

**ADDIS ABABA UNIVERSITY**

**SCHOOL OF COMMERCE**

**LOGISTICS AND SUPPLY CHAIN MANAGEMENT UNIT**



**PRACTICES AND CHALLENGES OF SUPPLY CHAIN  
MANAGEMENT OF BITUMEN IN ETHIOPIA: THE  
PERSPECTIVE OF OIL COMPANIES**

**BY  
MAHLET GETACHEW**

**A thesis Submitted to the Department of Logistics and Supply Chain  
Management, School of Commerce, Addis Ababa University for partial  
fulfilment of the requirements for the award of Master of Arts degree in  
logistics & Supply Chain Management**

**JUNE, 2019**

ADDIS ABABA UNIVERSITY  
SCHOOL OF COMMERCE

DEPARTMENT OF LOGISTICS AND SUPPLY CHAIN  
MANAGEMENT

PRACTICES AND CHALLENGES OF SUPPLY CHAIN  
MANAGEMENT OF BITUMEN: THE PERSPECTIVE OF OIL  
COMPANIES

BY  
MAHLET GETACHEW

A thesis Submitted to the Department of Logistics and Supply Chain  
Management, School of Commerce, Addis Ababa University for partial  
fulfilment of the requirements for the award of Master of Arts degree  
in logistics & Supply Chain Management

ADVISOR  
TARIKU JEBENA (PhD)

June, 2019

ADDIS ABABA UNIVERSITY

SCHOOL OF COMMERCE

DEPARTMENT OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT

PRACTICES AND CHALLENGES OF SUPPLY CHAIN  
MANAGEMENT OF BITUMEN: THE PERSPECTIVE OF OIL  
COMPANIES

BY  
MAHLET GETACHEW

**Approved by Board of Examiners**

---

**Chairman, Graduate Studies**

---

**Signature and date**

---

**Dr. Tariku Jebena**

**Advisor**

---

**Signature and date**

---

**Dr. Berhanu Denu**

**Internal Examiner**

---

**Signature and date**

---

**Dr. Delesa Daba**

**External Examiner**

---

**Signature and date**

## **DECLARATION**

I the undersigned, declare that, this thesis is my original work and has not been presented for a degree in any other University, and that all the sources of materials used for the thesis have been duly acknowledged.

**Signed by: -**

Name Mahlet Getachew

Signature \_\_\_\_\_

Date \_\_\_\_\_

## **CONFIRMATION**

This is to approve that the study made by Mahlet Getachew, entitled: Practices and Challenges of Supply Chain Management of Bitumen: the Perspective of Oil Companies, and submitted in partial fulfillment of the requirements for the Degree of Masters of Arts in Logistics and Supply Chain Management complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

**Signed by: -**

Advisor \_\_\_\_\_

Signature \_\_\_\_\_

Date \_\_\_\_\_

## **ACKNOWLEDGEMENT**

Above all I would like to thank almighty God who is the reason for my existence and gave me his grace to accomplish this research paper successfully in the most uptight schedule. Then my deepest gratitude goes to my advisor Dr. Tariku Jebena for his valuable comments and intellectual guidance. I would also like to extend my deepest appreciation to my husband, families and friends for their love, understanding and prayers to complete this research work.

Finally, my deepest gratitude goes to my office colleagues for their support during data collection. For the last not for the least, I like to thank all of my respondents and company managers for their cooperation.

## **Table of Contents**

### **Chapter 1. Introduction**

|                                    |    |
|------------------------------------|----|
| 1.1 Background of the study .....  | 5  |
| 1.2 Statement of the Problem.....  | 7  |
| 1.3 Objectives of the study .....  | 9  |
| 1.3.1. General Objective.....      | 9  |
| 1.3.2. Specific Objectives.....    | 9  |
| 1.4 Research Questions.....        | 10 |
| 1.5 Significance of the study..... | 10 |
| 1.6 Scope of the study.....        | 10 |
| 1.7 Limitations of the study ..... | 11 |
| 1.8 Definition of terms.....       | 11 |
| 1.9 Organization of the study..... | 12 |

### **Chapter 2. Literature review**

|                                                   |    |
|---------------------------------------------------|----|
| 2.1. Introduction .....                           | 13 |
| 2.2. Theoretical Literature Review .....          | 13 |
| 2.2.1. Supply Chain Management Practices .....    | 13 |
| 2.3. Empirical Literature review                  |    |
| 2.3.1 The Supply chain of Bitumen .....           | 16 |
| 2.3.1.1 Upstream Supply Chain of Bitumen.....     | 14 |
| 2.3.1.2. Downstream Supply chain of Bitumen ..... | 15 |

|                                                            |    |
|------------------------------------------------------------|----|
| 2.3.2. Challenges in Bitumen Supply Chain management ..... | 16 |
| 2.4. Literature Gap .....                                  | 28 |
| 2.5. Conceptual Framework of the study .....               | 28 |

### **Chapter 3. Research Methodology**

|                                                      |    |
|------------------------------------------------------|----|
| 3.1. Overview of the Study Area .....                | 29 |
| 3.2. Research design .....                           | 29 |
| 3.3. Population of the study .....                   | 29 |
| 3.4. Sampling Design .....                           | 30 |
| 3.5. Sources of data and Collection Techniques ..... | 30 |
| 3.6. Measurement and Instrumentation .....           | 30 |
| 3.7. Method of Data Analysis used .....              | 31 |
| 3.8. Ethical Consideration .....                     | 32 |

### **Chapter 4. Data Presentation, Analysis and Discussion**

|                                                                                 |    |
|---------------------------------------------------------------------------------|----|
| 4.1. Introduction.....                                                          | 33 |
| 4.2. Basic Information of the Firms under study and respondent Individuals..... | 33 |
| 4.2.1. Profiles of Respondent Individuals Representing the Companies .....      | 34 |
| 4.3. Bitumen Supply Chain Practices of Oil Companies in Ethiopia .....          | 35 |
| 4.4. Challenges of Bitumen Supply chain management .....                        | 43 |

## **Chapter 5. Summary of Findings, Conclusion and Recommendations**

|                                                                                         |    |
|-----------------------------------------------------------------------------------------|----|
| 5.1. Summary of findings.....                                                           | 49 |
| 5.2. Conclusion .....                                                                   | 50 |
| 5.3. Recommendations.....                                                               | 50 |
| 5.4. Suggestions for further research .....                                             | 52 |
| <br>                                                                                    |    |
| 6. List of relevant literature review .....                                             | 53 |
| <br>                                                                                    |    |
| 7. Appendices                                                                           |    |
| Appendix 1: List of supplying markets for imported bitumen by Ethiopia: .....           | 57 |
| Appendix 2: Ethiopia- Road quality: .....                                               | 57 |
| Appendix 3: Average Wholesale bitumen prices, FOB basis: .....                          | 58 |
| Appendix 4: Iran FOB bitumen Bulk Price per barrel Fluctuations (Mt) during 2017: ..... | 58 |
| Appendix 5: Questionnaire: .....                                                        | 59 |
| Appendix 6: Reliability Test Results: .....                                             | 64 |

## LIST OF FIGURES

|                                                                               |    |
|-------------------------------------------------------------------------------|----|
| Figure 1: The downstream supply chain of bitumen in the Case of Ethiopia..... | 7  |
| Figure 2: Schematic of the Bitumen Supply Chain .....                         | 18 |
| Figure 3: Conceptual Framework of the study .....                             | 28 |

## LIST OF TABLES

|                                                               |    |
|---------------------------------------------------------------|----|
| Table 1: Profile of respondents .....                         | 34 |
| Table 2: Strategic Supplier Partnership (SSP) practices ..... | 35 |
| Table 3: Customer Relationship (CR) practices .....           | 37 |
| Table 4: Information Sharing (IS) .....                       | 39 |
| Table 5: Information Quality (IQ) .....                       | 41 |
| Table 6: Lean internal practices .....                        | 42 |
| Table 7: Challenges of Bitumen SCM .....                      | 43 |

## **List of Acronyms**

CR: - Customer relationship

SSP: - Strategic supplier partnership

IS: - Information Sharing

IQ: - Information quality

JIT: - Just In Time

SCM: - Supply Chain Management

SC: - Supply Chain

ERCA: - Ethiopian Revenue & customs Authority

ERA: - Ethiopian Road Authority

## **ABSTRACT**

*The paper has made a study on the Practices and Challenges of Supply Chain Management of Bitumen in the case of Oil companies in Ethiopia, with regard to Strategic Supplier relationship, Customer relationship, Information Sharing, Information Quality and Internal lean practices. Also the Logistics, Economic, Legislative, Technological and other challenges were discussed. The main objective of the study was to describe the current supply practices and asses the challenges in the supply chain. The study raised three research questions that are answered as a result of the study. For the study descriptive type of research was used, and quantitative and qualitative data was collected related with the extent of companies' supply chain practices and challenges of supply chain management using structured questionnaires. The target population covers all four oil companies importing and supplying bitumen in Ethiopia. Finally, the collected data was analyzed using descriptive statistics, and secondary documents analysis is done for confirming the findings. The result indicates most of the SCM practices are practices at a lesser extent by all oil companies except for Oilibya. Even though these companies practiced the SCM activities in their day to day operations, most of the companies expect for Oilibya have no bitumen logistics and supply department that manages the distribution of the product. Price volatility, High shortage of foreign currency and High transport cost are found to be the critical challenges of bitumen Supply Chain Management. The study then recommends on establishing relationships with main suppliers, Optimizing company-owned warehouses and improve supply chain function along with product packaging and proper quality inspection*

*Key words: SCM Practices, SCM Challenges, Oil companies*

## **CHAPTER ONE: INTRODUCTION**

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

Bitumen can be defined as a dark brown to black substance which can either be a sticky liquid or a solid, composed of mainly of hydrocarbons (Conawe, 1992). Bitumen is obtained from refining process (fractional distillation) of crude oil (a petroleum product) and is mainly used as a binder mainly in construction of roadways (Read & Whiteoak, 2003).

