataset of the variables and the resulting coefficient shows the distance between the dataset and the expected value. Pallant (2003) stated that the Pearson's Correlation Coefficient ranges from -1 to 1indicating the change in one variable can be determined exactly knowing the value on the other variable. By using IBM SPSS CORRELATE output against acceptable relationship criteria, the researcher further discussed the level of relationship posed between the dependent and independent variables on chapter 4.

II. Multiple Linear Regression

Regression analysis is a powerful and flexible procedure for analyzing associative relationships between a metric-dependent variable and one or more independent variables (Malhotra, Daniel, & Birks, 2017). Multiple regression analysis uses several explanatory variables to predict the outcome of a response variable having a goal of modeling a linear relationship between the independent variables and dependent variable. The evaluation process involves all of the independent variables being entered into the equation at once and the result will indicate how well this set of variables is able to predict stress levels, and it also tell us how much unique variance each of the independent variables explains in the dependent variable (Pallant, 2003). Accordingly, IBM SPSS REGRESSION were used to analyze the surveyed data.

The formula for Multiple Regression is:

$$y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \ldots + \beta_p X_{ip} + \epsilon$$

Where, for i = n observations:

y_i = dependent variable

X_i = independent variables

β_0 = y-intercept (constant term)

β_p = slope coefficients for each independent variable

ϵ = the model's error term (also known as the residuals)

For this research case, X_1 = pricing structure of fuel with unstandardized beta coefficient of β_1; X_2 = marginal gain on fuel, with unstandardized beta coefficient of β_2; X_3 = fuel transportation rate with unstandardized beta coefficient of β_3; and y = petroleum supply chain effectiveness.

3.6. Validity and Reliability Test

3.6.1. Validity Test

The validity test measures the degree to which an instrument used by the researcher resulted in the intended output and it makes sure that the instrument used measures what it should measure. To assure the validity of the instrument used, the researcher drafted the first draft of it and conducted a pilot test for ten selected subjects. The researcher then collected constructive and logical comments from the pilot test and further made adjustment to assure the questionnaire presented to the respondents are as clear as possible. The researcher further conducted the second pilot test for selected five employees of Total Ethiopia S.C. to check against clarity, understandability, and easiness of the statements portrayed in the questionnaire. The final questionnaire, then, were restructured in such a way that it motivates the participants to willingly cooperate, become involved and provide complete, honest and accurate answers. In this way, the researcher assured the instrument's validity.

3.6.2. Reliability Test

Reliability refers to the extent to which a scale produces consistent results if repeated measurements are made (Malhotra, Daniel, & Birks, 2017). A reliability coefficient demonstrates whether the test designer was correct in expecting a certain collection of items to yield interpretable statements about individual differences (Cronbach, 1951).

The most widely used measure of internal consistency as a measure of reliability is expressed as a Cronbach's alpha coefficient. According to Cronbach (1951) when you move from 0 to 1, the level of reliability will increase. A value of 0.6 or less generally indicates unsatisfactory internal consistency reliability while a value more than 0.6 indicates satisfactory internal consistency reliability (Malhotra, Daniel, & Birks, 2017).

After the questionnaire is encoded into IBM SPSS Statistics version 26, the variables are checked for a reliability, expressed in terms of Cronbach's alpha coefficient. According to the analysis

result and Malhotra, Daniel, & Birks (2017) acceptable value, the scales used within the study is found to be reliable and the summery of the analysis is tabulated on Table 3:2 below.

Variables	**Cronbach's Alpha**	**No. of items**	**Reliability**
Petroleum Supply Chain Effectiveness	0.805	25	Satisfactory
Pricing Structure of Fuel	0.605	7	Satisfactory
Marginal Gain from Fuel	0.801	8	Satisfactory
Fuel Transportation Rate	0.879	11	Satisfactory
Overall	**0.926**	**51**	**Satisfactory**

*Source: IBM SPSS Output of the survey data, 2020

Table 3:2 Reliability statistics

3.7. Ethical Consideration

The researcher used oral and informed consent to solicit the willingness of the individual to participate in the research. The participants were also given information on the purpose of the study, the time it takes, the procedures to be followed, and its benefits before starting the research. It is only after getting an informed consent that the participants were required to move to the next steps. The potential participant were informed that he/she can refuse to answer any question and that he/she can quit the interview and questionnaire at any point. If the participant had any questions, the researcher was requested to respond adequately. The researcher assured information that participants provides during the study will be kept confidential. The raw data set and recorded interviews shall not be used for any other purpose than the intended purposes.

CHAPTER FOUR

4. RESULTS AND DISCUSSION

4.1. Introduction

This chapter deals with presenting and discussing the results obtained from the survey data gathered through self-administered questionnaires and structured interviews (see ANNEX I) to assess the effect of pricing policies and regulation on the petroleum supply chain effectiveness. IBM SPSS version 26 output of the survey data are presented in a tabular format and further discussed on the results obtained. This chapter focused on the research objectives and targeted on finding answers to the research questions depicted on chapter one of this research paper. The result and discussions of the analyzed data will be presented on the following sections of this chapter.

4.2. Response Rate and Demographic Data

4.2.1. Response Rate

Among the questionnaires distributed (51 in number), the researcher obtained a 100% rate of return (51 respondent). The summery of the response rate is tabulated under:

Description	**Quantity**
Sample size	51
Number of returned questionnaires	51
Response rate	**100 %**

*Source: Research survey data, 2020

Table 4:1 Response rate

4.2.2. Personal Profile (Demographic Data)

The personal profile (demographic data) of the questionnaire is a means through which a better understanding of certain background characteristics of the participants are illuminated. The demographic data of this research surveyed for the respondent's gender, age group, educational qualification, department, current position, work experience, and level of awareness of the petroleum supply chain.

Accordingly, survey result for the respondent's personal profile (demographic data) are summarized and described on the table portrayed below.

		Frequency	Percent	Valid Percent	Cumulative Percent
Gender					
Valid	Male	36	70.6	70.6	70.6
	Female	15	29.4	29.4	100.0
	Total	51	100.0	100.0	
Age Group					
Valid	19 – 25	1	2.0	2.0	2.0
	26 - 30	12	23.5	23.5	25.5
	31 - 35	12	23.5	23.5	49.0
	36 - 40	14	27.5	27.5	76.5
	>41	12	23.5	23.5	100.0
	Total	51	100.0	100.0	
Educational Qualification					
Valid	BA/BSC	38	74.5	74.5	74.5
	MA/MSc	13	25.5	25.5	100.0
	Total	51	100.0	100.0	
Department					
Valid	MD's office and ICA	1	2.0	2.0	2.0
	Specialties and B2B	13	25.5	25.5	27.5
	Network Sales	10	19.6	19.6	47.1
	Transport and Supply	11	21.6	21.6	68.6
	Customer Administration Service	3	5.9	5.9	74.5
	General Secretary	9	17.6	17.6	92.2
	Depots, Warehouses & Engineering	4	7.8	7.8	100.0
	Total	51	100.0	100.0	

		Frequency	Percent	Valid Percent	Cumulative Percent
Current position in the company					
Valid	Laborer	35	68.6	68.6	68.6
	Manager	16	31.4	31.4	100.0
	Total	51	100.0	100.0	
Work experience					
Valid	0 – 3 years	5	9.8	9.8	9.8
	4 - 6 years	15	29.4	29.4	39.2
	7 – 10 Years	12	23.5	23.5	62.7
	11 – 20 years	15	29.4	29.4	92.2
	>21 Years	4	7.8	7.8	100.0
	Total	51	100.0	100.0	
Level of awareness of the supply chain					
Valid	Very low	1	2.0	2.0	2.0
	Low	1	2.0	2.0	3.9
	Medium	30	58.8	58.8	62.7
	High	17	33.3	33.3	96.1
	Expert	2	3.9	3.9	100.0
	Total	51	100.0	100.0	

*Source: IBM SPSS Output of the survey data, 2020

Table 4:2 Summery of personal profile (demographic data) of respondents

As shown in Table 4:2 above, among the total 51 respondents 70.6% (36 in number) were male whereas the remaining 29.4% (15 in number) were females.

Table 4:2 also shows that the majority of the respondents, which constitutes for 27.5% of the respondents, belonged to 36 – 40 age group. The respondents' age group belonging to 26 – 30, 31 – 35 and >41 were 23.5% each. Only 2% of the respondent's age group were 19 – 25.

Moreover, the educational qualification of respondents shows that all the respondents have BA/BSc or MA/MSc educational qualification. The result output from SPSS (also shown on Table 4:2) shows that among the respondents, 74.5% have a BA/BSc educational qualification and the remaining 25.5% have MA/MSc degree.

Furthermore, majority of the respondents (25.5%) were in the specialties and B2B department. 21.6% of the respondents were from transport and supply, 19.6% were from network sales, and 17.6% were in the general secretary department. The remaining were from depots, warehouses and engineering (7.8%), customer administration service (5.9%) and MD's office and ICA (2%).

The position of respondents within the company's hierarchy was also tabulated under Table 4:2 from which the result portrays that the participants' falls under two categories. Accordingly; 68.6% of them were laborers and 31.4% were managers.