Bitumen is used in road construction due to various properties and advantages it has over other alternative pavement construction materials such as cement. It is economical, recyclable, gives smooth ride surface, and has gradual failure, it's also quick to repair and is temperature resistant. (Arjun, 2018)

The generic supply chain of Bitumen includes upstream sectors (actors involved in exploration and extraction of crude oil), downstream sectors (actors involved in refining, modification, trading, distributing and transporting of bitumen product), and the end customers (companies involved in road construction) (Hussain et al., 2006).

Ethiopia does not produce Bitumen, the country imports the product from abroad primarily from the Middle East. This paper focus on both the practices and challenges of the downstream supply chain management of bitumen in the case of oil companies in Ethiopia.

According Cuthbertson and Piotrowicz (2008), the best supply chain practices are the initiatives that influence the whole supply chain, its parts or key processes. As per Li, et al., (2005), Supply chain practices are divided into six dimensions namely strategic supplier partnership, customer relations practices, information sharing, information quality, lean system and postponement.

It's known that after the shutdown of the Assab Shell refinery in 1991, Ethiopia seized the production of petroleum products including bitumen. Today, according to ERCA import data (2016-2017), 50% and 60% of the bitumen products imported in the years 2016 and 2017 respectively, were from the U.A.E.

There are four Oil companies importing bitumen to Ethiopia which are Oil Libya, National Oil Ethiopia (NOC), Yetebaberut Beherawi Petroleum (YBP) and Gomeju Oil Ethiopia. These companies supply bitumen to both Government and Non-Government funded projects. Currently as road projects are expanding in the country, the demand for bitumen is expected to increase. On the contrary, the import of bitumen on the contrary has shown a gradual decline (ERCA, 2018). This shows that there is a mismatch between the demand and supply of bitumen in Ethiopia.

According to Raed H., et al., (2006), the Challenges of Bitumen Supply Chain Management of bitumen can be categorized as Logistics, Economical, Legislative, Technological and others. Despite the importance of the bitumen industry in our daily life and the operational challenges it involves, unfortunately the topic has received very little attention in operations and supply chain management literature. The objective of this paper, therefore, is to shed some light on practices and challenges in the bitumen industry's supply chain management.

## Key players in the downstream supply chain of bitumen in the Case of Ethiopia

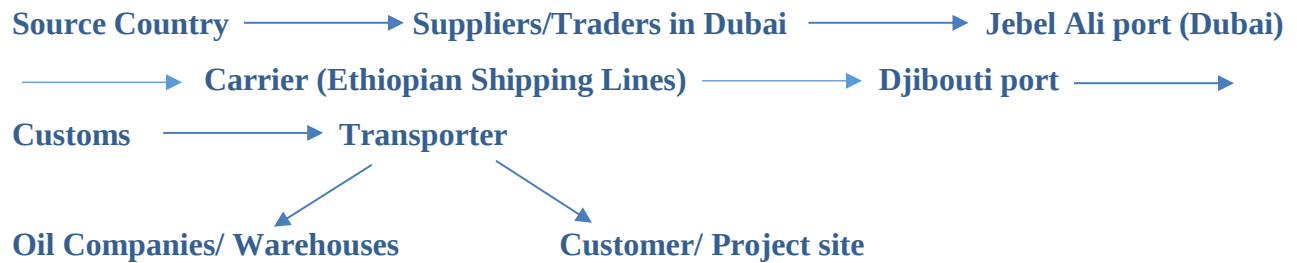


Figure 1: The downstream supply chain of bitumen in the Case of Ethiopia: Constructed by the Author

### 1.2. Statement of the problem

Bitumen being the main material used for road construction, the demand for bitumen in the country has increased and is expected to increase in the future as the country has been undertaking massive infrastructure projects, mostly notably in the Road Sector Development Program (RSDP) with objectives of improving transport efficiency (Admasu, et al., 2012). Given the development plans of the country, the construction of high standard quality road is also highly important. Almost all Government funded road construction projects awarded by The Ethiopian road Authority (ERA), buy drummed bitumen from Oil supplying companies in Ethiopia (ERA, 2018).

On the contrary, the importation of bitumen in Ethiopia has shown a gradual decline in the past few years. Ethiopia's import of bitumen immensely declined from 129.4k MT on 2016 to 22k MT on 2018 (ERCA, 2018). Bitumen supplying Oil companies, claim that they are not meeting their customers' demands due to the practices and challenges of supply chain management (Daniel, 2018).

In other words, the gradual decline of Bitumen import has disabled them to fulfill their local demands.

This shows that there is a disparity between the strong demand for road infrastructure and the supply of bitumen in Ethiopia. A shortage of bitumen in the local market causes chaos in the road construction and rehabilitation industry. It leads to a grinding halt for many jobs done by large and smaller enterprises in the sector that use asphalt for road construction projects. Some firms may leave the industry by going out of business because of cash flow problems caused by the bitumen shortage (Roy, 2013).

These arguments clearly show that an effective, efficient and economic supply of bitumen is very essential in Ethiopia given the development plans of the country. So when the shortage of bitumen occurs, construction companies suffer since at present there is no other substitutes that serve the same purpose (Richard & Francis 2014 cited by Melaku, 2017). What is not to forget, it touches on people's everyday lives as road projects get delayed too.

Regardless, of the impact of the problem in the country's road construction sector, the bitumen sector in Ethiopia is not well studied. Studies carried out so far on the problems mentioned above in the context of Ethiopia are not available. With this background, this research focuses in describing the practices and the challenges involved in bitumen supply chain management and suggests ways to improve the availability of bitumen in timely and cost efficient manner.

### **1.3. Objectives of the study**

#### **1.3.1. General objectives**

The general objective of the study is to assess the practices and challenges of the supply of chain management of Bitumen for oil companies in Ethiopia.

#### **1.3.2. Specific objectives**

The specific objectives of the study are:

1. To assess the practices of SCM of bitumen of Oil Companies in Ethiopia.
2. To profile the most critical challenges of supply chain management of Bitumen as experienced by Oil companies in Ethiopia.

### **1.4. Research questions**

1. How do Oil companies in Ethiopia manage Bitumen Supply Chains?
2. What are the most critical challenges of Bitumen supply chain management for Oil Companies in Ethiopia?

### **1.5. Significance of the study**

The study has not been done before that review of the supply chain of bitumen is limited. So this study will give an opportunity academically to better understand the strength and weakness of the supply chain and recommend actions that will help to make the supply chain more robust.

The study has a great significance for Oil companies and Government policy makers. It will help Oil companies understand and solve the problem seen in the supply chain. Since the outcome of the study helps them to easily understand the gap on their supply chain practices and take corrective actions that can enhance their capacity.

The government policy makers will benefit also from the outcome since it will assist them in examining the current policies towards the Bitumen sector and improve them accordingly. In addition, it will provide the platform for further researches in the area.

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

This research gives more attention to the downstream section of the supply chain management of Bitumen in the context of Ethiopia. The downstream supply chain management starts from shipment of refined bitumen from overseas to Ethiopia via Djibuti port, followed by logistics, sales and customer service activities.

The study focuses on Oil companies in Ethiopia engaged in the importing and supplying bitumen products. They are selected since they involve in the practices of the main supply chain activities that the study framework is organized. In addition they are the direct beneficiaries of the outcome of this research.

Even though there is a great potential seen in other non-Oil companies operating in the bitumen sector with limited capital and resource in improving to the overall supply, this study does not focus on these companies.

The supply chain practices of Oil companies are empirically studied based on the five main supply chain practices adopted from Li, et al., (2005) as a conceptual framework. For describing the supply chain challenges experienced by Oil companies, the challenges classification was adopted from Raed H., et al., (2006).

## 1.7. Limitations of the Study

On the downstream supply chain of bitumen all the suppliers/traders are located abroad specifically in Dubai. As they are the ones that link the buyer to the source, they play vital role in the chain. Due to their location and remoteness they are not directly considered as part of this study.

Since the research is focused on the selected frame work of supply chain practices, it is difficult to generalize the finding of the study to all other supply chain practices that are described by different researchers and authors. So to improve the generalizability, the study can be replicated for other supply chain practices.

## 1.8. Definition of terms

**Bitumen:** refers to dark brown to black substance used for construction of asphalt roads

**Downstream:** is a segment of the oil and gas industry which is focused on refinery processing, transporting, marketing and selling refined products made from crude oil.

**Oil Company:** A downstream focused oil and gas company which is a business entity that is engaged in the distribution and supply of Bitumen.

## 1.9. Organization of the study

The study will be performed using a systematic approach to create a clear path of understanding through the research document, for both researcher and reader with five chapters. Chapter one covers the introduction part that address the background information of the study starting from product knowledge to concerning oil companies. The research questions, the primary and specific objectives of the research, significance and scope and finally limitations of the research are included in the first chapter.

Following the introductory part, the second chapter continues with relevant theoretical, empirical and conceptual literature review of previously done researches.

The third chapter covers the type of research design used, the analysis of data and methods of data collection

The fourth chapter focuses on the descriptive data analysis and findings of the study.

The fifth and last chapter provides the conclusion and recommendations so as to highlight the gaps and challenges seen and improve the supply chain management of bitumen through better practices.

## **CHAPTER TWO: RELATED LITERATURE REVIEW**

### **2.1. Introduction**

The literature of the study covers Theoretical, Empirical reviews and a Conceptual frame work. It covers definition of product types, explanation on the basic concepts and practices and general challenges of bitumen supply chain management.

Although, in the review of empirical studies, it was difficult to get many literatures that matched with the title of the study, the basic findings from related studies are included.

### **2.2. Theoretical Literature Review**

#### **2.2.1 Supply Chain Management Practices**

##### **Strategic supplier partnership (SSP)**

Developing and maintaining a supply relationship can be achieved through either collaboration or compliance. Specifically, trust provides a basis for achieving collaboration, while power serves as a mechanism for achieving compliance (Sahay et al., 2002).

##### **A. Quality performance is the number one priority in selecting suppliers**

Quality has always been one of the most important performance criteria even with a conventional purchasing strategy Dickson, 1966.

The basic arguments of these studies by Baxter et al., 1989 are;

1. Supplier quality is a critical determinant for overall product quality and costs,
2. Information of the suppliers' quality control system and quality performance helps buyers to select the right price level of the components, and
3. A close supplier–buyer relationship is a requisite of information sharing

## **B. Long-term partnership**

A long term relationship is important for Supply chain management since each participant expects the relationship to continue for a considerable amount of time. A close relationship means that channel participants share the risks and rewards and have willingness to maintain the relationship over the long term (Shin et al, 1999).

## **Customer Relationship (CR)**

Customer Relationship practices can generate the organizational success in supply chain management efforts as well as its performance (Ellram, 1991; Turner, 1993). The success of supply chain management encompasses customer integration at the downstream (Thatte, 2007). In the competitive business, better relationship management with customers is crucial for organization success. Good relationship with business partners, including key customers are important role to success of supply chain management practiced by organizations. Customer relationship is recognized as an internal component of an organization's marketing strategy to increase sales and profits. Close customer relationship allow product differentiation from competitors, help sustain customer satisfaction and loyalty, and elevated the value provided to customer (Thatte, 2007). The global markets offer a variety of products of different quality and cost. As a result, companies are always competing and trying to reduce costs and improve quality. Customers look for more choices, better service, higher quality, and faster delivery. The relationship with customers has turned a strategic issue for today's companies. Singh and Power (2009), who observe that organizations would derive better results if they remain, engaged in collaborative relationship with customers. The endeavor on the part of the companies in forging relationships with those in the supply chain translates into an enhanced customer satisfaction.

## **Information Sharing (IS)**

Information sharing refers to the extent to which critical and proprietary information is communicated to one's supply chain partner (M. Monczka et al., 2007). Lalonde (1998), considers sharing of information as one of five building blocks that characterize a solid supply chain relationship. Supply chain partners who exchange information regularly are able to work as a single entity. Together, they can understand the needs of the end customer better and hence can respond to market change quicker (Stein and Sweat, 1998).

In a supply chain, members may attain perfect information about themselves, but might not have such perfect information about the other members. Uncertainties may arise as a result of this lack of information about other members. If the members have the ability and willingness to share information with other members, uncertainties can be significantly reduced (Yu Z., et al, 2001).

According to Yu Z., et al, (2001), information sharing gives advantage on the following areas.

- Reduces lead time
- Improved delivery performance
- Faster response to changing market demands
- Greater control over supply chain costs
- Greater customer satisfaction- through rapid response, minimum variance, quality, reverse logistics.
- Inventory optimization and reduction of on-hand inventory
- Early problem detection
- Better tracing and tracking

## **Lean internal practice**

The Just-In-Time (JIT) –principle was created by Japanese Toyota Car-manufacturer. The idea of JIT is to take the course of action when it is needed. That is to say, the bitumen product should not be shipped and transported to the buyer plant until they are needed by an end user/customer. The main purpose of the Just-in-time philosophy is to keep zero inventories in the suppliers' warehouse (Hahn et.al, 1983). Accordingly, the JIT-principle focuses on having the **zero inventory** in the manufacturing plant. It can be achieved by loading mixed cargo from different suppliers according to the requested volumes by the customer.

## **2.3. Empirical Literature review**

### **2.3.1. The Supply chain of Bitumen**

There are different types of bitumen available with different properties, specifications and uses based on requirements of consuming industry (Read & Whiteoak, 2003). According to Hindustan petroleum handbook, the penetration grade bitumen is refinery bitumen that is manufactured at different viscosities/thicknesses. The name penetration is given to indicate the hardness of the bitumen product. A test is carried out to characterize the bitumen, based on the thickness. It is classified by the depth to which a standard needle will penetrate under specified test conditions. The lower the penetration of the needle the harder the bitumen. The penetration bitumen grades range from 15 to 450 for road bitumen. But the most commonly used range is 25 to 200 (Read & Whiteoak, 2003).

Cutback bitumen is produced by blending (mixing) penetration grade bitumen and a solvent. It can be fuel such as AGO, MGR, KERO or other hydrocarbons. At the end the solvent evaporates, and

the bitumen will do the job. Cutback is different from penetration grade since it can be reshaped. Less heat is required to liquefy cutback bitumen than penetration bitumen, making it easier to use at lower temperatures. A rapid-curing (RC) solvent will evaporate faster than a medium-curing (MC) solvent. Curing relates to the evaporation rate of the solvent which influences the setting time of the bitumen. The viscosity of the cutback bitumen is determined by the proportion of solvent added: the higher the proportion of solvent, the lower the viscosity (less thick) of the cutback. Typical cutback bitumen are MC 30 and RC 250. The letters in the name refer to the curing action of the solvent, and the number to the viscosity of the binder (Read & Whiteoak, 2003).

The generic supply chain of Bitumen includes upstream sectors (actors involved in exploration and extraction of crude oil), downstream sectors (actors involved in refining, modification, trading, distributing and transporting of bitumen product), and the end customers (companies involved in road construction) (Hussain et al., 2006).

An extended supply chain includes suppliers of the immediate supplier and customers of the immediate customer, all involved in the upstream and/or downstream flows of products, services, finances, and/or information (Mentzer, 2001).

## Schematic of the Bitumen Supply Chain

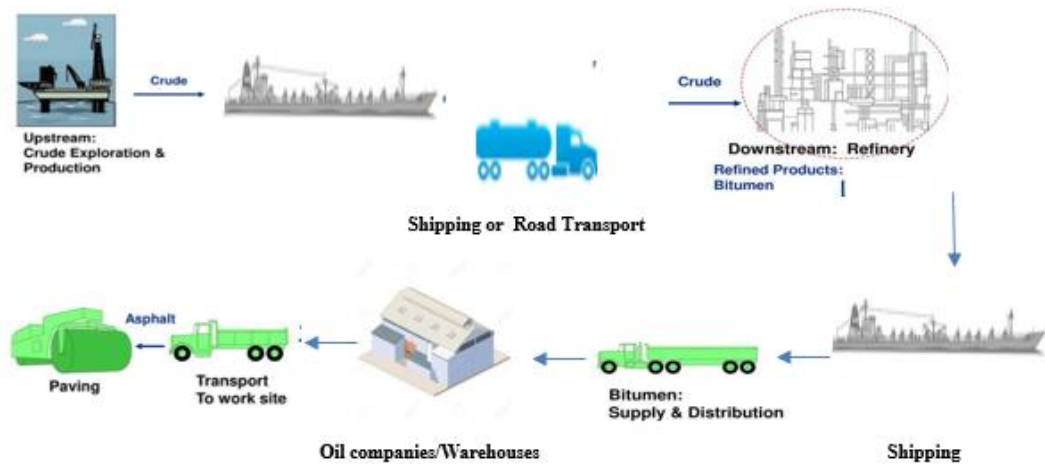


Figure 1: Schematic of the Bitumen Supply Chain: adopted from Gearoid Lohan (2018)

### 2.3.1.1. The Upstream Supply Chain

Upstream basically starts with the gaining of crude oil and with the related operation such as exploration and production. Afterward logistics management has to be involved in order to deliver the crude oil from the exploitation point to the refinery.

1. Exploration: This stage involves seismic and geological operations.
2. Production: This stage is about exploitation of the crude oil from the reservoir by drilling. Production needs highly qualified engineering work and it also links to other activities such as procurement, transportation. The crude oil produced is transported by pipelines or oil tankers to

the terminals for storage. From here it is either to transport directly to the refinery or export to other companies' refineries (Ribas et al., 2011).

### **2.3.1.2. The Downstream Supply Chain**

Bitumen products (also known as asphalts), tars or resins are well known materials used in many road building, construction, and other industrial applications (Jean-Luc, 2006). Bitumen is manufactured from the distillation of crude oil during petroleum refining. It is produced to meet a variety of specifications based upon physical properties for specific end uses (Eurobitume, 2015).

In the downstream supply chain, the first stage is the refining process the refining process and is considered as a separate component, both for its complexity as well as because it is the essential where the crude from various production sites comes together and from where the refined products diverge on their way to the end consumer. Then the logistics activities follow in order to supply the derivatives of the crude oil from the refinery to customers. Logistics management assures that the right products get delivered to the right customers in the right time preferably in a cost efficient way (Jasuja et al., 2009 cited in Firew, 2017). At the end there is marketing of different crude oil derivatives to the right customers. Marketing has to have an accurate knowledge about the current inventory level and refinery activities in order to manage its sale function.

Asia, America and Europe in descending order consume 32.9%, 32.7%, 18% of total world's bitumen (Argus, 2018). Middle East is the main source of Bitumen for Asia, India, and Africa. Between 40% and 50% of Iran's bitumen goes to the United Arab Emirates and GCC (Gulf Cooperation Council) countries which then trade it on. Availability, quality and price make Middle East the best choice for Asian and African bitumen markets (Argus, 2018). Seven of the world's ten fastest growing economies between 2011 and 2015 are African countries. (The Economist, 2011) And there is only 204km of road for every 1,000km<sup>2</sup>, only a quarter of which are paved, compared

to 944km for the rest of the world, and with over half paved (Argus, 2018). Africa buys drummed bitumen from the Middle East on average from 2000 to 3000 tons per year (Argus, 2018).