As shown on Table 4:2 above, the respondents' experience in the petroleum industry in years were summarized. The result shows that 29.4% of them have an experience ranging from 4 – 6 years and 11 – 20 years each. In addition, 23.5% had an experience of 7 – 10 year, 9.8% had 0 – 3 years of experience and 7.8% of the total respondents have an experience of more than 21 years.

Finally, table 4:2 depicted that majority of the respondents (58.8%) had a medium level of awareness about the petroleum supply chain. 33.3% of the respondents had a high level of awareness and the remaining 7.9% of the respondents have expert (3.9%), low (2%) and very low (2%) awareness of the petroleum supply chain.

4.3. Result of Survey Data

A five point Likert scale were used and the respondents put their level of agreement or disagreement to further analyze the effect of pricing policies and regulations on the petroleum supply chain effectiveness, being the main objective of the research. In this section, the collected data by using five point Likert scale is analyzed. The assumption of the presentation is based on the mean value finding of the responses, that is, a mean score value ranging between 1 – 1.9 is considered as strongly disagree, 2 – 2.9 means disagree, 3 means neither or neutral, 3.1 – 4.5 agree and >4.6 is strongly agree. Accordingly, the result of dependent and independent variables is presented as follows.

According to the conceptual framework of the research, the dependent variable corresponds to the petroleum supply chain effectiveness. The researcher portrays a total of 25 statements under 3 key practices to measure the current effectiveness of Total Ethiopia S.C's (TESC) supply chain. The first practice, containing 8 statements, were used to assess the effectiveness of transport related practice that measures the capability of transport system to deliver the desired requirements of TESC's customers. The second practice that measures effectiveness of fuel distribution practice contained 9 statements that measures the effectiveness of the different distribution channels, which are used to channel the company's products to the end users. The last one was wet stock management practices, containing 8 statements, that measured petroleum stock keeping practice and infrastructures for both government owned depots and company owned depots. Accordingly, the result is presented on the following section.

Dependent Variables	**Frequency (N = 51)**					**Mean**	**SD**
	Strongly Disagree	**Disagree**	**Neither**	**Agree**	**Strongly Agree**		
transport related practices							
Existing number of fuel transporting trucks satisfies the demand from the company's customers.	19	24	2	6	0	1.9020	0.94350
Currently, fuel is delivered to the customers in a way that ensures timely and consistent delivery.	14	32	2	2	1	1.9020	0.80635
Third party transporters are willing to inject new trucks into the supply chain whenever deemed required by the company.	15	27	5	3	1	1.9804	0.90532
The company is willing to invest and support its transporters to acquire more fuel transporting trucks.	7	25	14	3	2	2.3725	0.93725
Customers are satisfied with the company's transport management and follow-up system.	7	18	15	11	0	2.5882	0.98339
Customers are willing to pay extra to have the product at the right time, place, quality and quantity.	10	16	13	12	0	2.5294	1.06495

Dependent Variables	Frequency (N = 51)					Mean	SD
	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree		
The existing transport management system (information technology employed) contributes to the effectiveness of petroleum supply chain.	10	30	6	3	2	2.1569	0.94599
Health, Safety and Environment policies are paramount priority within the petroleum industry.	33	15	2	0	1	1.4510	0.75667
fuel distribution practices							
Currently, the number of the company's fueling stations is adequate to fulfill the needs of the consumers.	16	24	4	6	1	2.0588	1.02785
Fuel is delivered to the retail stations without interruptions (except for the case of payment related issues).	15	26	6	4	0	1.9804	0.86000
Currently, the company is willing to invest and build new fueling stations.	22	22	5	2	0	1.7451	0.79607
The fueling station owners have the financial strength and motivation to serve their customers.	12	22	12	5	0	2.1961	0.91694
Fuel, retailed by the stations, fulfill the required quality level.	5	10	19	16	1	2.9608	0.99922
The quantity of fuel dispensed to the end user is just.	5	10	30	5	1	2.7451	0.84482
The length of queues in a given fueling station is directly related to available number of fueling stations.	10	27	7	5	2	2.2549	0.86228
Owners or operators of the company's fueling stations are profitable by doing fuel retailing only.	23	19	8	0	1	1.7647	0.86228
TESC maintains its fueling stations on regular and scheduled manner.	5	15	16	11	4	2.8824	1.10720
wet stock management practice							

Dependent Variables	Frequency (N = 51)					Mean	SD
	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree		
Depots have an important role on the effectiveness of petroleum supply chain.	5	7	13	17	9	3.3529	1.21365
Fuel is always available at the port of Djibouti.	6	19	16	8	2	2.6275	1.01903
The number of government depots in the country have sufficient storage capacity and available stock to support the supply chain effectiveness.	13	20	11	5	2	2.2745	1.07849
Products can easily be availed from government depot during unexpected/seasonal demand fluctuations.	8	18	16	7	2	2.5490	1.04525
Government depots are equipped with information technology infrastructures.	12	15	23	1	0	2.2549	0.84482
Company depots have the capacity and ability to address its customers' demand whenever required.	9	14	12	11	5	2.7843	1.25401
Currently TESC is willing to invest in a new depot.	31	13	7	0	0	1.5294	0.73083
Company depots can accommodate the demand of its customers during fuel shortage.	18	26	4	2	1	1.8627	0.87223

*Source: IBM SPSS Output of the survey data, 2020

Table 4:3 Summery of survey result for the dependent variable.

Rank	Effectiveness of Petroleum Supply Chain	N	Mean	Std. Deviation
1	Transport Related Practices	51	2.1103	0.43707
2	Fuel Distribution Practices	51	2.2876	0.53852
3	Wet Stock Management Practice	51	2.4044	0.48708
	Average Mean		**2.2674**	

*Source: IBM SPSS Output of the survey data, 2020

Table 4:4 Summery of average mean and standard deviation value for the dependent variable.

Table 4:3 shows the survey result that measures the effectiveness of petroleum supply chain of the case company. Table 4:4 summarizes these results under the 3 major practices of the company's supply chain. The first practice corresponds to transport related practices and according to the

result (Table 4:4), majority of the respondents disagreed with the effectiveness of transport related practices (having an average mean value of 2.1103 and a standard deviation of 0.43707). Among the results on Table 4:3 of this practices, "health, safety and environment (HSE) policies are paramount priority within the petroleum industry" have the lowest mean of 1.4510 (SD of 0.75667) implying that the respondents highly disagreed that HSE policies are respected within the petroleum industry. As the supply chain involves the transaction of highly flammable liquids, HSE should be paramount priority in a way to assure precious human life and capital investments are kept safe from hazardous accidents. The respondents also highly disagreed with the statements "existing number of fuel transporting trucks satisfies the demand from the company's customers" and "currently, fuel is delivered to the customers in a way that ensures timely and consistent delivery" resulting a mean value of 1.9020 each (with a SD of 0.94350 and 0.80635 consecutively). Moreover, there was a high degree of disagreement of the respondents on the statement "third party transporters are willing to inject new trucks into the supply chain whenever deemed required by the company" resulting a mean of 1.9804 with SD of 0.90532.

The result on Table 4:4 also shows that majority of the respondents disagreed on the effectiveness of the fuel distribution practice by a mean result of 2.2876 with SD of 0.53852. Among the statements provided under fuel distribution practices (Table 4:3), the respondents highly disagreed on "currently, the company is willing to invest and build new fueling stations" (a mean result of 1.7451 with SD of 0.79607). The respondents also highly disagreed with the statement "owners or operators of the company's fueling stations are profitable by doing fuel retailing only" having a mean value of 1.7647 with SD of 0.86228.

The last practice corresponds to the measure of wet stock management practices and the respondents also disagreed with the general effectiveness of the practice (a mean result of 2.4044 with SD of 0.48708, Table 4:4). Under this practice, the respondents highly disagreed with the statement "currently TESC is willing to invest in a new depot" by having a mean result of 1.5294 and SD of 0.73083 followed by "company depots can accommodate the demand of its customers during fuel shortage" having a mean result of 1.8627 with SD of 0.87223. The respondents agreed that "depots have an important role on the effectiveness of petroleum supply chain" (a mean result of 3.3529 with a SD of 1.21365).

Generally, the average mean result of the responses obtained under the three practices was 2.2674 indicating that the respondents showed their disagreement on the factors raised on the petroleum supply chain effectiveness.