### **2.3.2. Challenges in Bitumen Supply Chain management**

#### **Logistics Challenges**

Supply chain management in the petroleum industry contains various challenges, specifically in the logistics area, that are not present in most other industries. These logistical challenges are a major influence on the cost of oil and its derivatives (Raed *et al*, 2006).

Logistics is a subset and an integral part of the overall supply chain process. Thus, it also plays an important role in managing an efficient chain of supplies whereby it is the function responsible for all aspects of the movement and storage of materials into organizations from suppliers through operations, and out to customers (J. Kondratjev, 2015).

Landlocked economies are primarily affected not only by a high cost of freight services, but also by the high degree of unpredictability in transportation time. The main sources of costs are not only physical constraints but widespread rent activities and severe flaws in the implementation of the transit systems, which prevent the emergence of reliable logistics services (Jean-François, et al., 2007).

The challenge attached to lengthy and slow-moving logistics has become unsustainable, forcing organizations to look again at how their logistics practices in the supply chains are structured and managed. (Martin, 2000).

## **A. Transport Cost**

The great distances between supply chain partners present a high variability of transportation times that can hurt suppliers in terms of service levels and final customers in terms of safety stock costs (Maweu, 2016).

Moreover, the transportation process is carried out either by ships, trucks, pipelines, or railroads. In many instances, a shipment has to exploit multiple transportation modes before reaching the final customer's location. Such constraints on transportation modes in this type of industry induce long lead times from the shipping point to the final customers' location compared to other industries. Hence, considering the amount of inflexibility involved, meeting the broadening prospect of oil demand and its derivatives such as bitumen while maintaining high service-levels and efficiency is a major challenge. (Raed et al, 2006).

The reduction in number of locations where bitumen is produced means longer distances for transporting the bitumen globally. Thus, transporters must account for greater distribution times for what are at present primarily hot also dirty liquid goods and adjust their fleets accordingly (Marius, 2013). Since bitumen is not a product with a high value, markets are regional and it is usually transported in bulk at a temperature of 160-180 degrees Celsius. Therefore, the cost of transport is takes the highest percentage of the total cost of the product. As a result, markets are structured mainly around the point of production or the refineries. Around 15% of the world bitumen moves from one place to another (Vinh, 2018).

The major transportation challenges are Ethiopia having no access to sea (Land-locked country) and back ward transport infrastructure. Due to this the deliver process is expensive and challenging.

Besides there are port demurrage costs that add up to the existing challenges. Truck shortage & retention is also an issue according to third party logistics study by DDC FPO in 2017.

## **B. Product Loss**

The characteristic that bitumen products have in common is that they are solid or semi-solid at ambient temperature and liquid at elevated temperatures. For transportation from source to end-use location, these materials are either carried in bulk or in containers. When carried in bulk, they should be maintained at such a temperature that their viscosity is low enough to allow for easy pumping and transfer thereof. When carried in containers, such as drums or pails of any size and shape, their temperature, after filling, drops to ambient and the product becomes solid or semi-solid (Jean-Luc, 2006). The most common is a drum from 150 to 220 kilos capacity and from 0.5mm to 1mm thickness. Bitumen drums are easily used in remote areas, thanks to their compatibility with all conditions of transport. Nevertheless, they remain very fragile and losses are unavoidable, about 5% of the product left adhering to the walls of the container is lost (Vinh, 2018). This increases the amount of wastage material released into the environment. Due to the loss of usable amount of bitumen products through its adherence to the container walls, this results in the need for an overestimation in the actual and final useable weight of bitumen products. Accordingly, to make up for the shortfall of useable bitumen one has to increase the volume of product ordered, which increases the total weight of product required to be transported. This increases transport cost and inefficiency (Jean-Luc, 2006).

The drums are generally transported and stored at ambient temperature. Before use, the containers and the material they contain have to be heated-up or melted to allow for the pouring, pumping and

transfer of the product. After heating, the drum usually cannot be reused and must be disposed of (Jean-Luc, 2006).

### **C. Cost of Product handling**

Bitumen is classified as a dangerous good, only when its temperature is above 100°C and below its flash point (Vinh, 2018). Hot bitumen in UN classification has two main obligations. The first is that all equipment has to be checked once a year. The second is that drivers and people involved in loading-unloading operations have to follow a specific training.

When unloading bitumen employees may be subject to dangerous conditions such as working with hot bitumen as well as working in close proximity to water (Hanekom, 2016). Bitumen products have an extra cost of handling as they are heavy and thus have to remain heated during transportation and storage. Bitumen the products require specialized handling and storage facilities (Shivo et al., 2102). As stated by Eurobitume on 2011, it requires the commitment of all stakeholders involved within the supply chain to safe delivery of bitumen. That involves suppliers, transporters, drivers, receivers and customers.

### **D. Inventory Cost**

The long distance between supply chain partners and slow modes of transportation induce not only high transportation costs and in-transit inventory, but also high inventory carrying costs in terms of safety stocks at the final customer location (Cheng, 2011).

P. Vrat (2014) in his study mentioned that companies have an inventory problem when they need to decide about (a) when to initiate a purchase order (when to buy) and (b) how much to buy (determine the lot size).

According to Vrat (2014), there are two types of inventory costs;

**A. Inventory carrying costs or holding cost-** This is the estimated or imputed cost of holding or carrying a unit of material in the form of inventory for a unit period of time. This is a function of the price of the material held in stock per unit and a fraction of carrying charge expressed as a fraction or percentage of unit price/unit time.

**B. Cost of shortage or stock out –** This is the estimated or imputed opportunity cost incurred if we do not have materials in stock when the demand arises. This depends upon the consequences of such a situation to arise. If we lost a customer, then it will be the opportunity cost of lost sales. If the demand remains backlogged (or back-ordered), then this will be the penalty cost (if any), loss of goodwill, cost of production or project delays, etc. Estimating the shortage cost is relatively more difficult than the carrying cost, but an approximate estimate is better than ignoring such costs altogether.

## **Legislative Challenges**

- Regulation and lengthy bureaucratic procedures (Hanekom, 2016)
- Foreign currency shortage – As Foreign exchange rates changes such as devaluation of local currency, the purchasing power of a currency declines the global trade becomes difficult. (Mentzer, 2011)
- Long lead time in port (Hanekom, 2016)

## **Technological Challenges**

- Lack of integrated system (Hanekom, 2016) such as use of ERP system which allows companies to have better control over product flow and information flow across the supply chain.

## **Economic Challenges**

- **Price volatility**

With globalization of business, companies are sourcing raw materials from different parts of the world, identifying suppliers who would provide goods at the best price, selling products in markets where companies would get the best price irrespective geographical distance. With increased opportunities of export and import, the attendant risk associated with international trade flow has also increased (Rajib, 2015).

Hanekom (2016) mentioned price fluctuations as economic and political challenges of global sourcing. Price fluctuation of international product prices due to global events, such as oil shortages, new source discovery, and the lifting of country sanctions.

The price of bitumen (asphalt), a key material in road construction, tracks the price of petroleum very closely. Since 2002, international cost indices show increases of 80 to 120 percent in the price of bitumen, hot mix, paved concrete, and other key materials used in road construction. Increases became particularly steep during 2005–06 (Africon, 2008).

Just recently, Iran's FOB bitumen bulk price since January 2017, hiked up by USD 65 PMT (27%) in December, 2017. Prices increases by 42% in December 2017 as compared to same period last year (<http://rahabitumen.com/iran-bitumen-price/>). In Ethiopia, the price of fuel is regulated by the government (Melaku, 2017) whereas bitumen, prices are prone to international markets (Argus, 2018).

Handfield and McCormack on 2008 explained in detail that price forecasts predict short- and long-term prices for component materials and services that the company needs for making its product and getting it to customers. The extent of variability and rapid escalation and de-escalation in price in today's supply market environments can be significant. Prices are often driven by supply and demand as well as strategic inputs, such as technology capabilities, information sharing, and operational streamlining. Price forecasts assist a company in laying out its buying strategies. For commodities that are expected to have rising prices, the purchasing department may stockpile the commodity (buy it in larger-than-normal quantities and store the commodity excess in inventory for future use) to save money. Common stockpiling strategies are forward buying and hedging, which involves buying more than required for the next month, and perhaps for the next year. Conversely, if prices are falling, buyers could utilize the hand-to-mouth buying strategy, buying fewer quantities than usual until the prices go down (Asteway Y., 2008).

- **Policy changes**

Actions of national governments like quota restriction and sanctions also affects imports (Mentzer, 2001). Iran's bitumen has been known as the main source of bitumen for its quality, availability and better price especially by Middle East, Asian and African countries before the sanctions (Argus, 2018). Thus finding reliable source has become difficult for importing Sub Saharan African countries. The lack of confidence in the field performance of different batches or supplies of the same grade of bitumen is also concerning (Greg, 2016).

Iran's bitumen has been known as the main source of bitumen for its quality, availability and better price especially by Sub Sahara African countries (Argus, 2018). Kenya was the first export market

for Iranian volumes taking 75000t, while 62,000t, 41,000t and 40,000 were imported by Djibouti, Sudan and Tanzania respectively (Argus, 2018). Smaller volumes were imported particularly by Cameroon, Democratic Rep. of Congo and Somalia (Argus, 2018). International sanctions on Iran have mainly targeted the oil production capacity of Iran and its exports to the global markets (Mohammad, 2011) Bitumen export of Iran to Sub Saharan African countries on March 2017 which is the Iranian year end, shows a 5% drop from the previous year (Argus, 2018).

Thus finding reliable source has become difficult for importing Sub Saharan African countries. The lack of confidence in the field performance of different batches or supplies of the same grade of bitumen is also concerning (Greg, 2016).

## **Other Challenges**

- **Contractual Challenges**

Variations to bitumen specifications, payment delays due to unavailability of funds by customers and other complications may delay solving contractual issues in a given period of time. (Hanekom, 2016)

- **Financial Challenges**

Inaccurate cost estimation of the bitumen import system could lead to additional costs. Also corrupt export, shipping- or third party corporations could result in poor quality bitumen product, late arrival of bitumen product, non-arrival of product or general financial losses. At times there can even be a scenario where cargo gets lost due to any reason will have financial or time associated implications. (Hanekom, 2016)

## 2.4. Literature Gap

Generally, from above literature reviews it can be easily understandable that the work on supply chain management practices and challenges influences on different perspectives of bitumen supply. But there is a lack of previous studies concerning SCM practices implementation and the challenges associated in the context of bitumen supplying Ethiopian oil companies. The researcher had hardly found such studies in the literature. Therefore, this study had bridged the gap left behind by some previous studies; it included quantitative and qualitative data from all bitumen supplying oil companies. Furthermore the study included the aspect of how SCM practices and challenges impact supply chain.

## 2.5. Conceptual Framework of the study

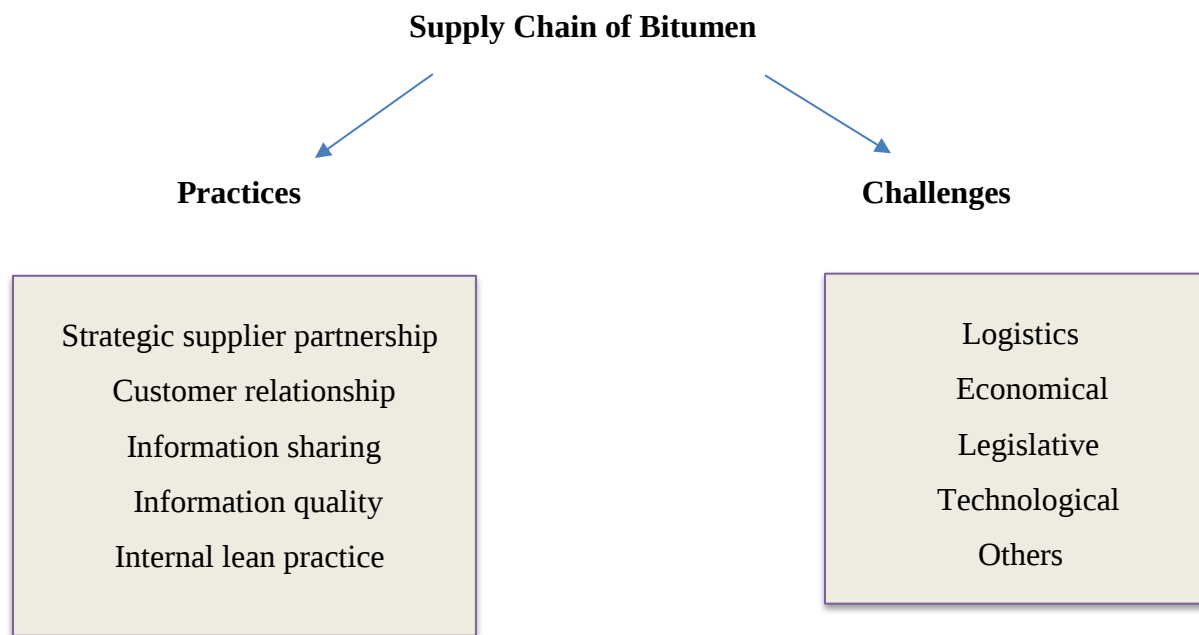


Figure 2: Conceptual Framework of the study: Adapted and customized from: Li, et al., (2005), Raed H., et al., (2006) and Hanekom (2016)

## **CHAPTER 3. RESEARCH METHODOLOGY**

### **3.1. Description of the Study Area**

The oil companies are Oil Libya, National Oil Ethiopia (NOC), Yetebaberut Beherawi Petroleum (YBP) and Gomeju Oil Ethiopia. These companies are located in Addis Ababa, Ethiopia with high customer base both government and private construction companies in different road construction projects. Amongst the oil companies, Oilibya is the only international company working in the downstream petroleum supply chain under a corporate level in 21 African countries. Oilibya was established in 2008 after buying Shell Ethiopia Limited. Whereas National Oil Ethiopia (NOC), Yetebaberut Beherawi Petroleum (YBP) established in 2004 and 2007 respectively and Gomeju Oil Ethiopia are locally owned share companies. Oilibya and National Oil Ethiopia (NOC), have higher customer base. Oilibya has been supplying bitumen since its establishment, NOC has supplied bitumen for the last 8 years whereas YBP and Gomeju are relatively new to the business.

### **3.2. Research design**

This research used descriptive type of research which tried to examine the supply chain management of bitumen in four oil companies in Ethiopia considering the main objective of the study is to describe the supply chain practices and challenges in the oil companies.

### **3.3. Population of the study**

Currently there are about four oil companies in Ethiopia supplying bitumen as they are the only oil companies supplying bitumen. The target population for the study is all the oil companies supplying bitumen which are located in Addis Ababa, Ethiopia. The employees working in this area are 50 in number.

### **3.4. Sampling Design**

Because the total population is finite and small in number, the study does covers all the total population of the study and sampling technique is not applied.

### **3.5. Sources of data and Collection Techniques**

Data for the research consists of primary and secondary data. For primary data, questionnaires were designed in such a way to give a comprehensive overview of the supply chain and associated challenges of bitumen supply in Ethiopia. Standard questionnaires for supply chain management practices are grouped into five constructs which focus on strategic supplier partnership, customer relationship, level of information sharing, level of information quality and lean internal practice which are adapted from Li, et al., (2006). For the case of Supply chain challenges classification is adapted from Raed H., et al., (2006) and Hanekom, (2016).

The questionnaire items are prepared in English language since the respondents from the companies have adequate understanding of the language and are professionals in their fields.

The secondary data of was collected from ERCA and ERA for further insight on the findings.

### **3.6. Measurement and Instrumentation**

The 5-point Likert-type scale (rating scale) that ranged from strongly disagree to strongly agree.

A standard questionnaire was used for the practices of Supply chain management adopted from Li, et al., (2006). Since there is no standard questionnaire is found that will rate all the selected challenges, the questionnaire is prepared by referring different related studies, and to increase validity of the instrument the questionnaire is pre tested on some of the respondents that have

adequate knowledge on the subject. Using the expert views and suggestions, the final questionnaire was prepared and distributed to the respondent companies.

Regular cross checking and follow-ups had also made at the time of data collection to ensure accuracy, relevance, completeness, consistency and uniformity of the data.

To check item reliability Cronbach's alpha coefficient was calculated to all items arranged in a five point Likert scale based on the responses of 30 the questionnaires collected from 4 companies for testing. The test results indicate that items reliability is good.

Table 1: Cronbach's alpha

| <b>Dimensions of SCM practice</b> | <b>Cronbach's alpha result</b> |
|-----------------------------------|--------------------------------|
| Strategic Supplier partnership    | 0.849                          |
| Customer relationship             | 0.889                          |
| Information Sharing               | 0.822                          |
| Information quality               | 0.917                          |
| Internal lean practice            | 0.812                          |

### **3.7. Method of Data Analysis**

The research is conducted using a systematic method to create a clear understanding of the research work and to meet the objectives of the research. The research approach used concurrent mixed method. Both qualitative and quantitative data will be combined in order to analyze the research as comprehensively as possible. The mixed approach to research is chosen over other approaches as the researcher believes that it provides a better understanding of the research problem.

For the analysis of the quantitative data descriptive statistics supported by SPSS software version 21.0 was applied.

Using SPSS mean and standard deviation are calculated to show the respondent firms experience in supply chain practices, and frequency and percentage are considered to present the respective SC challenges.

The study will use descriptive statistics (Mean and Standard deviation) to analyze the collected data.

Generally, data presentation and interpretation was made using tables in order to display the collected data in a concise and meaningful way. The data are finally interpreted based on statistical findings.

### **3.8. Ethical Consideration**

Ethical issues concerning a research, as identified by Creswell (2008), covers aim and objectives of the research, research questions, data collection, data analysis and interpretation; writing and disseminating the research. Ethical approval was obtained for this research. Ethical issues were taken into consideration in framing the research focus, objectives and research questions. The research focus, objectives, and strategy were disclosed and described to all the respondents who participated in the survey.

This research is to be made based on data collected from the Oil companies without invalidating the data which is to be gathered and by keeping the confidentiality of the informant.

## **CHAPTER FOUR**

### **DATA PRESENTATION, ANALYSIS AND DISCUSSION**

#### **4.1. Introduction**

Data obtained from the primary source using structured questionnaires are presented. The 40 questionnaire were distributed to the 4 Oil companies, each getting on average 10 questionnaires. From the 40 questionnaire 30 have completed and returned, while 10 were not complete, explicitly 30 out of 40 questionnaires are collected. This indicated that the response rate was 75 %. Therefore, the response rate found is very good for further analysis of the data.

#### **4.2. Basic Information of the Firms under study and respondent Individuals**

According to Regulations No. 270/2012 Import trade (excluding LPG, bitumen, and raw materials imported by foreign investors who are in the manufacturing industry) in Ethiopia is exclusively reserved for domestic investors. Registration from the Ministry of Trade is mandatory, which regulates imports, and to obtain a trade license. Companies in Ethiopia mostly import two type of bitumen grades known as Penetration grade bitumen and Cutback grade. Bitumen 40/50, 60/70, 80/100, 85/100 of penetration grades and bitumen MC30, MC800, MC3000 of cutback grades. The companies either store the product in a warehouse facility or directly transport it to the customer's site from Djibouti.