Independent Variables	Frequency					Mean	SD
	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree		
Pricing Structure of Fuel							
Government involvement in regulating the pricing structure of fuel have a positive effect on the effectiveness of petroleum supply chain.	9	22	14	3	3	2.3922	1.04074
The pricing structure of fuel is revised regularly.	5	24	6	14	2	2.6863	1.10436
The marginal gain (profit) from fuel is revised regularly.	26	19	1	3	2	1.7451	1.03621
Pricing policies regarding fuel promote competition within the petroleum industry.	11	29	4	4	3	2.1961	1.05867
The current pricing structure has effect on theft and adulteration of fuel.	18	20	9	2	2	2.0196	1.02937
The pricing structure of fuel is supportive for petroleum companies to invest in the sector.	16	27	5	2	1	1.9216	0.86817
The pricing structure considers current economic market conditions.	9	28	7	5	2	2.2745	1.00157
Marginal Gain from Fuel							

Independent Variables	Frequency					Mean	SD
	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree		
The marginal gain (profit) from fuel is adequate (reasonable).	34	8	3	2	4	1.7059	1.23764
The marginal gain from fuel sales supports the effectiveness of its supply chain.	29	17	3	2	0	1.5686	0.78115
The marginal gain on fuel is not the reason for petroleum companies to direct their focus to supportive activities (like lubes, LPG & services).	33	13	3	2	0	1.4902	0.78416
The margin on fuel assures product availability in the country by motivating petroleum companies.	16	16	5	10	4	2.4118	1.32931
The marginal gain on fuel is inspiring for new international oil and gas companies (like Total) as well local companies to join the oil market in Ethiopia.	19	25	6	0	1	1.8039	0.80049
Increasing the marginal gains from selling fuel will not have an effect on the effectiveness of petroleum supply chain.	27	21	2	0	1	1.5686	0.75511
Pricing policies regarding fuel promote competition within the petroleum industry.	17	20	9	3	2	2.0784	1.05533
The country will not benefit from increased	16	19	10	6	0	2.1176	0.99292

Independent Variables	Frequency					Mean	SD
	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree		
company profit margin of fuel.							
Fuel Transportation Rate							
The current fuel transportation rate increases the effectiveness of petroleum supply chain.	25	19	3	3	1	1.7451	0.95589
Current transportation rate considers operational expenses & return on investments.	18	16	9	7	1	2.1569	1.12022
Fuel transportation rate is revised in regular bases.	20	11	14	5	1	2.1373	1.11390
Fuel transportation rate revision is made by considering applicable economic & business considerations.	9	20	16	5	1	2.3922	0.96080
Unavailability and scarcity of fuel trucks is not caused by the low marginal gain from doing the business.	16	26	6	1	2	1.9608	0.93725
Third party transporters prefer to invest fuel trucks than on in dry cargo trucks because of fuel transportation rate.	14	29	6	1	1	1.9412	0.81023
Transporters are willing to invest in information technologies (mainly of tracking & controlling)	11	23	8	6	3	2.3529	1.12825

*Source: IBM SPSS Output of the survey data, 2020

Table 4:5 Summery of survey result for the independent variables.

Rank	Variables	N	Mean	Std. Deviation
1	Marginal Gain on Fuel	51	1.84314	0.639259
2	Fuel Transportation Rate	51	2.09808	0.667281
3	Pricing Structure of Fuel	51	2.17645	0.556585

*Source: IBM SPSS Output of the survey data, 2020

Table 4:6 Summery of average mean and standard deviation value for the independent variables.

Table 4:5 portrays the result of 22 statements surveyed to measure the effects of the independent variables over the dependent variable. Table 4:6 summarizes the three independent variables namely: pricing structure of fuel (7 statements), marginal gain on fuel (8 statements) and fuel transportation rate (7 statements). The result of the survey for the independent variables is presented as follows in accordance with the rank of the respondents' mean result.

1. **Marginal Gain on Fuel**

It can be witnessed from Table 4:5 above that the highest disagreement is resulted from the statement "the marginal gain on fuel is not the reason for petroleum companies to direct their focus to supportive activities (like lubes, LPG & services)" having a mean result of 1.4902 with SD of 0.78416 implying the case company tend to focus its business directions towards supportive activities for that the profit margin from fuel is very low. The respondents further strongly disagreed in the statements "increasing the marginal gains from selling fuel will not have an effect on the effectiveness of petroleum supply chain" and "the marginal gain from fuel sales supports the effectiveness of its supply chain" by having a mean value of 1.5686 each and a SD of 0.75511 and 0.78115 consecutively. The first statement result implies that the marginal gain from fuel sales does not tend to support the supply chain effectiveness. The later statement result, on the other hand, implies that the profit margin from fuel sales hinders the effectiveness of the supply chain. There is also high level of disagreement (a mean value of 1.7059 with SD of 1.23764) with the sentence "the marginal gain (profit) from fuel is adequate (reasonable)" implying the marginal gain from the fuel sales is unreasonable and is inadequate. The respondents further disagreed in that "the country will not benefit from increased company profit margin of fuel" and "pricing policies regarding fuel promote competition within the petroleum industry" having a mean result of 2.1176 (SD of 0.99292) and 2.07844 (SD of 1.05533) consecutively. The implications of the

response is that the country will benefit if decided to revise the margin and the pricing policies does not advocate competition among the participants in the market.

Generally, Table 4:6 portrayed that the average mean result and the standard deviation of the survey data on marginal gain on fuel were 1.84314 and 0.639259 consecutively, which was the highest disagreement when compared with the other independent variables mean value. These results shows there were a high level of disagreement of the respondents with the statements portrayed on marginal gain on fuel.

2. Fuel Transportation Rate

Table 4:5 shows that the strongest disagreement of the respondents is resulted from the statement "the current fuel transportation rate increases the effectiveness of petroleum supply chain" resulting a mean value of 1.7451 with SD of 0.99589. The implication of the result is that the government regulated rate for transportation fuel hinders the effectiveness of petroleum supply chain. The respondents further strongly disagreed (mean result of 1.9412 with SD of 0.81023) in that "third party transporters prefer to invest fuel trucks than on in dry cargo trucks because of the fuel transportation rate". Next to that, the respondents disagreed with the statements "fuel transportation rate is revised in regular bases", "the current transportation rate considers operational expenses and return on investments", and "transporters are willing to invest in information technologies (mainly of tracking and controlling)" having a mean result of 2.1373 (SD of 1.11390), 2.1569 (SD of 1.12022) and 2.3529 (SD of 1.12825) consecutively.

In general, according to Table 4:6 above, the average mean result and the standard deviation of the result were 2.09808 and 0.66728 consecutively showing that majority of the respondents disagreed with the scenarios presented under fuel transportation rate.

3. Pricing Structure of Fuel

As shown on Table 4:5, there is a high level of disagreement on the statement "the marginal gain (profit) from fuel is revised regularly" having a mean result of 1.7451 with SD of 1.03621. The implication for this result is that the rate, determined by the government, is not revised on a timely bases. There is also a high level of disagreement of the respondents (a mean result of 1.9216 with SD of 0.86817) with "the pricing structure of fuel is supportive for petroleum companies to invest in the sector" implying the pricing structure does not allow petroleum companies to make new

investments within the country. With a mean result of 2.0196 and a SD of 1.02937, the respondents further disagreed in that “the current pricing structure has effect on theft and adulteration of fuel”.

Generally, from Table 4:6, the average mean and standard deviation of in pricing structure of fuel attribute were 2.17645 and 0.556585 consecutively. This shows that majority of the respondents disagreed with the statements portrayed under the pricing structure of fuel.

4.4. Summary of the Interview Result

An interview was conducted for selected Total Ethiopia SC (TESC) managers to assess the current effectiveness of TESC petroleum supply chain and the respective effects of petroleum pricing policies and regulation on it. Four Total Ethiopia SC managers from core departments were selected to participate on the structured interview. The interview was structured with seven questions:

The first question corresponds to the effectiveness of TESC’s supply chain and all of the respondents pointed out in that the petroleum industry, in general, faces numerous challenges when it comes to delivering fuel at the acceptable service level. They further concluded that the supply chain of petroleum products is not effective due to numerous challenges of which the major challenge being the government regulations on the price for petroleum products and further suggested different macroeconomic challenges (devaluation of Ethiopian birr, forex issues, depreciation, bank loan interest rate, etc.).

The second question presented to TESC managers corresponds in assessing their view of the existing marginal gain for petroleum products with respect to applicable policies and regulations. Almost all of the interviewees share the same ideology in that the prevailing government pricing policy for petroleum products is the core challenge for that the government regulated pricing does not provide the required incentive and profitability in such a way to assure the productivity and effectiveness of the supply chain. They further stated that the sector have not been given the required attention from the government despite the fact that it is the core source of the country’s major energy supply and the government allocates tremendous amount of scarce forex to acquire the products from other countries.

The third question was “do you think the effectiveness of petroleum supply chain is affected by the current pricing policies and regulation of fuel?” All of the interviewees persistently agreed that

the pricing policies and regulation of fuel affects the petroleum supply chain. The third question is followed by additional clarification on answering the question stated "in what way does the current pricing policies and regulation have an effect on the effectiveness of petroleum supply chain?" The summery of their responses were: in availing the required number of fuel transport fleets, technologies required for controlling and monitoring of fleets, infrastructures for sales and distribution (like fuel stations and depots), responsiveness to the customer's demand, flexibility, agility, quality and measurement assurance against acceptable criteria, value added service provisions (like fuel management systems), market competitions, and customer satisfaction.

The fourth interview question inquired the considerations that should be taken into account while designing the pricing structure of fuel. The interviewees response suggested that the pricing structure should assess the major micro and macroeconomic considerations of the country (like inflation rates, discount rates, devaluation, capital requirements and return on investments) and they further added that the pricing structure should provide acceptable profitability to the industry in such a way to assure the required level of its supply chain effectiveness to make sure that products are available at the required place, time, quality and quantity.