#### 4.2.1. Profiles of Respondent Individuals Representing the Companies

Table 1: Profile of respondents

| S.N | Characteristics                  | Frequency | Percentage |
|-----|----------------------------------|-----------|------------|
| 1   | <b>Education Level</b>           |           |            |
|     | BSc/BA                           | 18        | 58.1%      |
|     | MSc/MA                           | 13        | 41.9%      |
| 2   | <b>Experience in the company</b> |           |            |
|     | 0-5                              | 13        | 43.3%      |
|     | 6-10                             | 2         | 6.7%       |
|     | 11-15                            | 2         | 6.7%       |
|     | 16-20                            | 9         | 30.0%      |
|     | 21 and above                     | 4         | 13.3%      |
| 3   | <b>Job title</b>                 |           |            |
|     | Managers                         | 23        | 74.2%      |
|     | Supervisors                      | 2         | 6.5%       |
|     | Coordinators                     | 6         | 19.4%      |

The demographic statistics of the respondents' profile are shown in Table 1. Among the 30 respondents, 58.1% hold bachelor degree in the academic qualification, 41.9% hold a master's degree.

The result shows that most of respondents furthered their study at higher level. Most of the respondents (74.2%) involved in this study were managers and followed by the coordinators (19.4%). In general, the senior positions were actively involved in this study.

In terms of years in the company, 43.3% had experience in the sector for less than 5 years, 30% of the respondents worked 16-20 years, 13.3 % of the respondents worked for more than 21 years whereas 6.7 %of the respondents worked for 6 to 10 years and 11 to 15 years each.

All of the respondents either have direct or indirect involvement in Supply chain management practices. Therefore, majority of respondents are seen as experienced enough and sufficiently knowledgeable about the supply chain practice in their company.

### 4.3. Bitumen Supply Chain Practices of Oil Companies in Ethiopia

Among 30 responses, only 7 representative respondents i.e. one company (Oilibya) indicated that they manage their supply chain within the logistics and supply chain department. It is observed from other 3 respondent companies (Gomeju, YBP and NOC), that the supply chain of bitumen is not managed by their logistics and supply chain departments. They are rather practicing these activities in marketing, sales or finance departments.

#### 1. Strategic Supplier Partnership (SSP) Practices

The U.A.E is on average where 50% of the bitumen is imported from. Dubai does not produce both penetration and cutback grades but re-exports other Middle East countries' bitumen products. Suppliers/Traders are based in Dubai and link the buyer (oil companies) to the source and facilitate exports through Jebel Ali port. Drummed bitumen weighting on average 208 KG in containers are exported by the traders.

Table 2: Strategic Supplier Partnership (SSP) Practices

| Strategic Supplier Partnership Practices                           | Mean  | Std. Deviation |
|--------------------------------------------------------------------|-------|----------------|
| Quality is no one criterion in selecting suppliers                 | 4.138 | .7894          |
| Regularly solve problems with suppliers                            | 2.621 | 1.2653         |
| Help suppliers improve quality                                     | 2.793 | .8610          |
| Inclusion of key suppliers in planning and goal setting activities | 2.724 | 1.0986         |
| Continuous improvement programs with key suppliers                 | 2.586 | 1.1501         |
| New product development process with suppliers                     | 2.517 | .8290          |

Respondents were asked to rate the practices of Supplier Partnership within their companies. The rating was a five point Likert scale, ranging from 1 =” Strongly Disagree” to 5 =” Strongly Agree”. It is discerning enough from Table 4 mean values, that there is a gap in most of the practices and more needs to be done to close these gaps. High rated practice was *‘Quality is no one criterion in selecting suppliers’* (4.1) and all the other practices are low rated (below 3.0).

*Out of 30 respondents, 9 from Oilibya, 7 from NOC and 4 from YBP agreed that the first criteria for selecting their suppliers is quality of products.* Which shows that most of them give emphasis for the purchase of the right quality bitumen. Hence it’s evident to say that companies are quality sensitive.

*Out of 30 only 3 from Oilibya and 4 from NOC agreed that they regularly solve problems with their suppliers.*

*Out of 30 only 4 from Oilibya agreed that they help suppliers improve their quality.*

*Out of 30 only 5 from Oilibya agreed that they have continuous improvement programs that include their key suppliers.*

*Out of 30 only 2 from Oilibya strongly agreed that they include key suppliers in planning and goal setting activities.*

*Out of 30 only 3 from Oilibya agreed that actively involve key suppliers in new product development.*

The result signifies that there is a low level of strategic partnership with suppliers for most of the companies except slightly for Oilibya. This also reveals that the rest of companies have weak linkage with their suppliers, and more efforts shall be made to improve their relationship. Also the higher standard deviation values indicate that there is a higher variation on responses given for supplier partnership practices, and the level of practice in each company.

Oilibya has established long lasting relationship with its suppliers in Dubai as the company works with the corporate Oilibya head office stationed in Dubai which process all orders on its behalf. NOC has a long time trading partner (supplier) in Dubai as well. On the contrary YBP's and Gomeju's management staff, it was found that international bitumen suppliers might not reliable with them. With their experience, bitumen suppliers have failed to supply the product even after LC was opened by the oil companies or product might not fulfill the requirements requested once it's purchased. What's more, even if the oil companies stop working with these suppliers, the suppliers can change their names and entities and re-enter the market once again making it more difficult for the oil companies to select suppliers from abroad.

Hence there is loose supplier partnership for YBP and Gomeju to establish long term relationships with their suppliers as they are new to the business.

## 2. Customer relationship (CR) practices

Table 3: Customer Relationship (CR) Practices

| Customer Relationship (CR)                                                                 | Mean   | Std. Deviation |
|--------------------------------------------------------------------------------------------|--------|----------------|
| Frequent interaction with customers to set reliability, responsiveness and other standards | 3.6667 | .95893         |
| Frequently measure and evaluate customer satisfaction                                      | 3.8333 | .53067         |
| Frequently determine future customer expectation                                           | 4.1000 | .75886         |
| Periodically evaluate the importance of relationship with customers                        | 4.000  | .7428          |
| Facilitate customers' ability to seek assistance                                           | 3.9667 | .61495         |

Respondents were asked to rate the practices of Customer Relationship within their companies. The rating was a five point Likert scale, ranging from 1 =” Strongly Disagree” to 5 =” Strongly Agree”.

From Table 5, the result shows that almost all Customer relationship practices are well practiced.

*60% of the respondents (out of 30 respondents 7 are Oilibya, 5 are NOC, 4 are YBP and 3 are Gomeju), agreed that they frequently interact with customers to set reliability, responsiveness and other standards.*

*76.7% of the respondents (out of 30 respondents 6 are Oilibya, 7 are NOC, 5 are YBP and 4 are Gomeju) agreed that they measure and evaluate their customers’ satisfaction.*

*83.3% of the respondents (out of 30 respondents 9 are Oilibya, 7 are NOC, 5 are YBP and 4 are Gomeju) agreed that they frequently determine future customer expectations.*

*80% of the respondents (out of 30 respondents 9 are Oilibya, 7 are NOC, 6 are YBP and 2 are Gomeju) agreed that they facilitate customers’ ability to seek assistance.*

*70% of the respondents (out of 30 respondents 8 are Oilibya, 6 are NOC, 3 are YBP and 4 are Gomeju) agreed that they periodically evaluate the importance of relationship with their customers.*

In percentile the majority of the responses indicate that all the companies give much emphasis to the needs and wants of their customers and exert effort to enhance their relationship with them.

The lowest standard deviation was frequently measuring and evaluating customer satisfaction (0.53).

These indicated that there is a slight variation on the responses given for this item, and there is a uniform practice level of this item by the companies.

Construction companies with high capital use open tender for all bitumen importers. Selection of supplier by the customer will be made based on illegibility and capability criteria such as legal license, formalities, and technical financial conditions. NOC and Oilibya regularly work with Chinese construction companies and big local private construction companies. They have

established higher storage capacity to satisfy their customers' high demand and frequently determine their future expectations. Construction companies with lower capital, usually select local bitumen suppliers by means of negotiations. Yetebaberut Beherawi Petroleum (YBP) and Gomeju often work with local construction companies relatively with smaller capitals and enables them to measure and evaluate their relationships with their customers.

According from the results, this item is relatively well practiced by the oil companies from all the SCM practices.

### 3. Information sharing (IS) Practices

Table 4: Information sharing (IS) Practices

| Information sharing (IS)                                                                                             | Mean   | Std.<br>Deviation |
|----------------------------------------------------------------------------------------------------------------------|--------|-------------------|
| Informing trading partners in advance of changing needs                                                              | 3.9333 | .52083            |
| Trading partners share proprietary information                                                                       | 3.6000 | .67466            |
| Trading partners share business knowledge of core business processes                                                 | 2.8000 | .84690            |
| Trading partners keep companies fully informed about issues that affect their business                               | 2.6333 | 1.27261           |
| Exchange of information that helps establish business planning                                                       | 2.9667 | .85029            |
| Trading partners and suppling companies inform each other about events or changes that may affect the other partners | 2.7667 | .97143            |

Respondents (oil companies) were asked to rate the practices of IS with five point Likert scale, ranging from 1 =” Strongly Disagree“ to 5 = “Strongly Agree”). It is discerning enough from Table

6 that there is a gap in information sharing in most of the practices. The reason for this is attributed to the confidentiality or the privacy of the information and lack of trust between companies and their suppliers. The level of information sharing is moderate to low as most items have mean score of below 3.00.

The lowest standard deviation (0.52) and the highest mean (3.9) were for informing trading partners in advance of changing needs. These indicated that there is a uniform practice level of this item by the companies. It was also indicated *83.3% of the respondents (out of 30 respondents 10 from Oilibya, 7 from NOC, 5 from YBP and 4 from Gomeju), agreed that they inform their trading partners in advance of changing needs.*

*63.3% of the respondents (out of 30 respondents 11 are Oilibya, 7 are NOC and 2 are YBP), agreed that their trading partners share proprietary information.* This reveals that the extent to which critical and proprietary information is communicated to one's supply chain partner is not the same for all the companies.

*Out of 30 only 7 from Oilibya agreed that their trading partners share business knowledge of core business.*

*Out of 30, 6 from Oilibya and 3 from NOC agreed that their trading partners, fully inform companies about the issues that may affect their business.*

*Out of 30 only 8 from Oilibya agreed that their trading partners exchange information that helps establish business planning.*

*Out of 30 only 7 from Oilibya agreed that their trading partners inform each other about events or changes that may affect the other partner.*

Generally, the analysis signifies that there is a low level of information sharing with suppliers for most of the companies except Oilibya. This gap is created as Oilibya works with the corporate head

office under the same entity and information is shared among the local and abroad staff on a constant level. Whereas for NOC, YBP and Gomeju information sharing practices are minimal as they don't engage with their trading partners on constant level.

#### 4. Information quality (IQ) Practices

Table 5: Information Quality (IQ) Practices

| Information Quality (IQ)                                                          | Mean   | Std.<br>Deviation |
|-----------------------------------------------------------------------------------|--------|-------------------|
| Information exchange between trading partners and supplying companies is timely   | 4.0000 | .53452            |
| Information exchange between trading partners and supplying companies is accurate | 3.3182 | .89370            |
| Information exchange between trading partners and supplying companies is complete | 2.8636 | .77432            |
| Information exchange between trading partners and supplying companies is adequate | 2.7727 | .86914            |
| Information exchange between trading partners and supplying companies is reliable | 2.8636 | .94089            |

Respondents (oil companies) were asked to rate the practices of IQ with five point Likert scale, ranging from 1 = "Strongly Disagree" to 5 = "Strongly Agree". It is discerning enough from Table 7 that there is a gap in exchange of quality of information between Oil companies and their Suppliers. The lowest standard deviation (0.53) and the highest mean (4.0) were for timely information exchange between trading partners and supplying companies. These indicated that is a uniform practice level of this item by the companies. It was also indicated *84.2% of the respondents (out of*

30 respondents, 8 from Oilibya, 6 from NOC and 6 from YBP and 5 from Gomeju), agreed that they timely exchange information with their trading partners. Most of the oil companies exchange information on timely basis with their trading partners as bitumen products have to arrive at fixed dates due to the contractual agreements that they have with their local customers.

51% of the respondents (out of 30, 5 from Oilibya, 4 from NOC, 3 from YBP and 2 from Gomeju), agreed that they exchange accurate information with their trading partners.

36.4% of the respondents (out of 30, 4 from Oilibya, 2 from NOC and 2 from Gomeju) agreed that they exchange complete information with their trading partners.

22.7% of the respondents (out of 30, 3 from Oilibya and 2 from NOC, 1 from YBP and 1 from Gomeju), agreed that they exchange adequate information with their trading partners

27.3% of them (out of 30, 5 from Oilibya and 3 from NOC) agreed that they exchange reliable information with their trading partners.

There is low quality of information exchange among the supply chain members of the industry. Except for Oilibya, all the other Oil companies don't have a well-integrated ERP system and long lasting relationships with their trading partners.

## 5. Internal lean practice

Table 6: Internal lean practice

| Lean internal practice                                                 | Mean   | Std.<br>Deviation |
|------------------------------------------------------------------------|--------|-------------------|
| Reduction in process set up time                                       | 3.5862 | .56803            |
| Companies deliver what is demanded by customers when needed (e.g. JIT) | 3.2759 | .92182            |

55% of the respondent companies, reduction in process set up time and 53% of the respondent companies deliver what is demanded by customers when needed. In internal lean practice, reduction in process set up time (3.5) and delivery of what is demanded by customers when needed (3.2) are moderately practiced.

#### 4.4. Challenges of Bitumen Supply Chain Management

The respondents are asked to select what they believe is a SCM challenge, that are collected from different literatures, for their company during their supply chain management operations. The data was gathered from the questionnaires which are of 5 categories classified into Logistics, Legislative, Economic, Technological and Others each having sub categories to specific challenges. The frequency and percentage of each category of the challenges are calculated and presented as follows.

Table 7: Challenges of Bitumen SCM

| S.N | Types of challenges of SCM    | Specific SCM Challenge          | Frequency | Percentage |
|-----|-------------------------------|---------------------------------|-----------|------------|
| 1   | <b>Logistics Challenges</b>   | High transport cost             | 25        | 86.2%      |
|     |                               | Truck shortage & retention      | 18        | 62.1%      |
|     |                               | Backward transportation system  | 8         | 27.6%      |
|     |                               | High demurrage cost             | 23        | 79.3%      |
|     |                               | High inventory/storage cost     | 16        | 55.2%      |
|     |                               | High cost of product handling   | 18        | 62.1%      |
| 2   | <b>Legislative Challenges</b> | International Policy changes    | 20        | 69.0%      |
|     |                               | Government Regulations          | 21        | 72.4%      |
|     |                               | Lengthy bureaucratic procedures | 19        | 65.5%      |
|     |                               | Long lead time in port          | 17        | 58.6%      |

| S.N | Types of challenges of SCM     | Specific SCM Challenge                | Frequency | Percentage |
|-----|--------------------------------|---------------------------------------|-----------|------------|
| 3   | <b>Economic Challenges</b>     | International price volatility        | 30        | 100%       |
|     |                                | Foreign currency shortage             | 18        | 60%        |
| 4   | <b>Technological Challenge</b> | Lack of integrated system             | 19        | 63%        |
| 5   | <b>Others Challenge</b>        | Variation to bitumen specification    | 15        | 51.7%      |
|     |                                | Delay in solving contractual issues   | 20        | 69.0%      |
|     |                                | Inaccurate cost estimation of bitumen | 14        | 48.3%      |
|     |                                | Late arrival of bitumen               | 24        | 82.8%      |
|     |                                | Non-arrival of bitumen                | 10        | 34.5%      |
|     |                                | Product loss                          | 17        | 58.6%      |
|     |                                | Theft                                 | 4         | 13.8%      |

## 1. Logistics Challenges

High transportation cost was selected by 25 of the respondents (86.2%) and high demurrage cost was selected by 23 of the respondents (79.3%) which indicates that the challenge is faced by almost all of the companies. Half of the respondents selected storage cost challenge (55.2%). Truck shortage and high cost of product handling were selected by 18 respondents (62.1%) each. Whereas backward transportation system was selected by 8 respondents (27%) which indicates that this challenge is not critical for the companies.

Transportation is arranged by the buyer to transport the drums from Djibouti to Ethiopia. The transport cost is high as bitumen is transported usually to remote construction sites with rough and terrain roads. Which makes transportation hard so transporters and drivers ask for higher transportation fee.

Also there is seasonal shortage and retention of loading trucks that pick up from Djibuti port, at times when the Government wants to use the trucks for relief and emergency programs.

Unimodal is cost effective for transportation from Djibuti Port to direct customer sites. Rather than multimodal system which requires transporting to inland dry port then to warehouses or construction sites. As multi modal has logistics costs such as demurrage, port and storage costs which are paid on spot by the buyer when product is taken from inland dry port often Mojo dry port. The buyer has to request the government prior to the start of operation for unimodal system.

All logistics costs are incurred by the buyer after product leaves from Djibuti port. The Djibouti transistor usually asks 30%-50% pre-payment from the agent of the local transistor (is a Djibouti representative that facilitates, unloading of bitumen drums, documents with shipment and freight. Arranges payments such as port and custom fees. Then once again facilitates reloading of products on truck and transportation to Ethiopia).

If the local transistor is incapable to give the pre-payment in foreign currency, he asks from the buyer. If the buyer fails to do so not only there will be dalliance in lead time but there will be demurrage cost. In this case buyer needs financially strong clearing agent.

There is also high storage problem. Items of storage capacity, companies rent large warehouses. Oilibya and NOC have established higher storage capacity to satisfy their customers' high demand whereas YBP and Gomeju face storage challenges.

Bitumen product requires safe handling. If one drum gets burst (leaks) inside a container during shipment or on a truck during transportation, the leakage will glue (stick) the other drums each other. Detaching the drums will be difficult which requires the use of chemicals or another petroleum product such as Gas oil. Besides it creates environmental pollution it to the surrounding.

In general, challenges in this category are the second most selected by the respondents among the supply chain challenges.

## **2. Legislative Challenges**

International policy changes was selected by 20 of the respondents (69%), Government regulations was selected by 21 respondents (72.4%), Lengthy bureaucratic procedures was selected by 19 respondents (65.5%) and Long lead time in port was selected by 17 respondents (58.6%). This indicates that the challenges are faced by almost all of the companies.

The sanction on Iran by USA on including bitumen trade has forced local oil companies to look for other options. Iran's Bitumen has high quality and standard with lower price than other markets. But due to the current international policy changes it's impossible to directly import bitumen from Iran.

Even if a supplier from other country is found, there is also a long process and waiting time to obtain LC from local banks as well.

## **3. Economic Challenges**

International price volatility was selected by all 30 respondents (100%) which implies that the challenge is everywhere and companies are facing difficulties with managing their supply in adjacent with frequent international bitumen price fluctuation. Foreign currency shortage was selected by 18 of the respondents (60%).

Price volatility is inevitable. The business is done in more of a gambling manner, i.e., buyers may get profit or loss. As bitumen industry is capital intensive both the loss and profit are very high. So

it requires to have high capital before entering the industry as an importer. While importing bitumen, suppliers from abroad set a price validity date on their agreement with the importing oil companies, i.e., if prices change after that a certain period (most recently validity date has declined to 5 days due to the high international price fluctuations), the payment will be made at that time current market price. The same agreement holds true between the oil companies and the end customers in terms of bid validity. For bid validity oil companies give up to 60 days for their customers. After this period, the bidder (Oil Companies) are at liberty to change their bid price. But there is a gap between the international suppliers' price validity date and the companies' bid validity date. This implies if prices increase in the international market the company losses and vice versa. As said before, bitumen industry is capital intensive both the loss and profit are very high. So it requires importers to have high capital in order to survive big losses.