The fifth interview question was "what will be your company's contribution to the supply chain effectiveness if the pricing policies and regulation is revised up to your expectations?" The interviewees strongly believed that TESC could bring innovative and problem solving state of the art technologies in the supply and distribution; the company will be willing to invest in new fuel stations, depots, warehouses, and fuel management systems; the company could also assure that the product delivered are within the acceptable quality levels; the company will give the required level of attention to improve the effectiveness of the petroleum supply chain; and further assures reliability and safety of its operations at all cost.

The sixth question was "what is your view on the current fuel transportation rate and its effect on the petroleum supply chain effectiveness?" All of the interviewees agreed that the fuel transportation rate, which is regulated by the government, is low and for this reason the transporters are unwilling to inject additional trucks as the market demand increases. Nevertheless, some of the interviewees said that some petroleum companies in the country is subsidizing the transporters even with the existing low margin that they get from the fuel sales. They further stated that if the company's margin is revised to an acceptable level, petroleum companies will be willing to share

the profit with their transporters to meet customers' expectations. Even though this was the case for some of the interviewees, all of them agreed that the government should give a due attention on solving the truck shortages emanated mainly from the unbalanced rate for transporters.

The final question asks the interviewees if they have other opinion on the effect of pricing policies and regulations on the petroleum supply chain effectiveness. Most of them strongly believed that unless the current pricing policy and regulation is revised, the supply chain effectiveness is at danger. They further stated that the lowest recorded fuel margin in the world is the core challenge faced towards the effectiveness of the petroleum supply chain in the country and thus the government should place enough emphasis on studying the impacts and implications of such a low marginal gain will have on the country's development and on the general effectiveness of the petroleum supply chain. Some of them also stipulated that the government should balance the cost of doing business and the level of profit gained from petroleum product sales within the industry.

4.5. Correlation Analysis

Correlation Coefficient or Pearson's Correlation coefficient, "r", attempts to find the best fit from the dataset of the variables and the resulting coefficient shows the distance between the dataset and the expected value. Table 4:13 shows the interpretation of the Pearson coefficient value on the strength and weakness of the relationship possessed between variables.

Range of value for Pearson's coefficient (r)	**Level of Association/relationship**
r = 0.10 to 0.29 or r = -0.10 to -0.29	Small
r = 0.30 to 0.49 or r = -0.30 to -0.49	Medium
r = 0.50 to 1.00 or r = -0.50 to -1.00	Large

*Source: Adopted from *pallant (2003, p. 120)*

Table 4:7 Interpretation Guideline for the value of Pearson's Coefficient (Pallant, 2003)

Accordingly IBM SPSS CORRELATE result output, presented on the next section, for the dependent and independent variables is interpreted according to Table 4:7 above.

A- Correlation Analysis between Petroleum Supply Chain Effectiveness and pricing Structure of Fuel

Correlations			
		Petroleum Supply Chain Effectiveness	Pricing Structure of Fuel
Petroleum Supply Chain Effectiveness	Pearson Correlation	1	.515**
	Sig. (2-tailed)		0.000
	N	51	51
Pricing Structure of Fuel	Pearson Correlation	.515**	1
	Sig. (2-tailed)	0.000	
	N	51	51
**. Correlation is significant at the 0.01 level (2-tailed).			

*Source: IBM SPSS Output of the survey data, 2020

Table 4:8 Summery of correlation output for Petroleum Supply Chain Effectiveness and pricing Structure of Fuel

According to the SPSS output for the correlation values (Table 4:8), the Pearson correlation coefficient between petroleum supply chain effectiveness and pricing structure of fuel is large (r = 0.515**). The implication of the output is that there is a strong relationship between the pricing structures of fuel and the effectiveness of petroleum supply chain.

B- Correlation Analysis between Petroleum Supply Chain Effectiveness and Marginal Gain on Fuel

Correlations			
		Petroleum Supply Chain Effectiveness	Marginal Gain on Fuel
Petroleum Supply Chain Effectiveness	Pearson Correlation	1	.729**
	Sig. (2-tailed)		0.000
	N	51	51
Marginal Gain on Fuel	Pearson Correlation	.729**	1
	Sig. (2-tailed)	0.000	
	N	51	51
**. Correlation is significant at the 0.01 level (2-tailed).			

*Source: IBM SPSS Output of the survey data, 2020

Table 4:9 Summery of correlation output for Petroleum Supply Chain Effectiveness and Marginal Gain on Fuel.

The SPSS output on Table 4:9 revealed that there is significantly higher (r = 0.729**) relationship between the petroleum supply chain effectiveness and marginal gain on fuel. The relationship

implied that the profit margin gained from petroleum sales have a strong influence on the effectiveness of the general petroleum supply chain.

C- Correlation Analysis between Petroleum Supply Chain Effectiveness and Fuel Transportation Rate

Correlations			
		Petroleum Supply Chain Effectiveness	Fuel Transportation Rate
Petroleum Supply Chain Effectiveness	Pearson Correlation	1	.612**
	Sig. (2-tailed)		0.000
	N	51	51
Fuel Transportation Rate	Pearson Correlation	.612**	1
	Sig. (2-tailed)	0.000	
	N	51	51
**. Correlation is significant at the 0.01 level (2-tailed).			

*Source: IBM SPSS Output of the survey data, 2020

Table 4:10 Summery of correlation output for Petroleum Supply Chain Effectiveness and Fuel Transportation Rate

From Table 4:10, Pearson's correlation factory (0.612**) between petroleum supply chain effectiveness and fuel transportation rate indicates the presence of a significantly high level of relationship between the two variables. That is, the transportation rate for petroleum products affects the effectiveness of the petroleum supply chain.

Summary of the correlation analysis

The correlation analysis conducted to assess the level of relationship between the dependent variable and the independent variables showed that all the three independent variables possess high level of relationship. The correlation between petroleum supply chain effectiveness and marginal gain on fuel resulted the highest correlation value (r=0.729) followed by correlation output for petroleum supply chain effectiveness and fuel transportation rate (r=0.612) and lastly petroleum supply chain effectiveness and marginal gain on fuel (r=0.515).

4.6. Multiple Regression Analysis

4.6.1. Multiple Regression Result of the Survey

IBM SPSS Regression is used to compute the standard multiple regression in between petroleum supply chain effectiveness (SPSS REGRESSION dependent variable/DV) and pricing structure of

fuel, marginal gain on fuel, and fuel transportation rate (SPSS REGRESSION independent variables/IVs). The result of the output are discussed on the coming sections.

4.6.2. Multiple Regression Assumptions Evaluation

Following the result obtained from IBM SPSS REGRESSION output for the dependent and independent variables, the researcher tested the major assumptions to further proceed with the multiple regression. The analysis and result of the assumptions tests are presented as follows:

I. Multicollinearity Test:

Multicollinearity refers to the relationship among the independent variables. The first multicollinearity test relates to the correlation possessed within the independent variables. The statistical problems created by multicollinearity occur at much higher correlations (.90 and higher) (Tabachnick & Fidell, 2013, p. 90). According to IBM SPSS output of the correlation results between the three independent variables were below the critical value (r=0.9). The correlation value between fuel transportation rate and pricing structure of fuel, fuel transportation rate and marginal gain on fuel, and pricing structure of fuel and marginal gain on fuel were 0.612, 0.716 and 0.714 consecutively that are below the critical value, r=0.9 as suggested by Tabachnick & Fidell (2013).

The next multicollinearity test corresponds to see for the correlation that exists between the independent and dependent variables. According to Pallant (2003, p. 143), the independent variables must show at least some relationship with the dependent variable (above 0.3 preferably). IBM SPSS correlation output oncemore shows that the correlation between the indepent variables with the dependent varibles were way above the minimum criterea. The result obtained for the correlations between pricing structure of fuel and petroleum supply chain effectiveness was 0.515, marginal gain on fuel and petroleum supply chain effectiveness was 0.729, and fuel transportation rate and petroleum supply chain effectiveness was 0.612 that satisfies the minimum criteria set by Pallant (2003).

The third statistics to test is for the tolerance value on Table 4:11 below. The tolerance of an explanatory variable is defined as the proportion of variance of the variable in question not explained by a regression on the remaining explanatory variables with smaller values indicating stronger relationships (Landau & Brian, 2004). Tolerance is calculated by the formula: $1\text{-}R^2$ for

each variable and if this value is very low (near 0), then this indicates that the multiple correlation with other variables is high, suggesting the possibility of multicollinearity (Pallant, 2003, p. 143). In the multiple regression SPSS output data (see table 4:11 below), the tolerance values for pricing structure of fuel, marginal gain on fuel, and fuel transportation rate were 0.428, 0.394 and 0.426 consecutively. As a result, the data do not appear to have violated this assumption.

Model		Collinearity Statistics	
		Tolerance	VIF
1	Pricing Structure of Fuel	.428	2.335
	Marginal Gain on Fuel	.394	2.540
	Fuel Transportation Rate	.426	2.350

*Source: IBM SPSS Output of the survey data, 2020

Table 4:11 Collinearity Statistics

The last check relates to the VIF (variance inflation factor) of an explanatory variable, which measures the inflation of the variance of the variable's regression coefficient relative to a regression where all the explanatory variables are independent (Tabachnick & Fidell, 2013). The VIFs are inversely related to the tolerances with larger values indicating involvement in more severe relationships (according to a rule of thumb, VIFs above 10 or tolerances below 0.1 are seen as a cause of concern) (Landau & Brian, 2004, p. 116). According to this assumption, the IBM SPSS REGRESSION output of the survey data (table 4:11 above), the VIF result obtained for pricing structure of fuel, marginal gain on fuel, and fuel transportation rate were 2.335, 2.540 and 2.350 consecutively. In addition, Table 4:11 also showed that the tolerance value of pricing structure of fuel, marginal gain on fuel, and fuel transportation rate were 0.428, 0.394, and 0.426 consecutively. These shows that both VIF and tolerance values falls within the limit of Landau & Brian (2004) rule of thumb.

In summary, the IBM SPSS REGRESSION output of the survey data passed all the four tests that are conducted to check for collinearity among the independent variables.

II. Normality, Linearity, Homoscedasticity, Independence of Residuals

Examination of residuals scatterplots provides a test of assumptions of normality, linearity, and homoscedasticity between predicted dependent variable scores and errors of prediction.

> Assumptions of analysis are that the residuals (differences between obtained and predicted dependent variable scores) are normally distributed about the predicted dependent variable scores that residuals have a horizontal- line relationship with predicted dependent variable scores, and that the variance of the residuals about predicted dependent variable scores is the same for all predicted scores. (Tabachnick & Fidell, 2013, pp. 125-126)

One of the ways that these assumptions can be checked is by inspecting the residuals scatterplot and the Normal probability Plot of the regression standardized residuals that were plotted by using IBM SPSS REGRESSION output (see ANNEX II). In the normal probability plot, the points will lie in a reasonably straight diagonal line from bottom left to top right that would suggest no major deviations from normality (Pallant, 2003). According to the Normal Probability plot obtained from IBM SPSS REGRESSION output result (ANNEX II, first figure), the points on the plot are reasonably straight diagonally which suggests that the relationship between the independent variables with that of the dependent variables is approximately linear. From the data also passes the assumption that errors of prediction are normally distributed around the predicted dependent variable score.

In the scatterplot of the standardized residuals (the second plot in ANNEX II), the residuals seems to be roughly rectangular distributed. Tabachnick & Fidell (2013) stated that, in the scatter plot, what we hope to see is the residuals to be roughly rectangularly distributed and what we don't want to see is a clear or systematic pattern to the residuals (like curvilinear, or higher on one side than the other). The resulting residual plots (the second plot of ANNEX II) varies around the zero reference line in a nonsystematic way.

In general, by the guidance of the plotts of predicting values of the dependent variable against residuals (ANNEX III), the plots obtained from IBM SPSS REGRESSION analysis (ANNEX II) apears to met the normality, linearity, and homoscedasticity assumptions.

III. Outliers

Outliers are cases with values well above or well below the majority of other cases. While running IBM SPSS REGRESSION, the researcher included the Mahalanobis distance which are presented in the data file as an extra variable on the software. To identify outliers, the researcher further run additional analysis using IBM SPSS DESCRIPTIVES, EXPLORE and requested outliers from the

list of statistics. Pallant (2003, p. 144) suggested critical values for evaluating Mahalanobis distance values (see table 4:12 below).

No. if indep. Variables	Critical value	No. if indep. Variables	Critical value	No. if indep. Variables	Critical value
2	13.82	4	18.47	6	22.46
3	16.27	5	20.52	7	24.32

*Source: Adopted from *Pallant (2003);* extracted and adopted from a table in Tabachnrik abd FFidell (1996); originaly from Pearson, E.S. and Harley, H.O. (Eds) (1958). *Biometrika tables for statisticians* (vol. 1, 2nd edition), New York, Cambridge University Press

Table 4:12 Critical Values for Evaluating Mahalanobis Distance Values

In summary, the number of variables in this research were 3 and thus, the critical value from Table 4:12 was foud to be 16.27. Accordingly, from the SPSS result optained (see ANNEX IV) the researcher found one outlying case (CASE008 with a value of 20.93205) which is not unusual to find few outlying case. Thus, the the data passes this assumption as well.

Conclusion on the Multiple Regression Assumption Tests

The three assumptions of multiple regression were tested and the test result indicated that the data have passed all the assumptions and thus, the researcher can proceed with the evaluation of multiple regression analysis results.

Accordingly, by using the IBM SPSS REGRESSION outputs, the researcher evaluated the multiple regression model on the next sections.

4.6.3. Evaluation of the Model

I. Model Summery

From Table 4:13 below, the correlation coefficient between the observed and predicted values of the dependent variable showed a result of R = 0.743. This value indicates that there is a high linear relationship between petroleum supply chain effectiveness and those predicted by the regression model fit (fuel transportation rate, pricing structure of fuel, and marginal gain on fuel). On the same case, the value of R Square (goodness-of-fit measure of a linear model, sometimes called the

coefficient of determination) is 0.552 which indicates the model fits the data very well and the model also explains 55.2 percent of the variance in petroleum supply chain effectiveness.

Model Summery[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.743[a]	.552	.524	.278562

a. Predictors: (Constant), Fuel Transportation Rate, Pricing Structure of Fuel, Marginal Gain on Fuel
b. Dependent Variable: Petroleum Supply Chain Effectiveness

*Source: IBM SPSS Output of the survey data, 2020

Table 4:13 Model Summery

II. ANOVA

The ANOVA table (Table 4:14) provides an F-test for the null hypothesis that none of the explanatory variables are related to petroleum supply chain effectiveness or in a case where R Square is zero. When the F value is large and the significance level is small (typically smaller than 0.05 or 0.01) the null hypothesis can be rejected. A small significant level indicates that the results probably are not due to random chance. The significance level for *R* is found in the ANOVA table (Table 4:14) with $F(3, 47) = 19.322$, $p<0.0002$. Hence, the researcher concluded that there is at least one of the independent variables (pricing structure of fuel, marginal gain on fuel, and fuel transportation rate) is related to the petroleum supply chain effectiveness and thus rejected the null hypothesis.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.498	3	1.499	19.322	.000[b]
	Residual	3.647	47	.078		
	Total	8.145	50			

a. Dependent Variable: Petroleum Supply Chain Effectiveness
b. Predictors: (Constant), Fuel Transportation Rate, Pricing Structure of Fuel, Marginal Gain on Fuel

*Source: IBM SPSS Output of the survey data, 2020

Table 4:14 ANOVA Model Fit

III. Standardized Regression Coefficient (Beta Coefficient)

Standardized means that the values of each of the different variables have been converted to the same scale so that we can compare them (Pallant, 2003). The standardized Beta coefficient is used to compare the contribution of each independent variable. The contribution of the independent variables is measured by looking at the magnitude (absolute value) of the standardized beta coefficient. When the absolute value of the Beta coefficient is higher, the more the contribution is made by the corresponding independent variable.

Accordingly, from Table 4:15 below (coefficients table), the highest standardized Beta coefficient was 0.638 (P<0.0002) which corresponds to marginal gain on fuel. This implies that marginal gain on fuel makes the strongest unique contribution to explaining the dependent variable (petroleum supply chain effectiveness), when the variance in the model is controlled for. The standardized Beta coefficient for pricing structure of fuel is the least (Beta=-0.088, P=0.556) implying that it makes the least contribution.

To check for the statistical significance of a variable, Pallant (2003, p.146) suggested that if the Sig. value is less than 0.05, then the variable is making a significant unique contribution to the prediction of the dependent variable. According to the IBM SPSS REGRESSION output (table 4:15), Marginal gain on fuel made a unique and statistically significant contribution (Beta=0.638, P<0.0002) to the prediction of petroleum supply chain effectiveness.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.391	.161		8.638	.000
	Pricing Structure of Fuel	-.064	.108	-.088	-.592	.556
	Marginal Gain on Fuel	.402	.098	.637	4.098	.000
	Fuel Transportation Rate	.131	.091	.217	1.449	.154

a. Dependent Variable: Petroleum Supply Chain Effectiveness

*Source: IBM SPSS Output of the survey data, 2020

Table 4:15 Coefficients

IV. Unstandardized Beta Coefficient (β)

Unstandardized coefficients "$\boldsymbol{\beta}$" are the estimated regression coefficients which are used to complete the model for the petroleum supply chain effectiveness developed on chapter three, which can now be written by including the results obtained for the unstandardized coefficients and the error term (see table 4:15 for the $\boldsymbol{\beta}$ coefficient result)

$$y_i = \beta_0 + \beta_1 X_i + \beta_2 X_{i2} + \ldots + \beta_p X_{ip} + \epsilon$$

$$\boxed{Y = 1.391 - 0.064\, X_1 + 0.402\, X_2 + 0.131\, X_3 + \epsilon}$$

Where:

y = Petroleum supply chain effectiveness

X_1 = Pricing Structure of Fuel

X_2 = Marginal Gain on Fuel

X_3 = Fuel Transportation Rate

ϵ = Error term

The prediction model formula above shows that the y-intercept for the model (β_0 - constant) is 1.391 which is arithmetically calculated by giving zero value for all the independent variables (X_i).

The prediction model further shows that marginal gain on fuel have a relatively higher importance for the petroleum supply chain effectiveness followed by fuel transportation rate and pricing structure of fuel.

The prediction model formula of petroleum supply chain effectiveness also shows that for every one unit change in marginal gain on fuel, the petroleum supply chain effectiveness will increase by a unit of 0.402 while keeping other independent variables constant.

4.6.4. Summary of Multiple Regression Analysis Result

A multiple linear regression was performed by using IBM SPSS REGRESSION between the dependent variable (petroleum supply chain effectiveness) and the independent variables (pricing

structure of fuel, marginal gain on fuel, and fuel transportation rate) and further tests of multiple regression assumptions were conducted followed by the multiple regression result of the data.

To test the assumption for multicollinearity, the researcher checked for the correlation that existed in between the dependent and independent variables, between the independent variables themselves, the tolerance limit and the variance inflation factor (VIF) of the explanatory variables. Accordingly, all the tests passed the multicollinearity assumption criteria. The IBM SPSS REGRESSION normality and scatterplot residuals where checked for normality, linearity, homoscedasticity, independence of residuals and the result showed that all the assumptions were met from the analysis of the plots (ANNEX II). Furthermore, by making use of a $P < 0.001$ criterion for Mahalanobis distance, the researcher found one outlier and hence accepted the assumption for that few outliers are not unusual to occur based on the size of the data figure.

The IBM SPSS multiple linear regression analysis was done and the results of the model summery for the multiple regression coefficient (R) and the R Square values, the ANOVA (*F*-test for the null hypothesis), unstandardized regression coefficients ($\boldsymbol{\beta}$) and intercept ($\boldsymbol{\beta_0}$), and the standardized regression coefficient (Beta) were discussed in the previous section. According to the result obtained, the R value (R = 0.743) of the multiple regression showed the existence of a strong linear relationship between the variables and the R Square value (0.552) tells us that the model explains more than half (55.2%) of the variance in the petroleum supply chain effectiveness.

The significance level for R with $F(3, 47) = 19.322$ ($P<0.0002$) rejects the null hypothesis and showed that at least one of the independent variable is related to the petroleum supply chain effectiveness. On the other hand, the standardized regression coefficient (Beta) analysis indicated that marginal gain on fuel made a unique and statistically significant contribution to the prediction of petroleum supply chain effectiveness.

CHAPTER FIVE

5. SUMMERY, CONCLUSION AND RECOMMENDATION

5.1. Summary of Research Findings

By aiming at the objectives of the research, the researcher used descriptive and inferential statistics (correlation and regression) to analyze the data gathered from self-administered questionnaires that were completed by the case company employees. The survey data gathered were analyzed by making use of IBM SPSS (version 26). Structured interviews were also analyzed qualitatively in the research. Throughout the research, the researcher assessed and examined the effects posed by the pricing policies and regulations on the petroleum supply chain effectiveness within the case of Total Ethiopia Share Company; identified the petroleum pricing policies and regulation factors; analyzed their relationship strength with the supply chain effectiveness of petroleum products; and further analyze the significant contributions that each of these factors made for the effectiveness of petroleum supply chain. Accordingly;

From the personal profile (demographic data) gathered, majority of the respondents (70.6%) were males and the remaining 29.4% of them were females and all of the respondents had at least a BA/BSc degree when it comes to educational qualification. In addition, all of the respondents had a direct involvement in the supply chain of petroleum products out of which the majority of them were from specialties and B2B department (25.5%), transport and supply department (21.6%), network sales department (19.6%). Furthermore, 90.2% of the respondents had a work experience of more than 4 years in the petroleum industry. 96% of the respondents had a medium to expert level of awareness of the petroleum supply chain. The demographic survey data analysis result assures the validity of the responses provided by the respondents, which further strengthen the validity of the research conducted.

The correlation analysis of the survey data revealed that all the three pricing policies and regulation factors have a positivize correlation with the petroleum supply chain effectiveness. The highest correlation was witnessed between marginal gain on fuel and petroleum supply chain effectiveness ($r=0.729$, $p<0.0001$) followed by fuel transportation rate and petroleum supply chain effectiveness ($r=0.612$, $p<0.001$) and the least correlation is shown between pricing structure of fuel and petroleum supply chain effectiveness ($r=0.515$, $p=0.001$). The interviews also showed that

marginal gain on fuel, fuel transportation rate and pricing structure of fuel affects the effectiveness of petroleum supply chain.

The multiple linear regression analysis on the survey data revealed that the marginal gain on fuel makes the strongest unique contribution and also makes statistically significant contribution (Beta=0.637, $p<0.0002$) on explaining the effectiveness of petroleum supply chain. Fuel transportation rate made lesser contribution (Beta=0.031, $p=0.154$) and pricing structure of fuel made the least contribution (Beta=-0.088, $p=0.556$) on explaining the effectiveness of petroleum supply chain. The interview also strengthen this finding in that the interviewees strongly agreed in that marginal gain on fuel sales is the core challenge posed to the effectiveness of petroleum supply chain.

Finally, according to the multiple linear regression model summery output, the R Square value was 0.552, implying that the model accounts for 55.2% of the variance in the petroleum supply chain effectiveness is explained by pricing structure of fuel, marginal gain on fuel and fuel transportation rate. The ANOVA test further revealed that R and R Square values of the model summery were significance with $F(3,47)=19.322$, $p<0.0002$.

5.2. Conclusions

The researcher made all the efforts on answering the three research questions and further made the required analysis and answered these basic questions.

The first research question corresponds to identifying the petroleum pricing policies and regulation factors that affect the effectiveness of the petroleum supply chain. From the findings of the research, the researcher concluded that pricing structure of fuel, marginal gain on fuel and fuel transportation rate are the factors that affects the petroleum supply chain effectiveness.

The second research question corresponds to identifying petroleum pricing policies and regulation factors contributing the most for the petroleum supply chain effectiveness. The researcher concluded from the findings that marginal gain on fuel contributes the most for the petroleum supply chain effectiveness.

The third research question inquires to identify the effect of pricing policies and regulations on the effectiveness of petroleum supply chain. From the research findings, the researcher concluded that the variance in the petroleum supply chain effectiveness can be explained by pricing structure of fuel, marginal gain on fuel and fuel transportation rate.

From the multiple regression analysis, it could be possible to conclude that marginal gain on fuel has a unique and statistically significant contribution to the prediction of petroleum supply chain effectiveness. It could also be possible to conclude that fuel transportation rate and pricing structure of fuel are not making a significant unique contribution to the prediction of the petroleum supply chain effectiveness.

5.3. Recommendations

From the research findings, the researcher made the following suggestions as a reliable recommendation.

- The research findings indicated that marginal gains (profit margin) from petroleum products sales have a strong relationship with the effectiveness of petroleum supply chain. Thus, the researcher strongly recommends the concerned government authority and Ministry of Trade to direct their focus on revising the marginal gains that assure the supply chain effectiveness of petroleum products.
- Furthermore, the researcher recommends the concerned government body to conduct detail studies and make further revisions on the prevailing petroleum transportation rate to make sure that adequate number of road fuel trucks are available to provide uninterrupted supply of petroleum products, thereby assuring the petroleum supply chain effectiveness.

5.4. Suggestions for Future Studies

As the research was limited to only for the case of Total Ethiopia S.C., the researcher recommends for future studies to be made in much broader direction to assess other pricing policies and regulation factors in addition to the three factors which might affect the petroleum supply chain in such a way to include major stakeholders of the petroleum supply chain in Ethiopia.

Petroleum products in Ethiopia are imported with a very scarce foreign currency resource and there might be an implication of poor supply chain on the country's economic development. As a result, the researcher recommends to those involved in the petroleum supply chain to further study the stakes held by ineffective petroleum supply chain on the country's economic and social development.

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ANNEX I

RESEARCH QUESTIONNAIRE

Addis Ababa University
School of Commerce
College of Business and Economics
Logistics and Supply Chain Department

Questionnaire to be filled by Total Ethiopia S.C. employees who have a direct involvement with the supply chain of petroleum products.

Dear respondents,

This research questionnaire is prepared as an instrument for the collection of relevant data on a research titled *"Effect of Pricing Policies and Regulation on the Petroleum Supply Chain Effectiveness: The Case of Total Ethiopia S.C."* in partial fulfillment of the requirements for the award of the Master of Arts degree in Logistics and Supply Chain Management. The data gathered from the questionnaire is purely designated for academic purposes only. Thus, it is designed and will be conducted in a way that assures confidentiality and absolute secrecy of the respondents.

The answers made by you will not affect you or any volunteers participated in this questionnaire or the company you are working for in any way. The data collected from the respondents will be analyzed to assess the effect of pricing rules and regulations in the effectiveness of the petroleum market supply chain in Total Ethiopia SC (TESC).

The outcome of the said research is highly dependable upon the responses that you provide. I, therefore, kindly request you to avail your precious time to properly fill out the questionnaire following the instructions carefully.

Time required to fill out the questionnaire: 30 minutes

Thank you for your time and willingness to participate in this research.

Zelalem TILAHUN (Researcher)

General Instruction:

- *Respond to the closed-end questions by putting **"X"** or **in writing** on the space provided.*
- *You shall not write your name in any parts of this questionnaire.*

Part I- Personal Profile

---

1. ***Direction**: Please indicate your response by putting **"X"** or **in writing** on the space provided*

   (Please put "X" on the check box (☐) indicating your response)

2. Please indicate your gender: ☐ Male ☐ Female
3. Please indicate your age group:
   ☐ 19 – 25 ☐ 26-30 ☐ 31-35 ☐ 36-40 ☐ >41
4. Please indicate your highest educational qualification:
   ☐ TVET ☐ BA/BSC ☐ MA/MSc ☐ PhD ☐ Other _____
5. Please indicate the department that you are currently working:
   ☐ MD's office and ICA ☐ Specialties and B2B
   ☐ Network Sales ☐ Transport and Supply
   ☐ Customer Administration Service ☐ General Secretary
   ☐ Depots, Warehouses and Engineering Other _____
6. Kindly indicate your current position in the company:
   ☐ Laborer ☐ Manager ☐ Management Committee (MANCOM)
   Other _____
7. Kindly indicate your total work experience in the petroleum industry:
   ☐ 0 – 3 years ☐ 4 - 6 years ☐ 7 – 10 Years ☐ 11 – 20 years ☐ >21 Years
8. Please indicate your level of awareness of the supply chain for petroleum products (in Ethiopia's context)
   ☐ Very low ☐ Low ☐ Medium ☐ High ☐ Expert

Part II- Assessment of the Supply Chain Effectiveness of Total Ethiopia S.Co.

Direction*: In this section, key aspects of the petroleum supply chain will be presented for you to put your level of agreement or disagreement which will help the researcher analyze the current effectiveness of petroleum supply chain in TESC. Accordingly, three (3) selected key activities of the petroleum supply chain will be presented on the following part. Therfore, you are kindly requested to indicate your response by putting **"X"** on your rating scale.*

Rate scales*: **1 – Strongly Disagree, 2 – Disagree, 3 – Neither, 4 – Agree, 5 – Strongly Agree***

1. Indicate your rating scale on the current **transport related practices** of TESC.

No.	Variables	1	2	3	4	5
1	Existing number of fuel transporting trucks satisfies the demand from the company's customers.					
2	Currently, fuel is delivered to the customers in a way that ensures timely and consistent delivery.					
3	Third party transporters are willing to inject new trucks into the supply chain whenever deemed required by the company.					
4	The company is willing to invest and support its transporters to acquire more fuel transporting trucks.					
5	Customers are satisfied with the company's transport management and follow-up system.					
6	Customers are willing to pay extra to have the product at the right time, place, quality and quantity.					
7	The existing transport management system (information technology employed) contributes to the effectiveness of petroleum supply chain.					
8	Health, Safety and Environment policies are paramount priority within the petroleum industry.					

2. Indicate your rating scale on the current **fuel distribution practices** of TESC.

Definition*: A fueling station is a designated distribution place having the required infrastructure to operate and sell petroleum products and is duly authorized by TESC.*

No.	Variables	1	2	3	4	5
1	Currently, the number of the company's fueling stations is adequate to fulfill the needs of the consumers.					
2	Fuel is delivered to the retail stations without interruptions (except for the case of payment related issues).					

No.	Variables	1	2	3	4	5
3	Currently, the company is willing to invest and build new fueling stations.					
4	The fueling station owners have the financial strength and motivation to serve their customers.					
5	Fuel, retailed by the stations, fulfill the required quality level.					
6	The quantity of fuel dispensed to the end user is just.					
7	The length of queues in a given fueling station is directly related to available number of fueling stations.					
8	Owners or operators of the company's fueling stations are profitable by doing fuel retailing only.					
9	TESC maintains its fueling stations on regular and scheduled manner.					

3. Indicate your rating scale on the current **wet stock management practice** of petroleum products (both government and TESC).

Definition:

- *A "depot" is a place where fuel is stored, managed, and distributed.*
- *A "government depot" is owned by the concerned government body, whereas "company depot" is owned by TESC.*

No.	Variables	1	2	3	4	5
1	Depots have an important role on the effectiveness of petroleum supply chain.					
2	Fuel is always available at the port of Djibouti.					
3	The number of government depots in the country have sufficient storage capacity and available stock to support the supply chain effectiveness.					
4	Products can easily be availed from government depot during unexpected/seasonal demand fluctuations.					
5	Government depots are equipped with information technology infrastructures.					
6	Company depots have the capacity and ability to address its customers' demand whenever required.					
7	Currently TESC is willing to invest in a new depot.					
8	Company depots can accommodate the demand of its customers during fuel shortage.					

Part III- Assessment of Applicable Petroleum Pricing Policies and Regulations

Direction*: In Ethiopia, the selling and transportation rates of petroleum products is regulated by the Ministry of Trade. In this section, currently available pricing policies and regulations of petroleum products will be presented for you to rate your level of*

*agreement on each topic. Thus, you are kindly requested to indicate your response by putting **"X"** on your rating scale.*

Rate scales*: **1 – Strongly Disagree, 2 – Disagree, 3 – Neither, 4 – Agree, 5 – Strongly Agree***

No.	Variables	1	2	3	4	5
Pricing Structure of Fuel						
1	Government involvement in regulating the pricing structure of fuel have a positive effect on the effectiveness of petroleum supply chain.					
2	The pricing structure of fuel is revised regularly.					
3	The marginal gain (profit) from fuel is revised regularly.					
4	Pricing policies regarding fuel promote competition within the petroleum industry.					
5	The current pricing structure has effect on theft and adulteration of fuel.					
6	The pricing structure of fuel is supportive for petroleum companies to invest in the sector.					
7	The pricing structure considers current economic market conditions.					
Marginal Gain from Fuel						
1	The marginal gain (profit) from fuel is adequate (reasonable).					
2	The marginal gain from fuel sales supports the effectiveness of its supply chain.					
3	The marginal gain on fuel is not the reason for petroleum companies to direct their focus to supportive activities (like lubes, LPG & services).					
4	The margin on fuel assures product availability in the country by motivating petroleum companies.					
5	The marginal gain on fuel is inspiring for new international oil and gas companies (like Total) as well local companies to join the oil market in Ethiopia.					
6	Increasing the marginal gains from selling fuel will not have an effect on the effectiveness of petroleum supply chain.					
7	Pricing policies regarding fuel promote competition within the petroleum industry.					
8	The country will not benefit from increased company profit margin of fuel.					
Fuel Transportation Rate						
1	The current fuel transportation rate increases the effectiveness of petroleum supply chain.					
2	The current transportation rate considers operational expenses and return on investments.					
3	Fuel transportation rate is revised in regular bases.					
4	Fuel transportation rate revision is made by considering applicable economic and business considerations.					

No.	Variables	1	2	3	4	5
5	Unavailability and scarcity of fuel trucks is not caused by the low marginal gain from doing the business.					
6	Third party transporters prefer to invest fuel trucks than on in dry cargo trucks because of the fuel transportation rate.					
7	Transporters are willing to invest in information technologies (mainly of tracking and controlling)					

Thank you for your time!

Interview Questions for Selected Total Ethiopia S.C. Staffs

1. Do you think TESC supply chain of fuel is effective?

_____

2. What is your view of the current marginal gain from fuel in related to applicable policies and regulation in Ethiopia?

_____

3. Do you think the effectiveness of petroleum supply chain is affected by the current pricing policies and regulations of fuel?

_____

If yes, in what way does the pricing policies and regulation have an effect on the effectiveness of petroleum supply chain?

_____

4. In your opinion, what are the considerations that should be taken into account while designing the pricing structure of fuel?

_____

5. What will be your company's contribution to the supply chain effectiveness if the pricing policies and regulation is revised up to your expectations?

_____

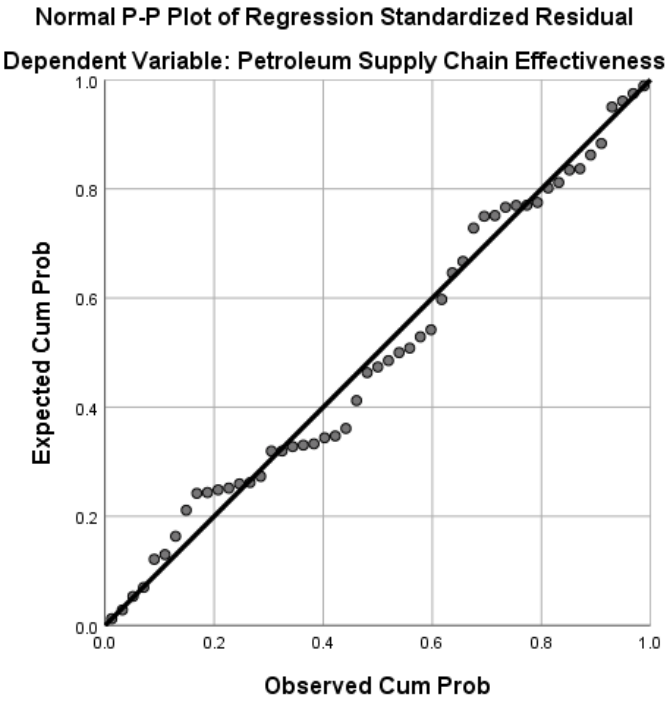
6. What is your view on the current fuel transportation rate and its effect on the petroleum supply chain effectiveness?

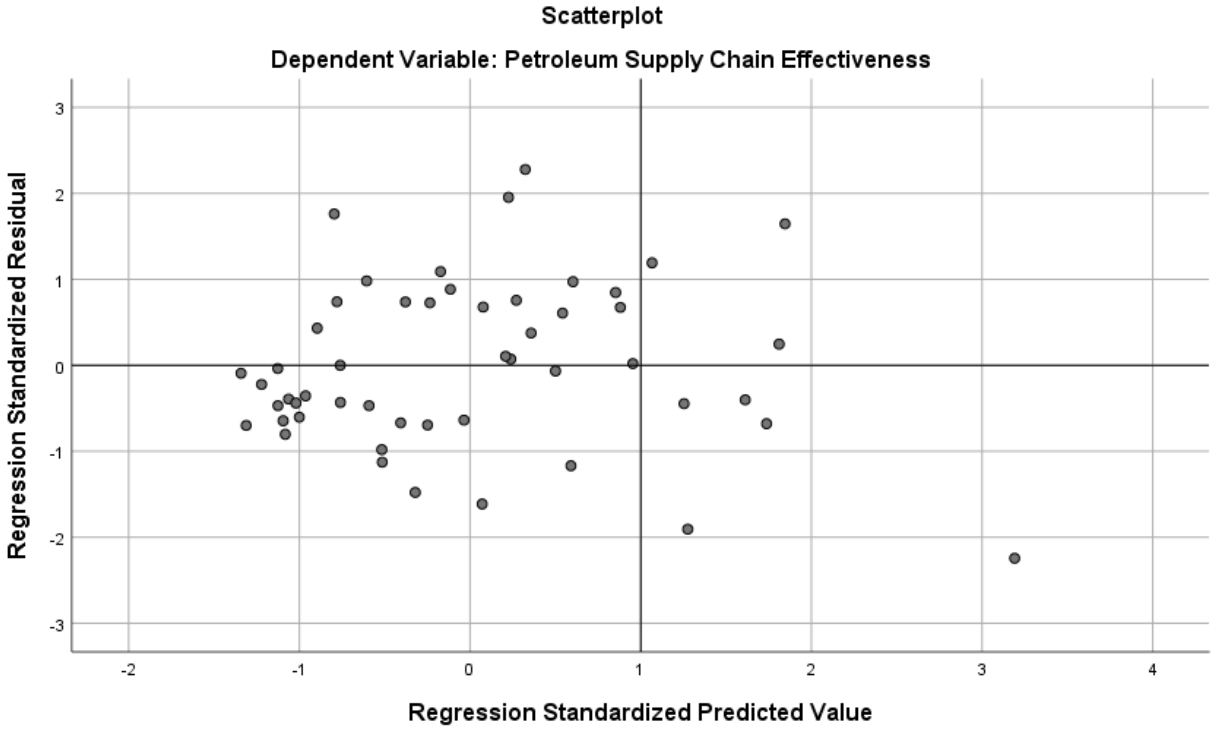
_____

7. Do you have other opinion on the effect of pricing policies and regulations on the petroleum supply chain effectiveness?

_____

ANNEX II


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Petroleum Supply Chain Effectiveness
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0


Scatterplot
Dependent Variable: Petroleum Supply Chain Effectiveness
Regression Standardized Residual
Regression Standardized Predicted Value
3
2
1
0
-1
-2
-3
-2
-1
0
1
2
3
4

ANNEX III

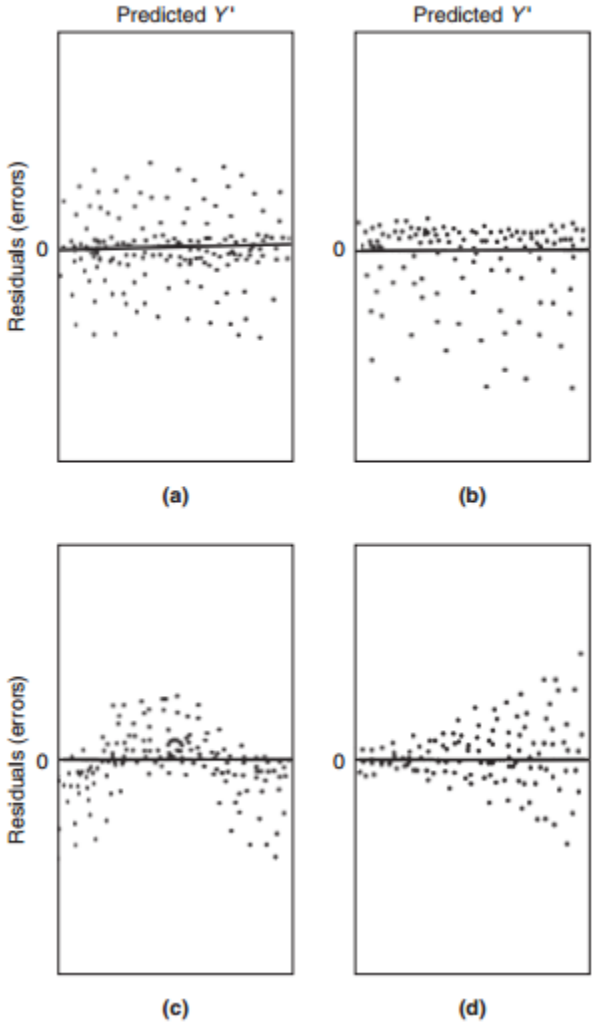
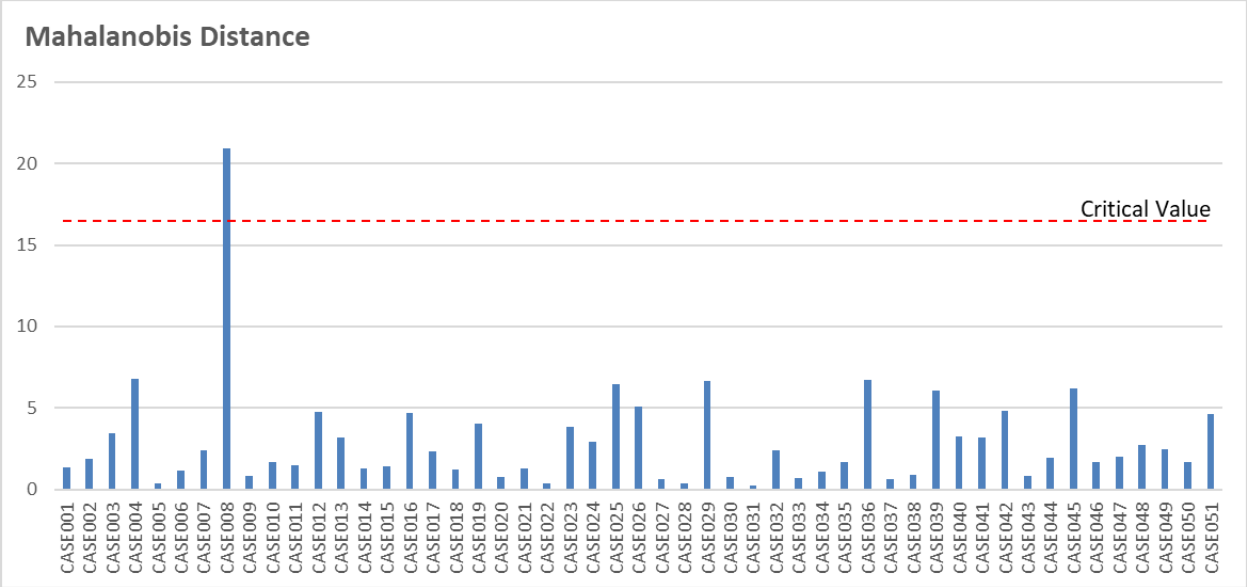


FIGURE: Plots of predicted values of the DV (Y) against residuals showing (a) assumptions met, (b) failure of normality), (C) nonlinearity, and (d) heteroscedasticity

Source: Adopted from (Schoonenboom & Burke, 2017, p. 126))

ANNEX IV



*Source: Microsoft® EXCEL 2016 output of the Mahalanobis distance value, 2020

Figure: Mahalanobis Distance Values

Extreme Values					
			Case Number	Case Number ID	Value
Mahalanobis Distance	Highest	1	8	CASE008	20.93205
		2	4	CASE004	6.79076
		3	36	CASE036	6.70386
		4	29	CASE029	6.68162
		5	25	CASE025	6.44426
	Lowest	1	31	CASE031	0.21853
		2	5	CASE005	0.34742
		3	28	CASE028	0.38107
		4	22	CASE022	0.39549
		5	37	CASE037	0.65729

*Source: IBM SPSS output of the survey data for Mahalanobis distance value, 2020

Table: Mahalanobis Distance Extreme Value