In addition, it was evident that there is a high shortage of foreign currency in the country. It takes 3-5 months for banks to approve requests in the current situation. Which on the other hand is discouraging for the companies to do business.

In general, the challenges under this category are selected by most of the respondents, which makes it the most critical challenge.

#### **4. Technological Challenges**

Lack of integrated system was selected by 19 respondents (63%). Only one company uses ERP system, others use emails and telephones for communication.

In general, the challenges under this category are the least selected by the respondents.

## 5. Others

It was found that financial and contractual challenges are most evident within the companies as well.

### a) Financial challenges

The sector is a capital intensive that one barrel of bitumen on average 180K, is worth 5000 birr. Even if the seller gets profitable, an immense working capital is held tight until product is sold. There is significant product leakage when carried by forklift. The drum thickness is related with price i.e., the thicker the drum the higher the price. Thickness ranges from 0.6mm to 1mm. There is a 10\$ difference between the two types of steel drums. So companies choose the lesser price for 0.6mm. The disadvantage is that it makes it prone to leakage.

### b) Contractual challenges

20 respondents (69%) have selected contractual challenges as existing challenges in their companies. 24 respondents (82.8%) have selected late arrival of bitumen.

The challenge of non-confirmation of product specification, was highlighted to be a large concern. A random test of the product is conducted by a third party after product reaches the customer site with the presence of the seller and the buyer. Should the product not conform to specification it will be inadequate for use on site. Because of this, the financial implications associated with a loss of this magnitude can cripple the sellers (oil companies).

The absence of a well-defined contractual agreements between companies and their customers can lead to disagreements. The settlement of the agreements, or the breaching thereof, results in legal issues, which as a result will have schedule and financial implications.

## **CHAPTER-FIVE**

### **SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS**

#### **5.1. Summary of findings**

According to the data analysis in the previous section, the summary of the findings is presented as follows.

- The findings from the study indicate that there are logistics, economic, legal, technological and other challenges causing supply variability in bitumen products. Especially in the past two years the shortage of foreign currency has negatively affected the importation of bitumen which has resulted the shortage of the product in general. In addition, the study has shown that logistics challenges have made Oil companies fail multiple of times to meet their planned logistics time. This is due to longer lead time to position products at port, government warehouse with incurring demurrage and storage costs and other delayed activities along the supply chain.
- Furthermore, the study indicated that Oil companies don't have long lasting partnership with their suppliers from abroad. For most of the oil companies suppliers can be unreliable (in terms of product quality and standard) to have long lasting relationships with.
- The study also reveals that there is also lack of information sharing and information quality between trading partners.
- On the contrary, the study shows that Customer Relationship practices are well performed in relation to other the supply chain practices.

## **5.2. Conclusion**

- The study concludes based on the findings that there is poor SCM practice and the challenges seen in most of the companies have cumulatively have affected the supply of bitumen inhibiting an efficient and sustainable supply of the product.
- Furthermore, the findings from the analysis show that most of the respondent companies have not started to practice supply chain activities to a great extent. The study provides a means to help companies to apply best and recent supply chain practices that suit the existing conditions and factors affecting their operation.
- The study concluded that there is incompatibility between the demand growth of bitumen in the country and the resource deployed to support the supply chain process. The management and policy makers should understand and emphasis the need to overcome supply chain challenges for the success of the bitumen sector as it touches everyday lives of people when road projects are delayed.

## **5.3. Recommendations**

Based on the findings of the study and conclusions drawn from them, the following possible and plausible recommendations are suggested for actions to be undertaken by each stakeholder at different levels.

### **a) Establishing relationships with main suppliers**

- Monitoring the financial position of suppliers by discussing with industry colleagues and competitors about the general financial stability of those businesses that supply bitumen.

- Reviewing and renegotiating the terms of trade with suppliers from time-to-time.
  - Technology makes supplier relationship management simple. The use of supplier management software helps keep track of information about suppliers in one place specially when dealing with multiple suppliers from time to time.
  - Making sure to maintain strong and regular communication with suppliers by keeping them regularly informed and up to date, on strategy and plans so that they know where they fit in and how they can help, plan for and benefit from those plans.
- b) Companies should work under the supply chain function and within logistics and supply departments rather than one department (or one individual in some cases) that handles most of the supply chain works. By doing so companies can enhance they can improve visibility of information as well the quality of information shared.
- c) Optimizing company-owned warehouses will help both the oil company and the customer. Once a purchase is made it can be sold at any time with better price. And customers will get products on time without having to wait for longer periods.
- d) To improve product packaging in order to minimize product leakage/spill during transportation oil companies should import steel drum with 1mm thickness. As drums get less thick their resistance to shrinkage (when containerized or packed together) or burst (when moved by forklifts) is high.
- e) A Government body has to inspect the quality, specification and standard of bitumen product before receiving it at customs. Local buyers (oil companies) take only a quality certificate issued by the suppliers from abroad alongside with other documents. This certificate is not a standard certificate. Acceptance of it as a validation to any standard, should be avoided because there were multiple incidents where product at the customer's site has failed to pass a quality

check test. In general, when imported bitumen is found to be poor in its quality, it will affect the road quality.

- f) The use of carriers other than Ethiopian shipping lines to fasten the logistics lead time.

#### **5.4. Suggestions for further research**

- Product packaging in Ethiopian condition is limited to steel drums of 180 - 208 kg. It is because of no bitumen bulk facility at the port (Djibouti) and costly operations due to requirement for continuous heating. This has also limited the types of bitumen to be imported to "penetration grade bitumen" such as bitumen 60/70 and 85/100. Penetration grade bitumen can be handled by drums easily with minimal risk of spillage in transit as compared to "cut back" grades (MC 30 or MC 3000) or even RC 70s which are liquid or loose types of bitumen. With the port Assab into the picture at present and hence possible cheaper operational costs, it may need to explore the possibility of establishing a bulk facility for the production of penetration grade bitumen from crude oil at the port Assab and even the production of cutback bitumen grades. (Note that cut back is produced by mixing of Gasoil or Kerosene with penetration grade bitumen).
- Another one is bagged bitumen, big bags and blocks package, which represent relevant alternatives to drums and bring much less environmental concern. Bags weight typically 20-30 kg and big bags 500 kg to 1 ton. Bitumen is filled in a polyethylene bag which is 100% meltable without compromising the product characteristics. The bag is easy to carry by hand. Big bags are packed in an external bag and handled by forklift or small crane. No loss and no waste, thanks to the reusable packaging of big bags, is a great improvement compared to drums. So it may require to do a further research on packaging costs and benefits.

## References

- Alex Musyoka Maweu, 2016. Inbound Logistics Practices and Supply Chain Performance of mobile phone operators in Kenya.
- Argus Bitumen, Jan, 2018, Country government data, Europe, Middle East and Asia-Pacific prices and commentary, Incorporation Argus asphalt report, issue 18-004
- Asteway Yigezu, 2008. Study on the effects of unpredictable price fluctuation on the capacity of construction contractors.
- Baxter, L.F., Ferguson, N., Macbeth, D.K., Neil, G.C., 1989. Getting the message across? Supplier quality improvement programmes: some issues in practice. *International Journal of Operations and Production Management* 9 5, 69–76.
- B.J. Lalonde, Building a supply chain relationship, *Supply Chain Management Review* 2 (2) (1998) 7–8.
- Carlo Giavarini, October, 2010 Bitumen Market, AEA conference, Stratfordon Avon
- Carr, A.S., Pearson, J.N., 1999. Strategically managed buyer–seller relationships and performance outcomes. *Journal of Operations Management* 17, 497–519.
- Carneiro, M. C., Ribas, G. P. & Hamacher, S., 2010. Management in the Oil Supply Chain: a CVaR Approach. *Industrial Engineering*. 49 (7), 3286-3294.
- Choi, T.Y., Hartley, J.L., 1996. An exploration of supplier selection practices across the supply chain. *Journal of Operations Management* 14, 333–343.
- Christiaan H. Hanekom, 2016. Assessment for the importation of bitumen for road construction into South Africa
- Christopher M. Chima, 2007. Supply-Chain Management Issues in the Oil and Gas Industry, California State University, Dominguez Hills, *Journal of Business & Economics Research* – June 2007, Volume 5, Number 6
- Concawe, 1992, Bitumen's and bitumen derivatives, product dossier no. 92/104
- Creswell, J. W. (2008). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (3rd ed.). Upper Saddle River, NJ: Pearson Education, Inc.

Cuthbertson R, Piotrowicz W (2008), Supply chain metrics – review of supply chain best practices, International Journal of Productivity and Performance Management 57(5): 389-404

Daniel Melaku, 2018. Annual report of Bitumen Import and Sales. Libya Oil Ethiopia Ltd. S.C

DDC FPO, November 1, 2017. Top 8 Logistics Challenges Facing the Industry available online, by [[https://www.logisticsmgmt.com/article/top\\_8\\_logistics\\_challenges\\_facing\\_the\\_industry](https://www.logisticsmgmt.com/article/top_8_logistics_challenges_facing_the_industry)]

De Toni, A., Nassimbeni, G., 1999. Buyer–supplier operational practices, sourcing policies and plant performance: result of an empirical research. International Journal of Production Research 37 3, 597–619.

Dickson, G.W., 1966. An analysis of supplier selection systems and decisions. Journal of Purchasing 2, 5–17.

Dr. Prabina Rajib, 2015. International Trade & Risk Associated with International Trade.

Eurobitume and Asphalt institute, The bitumen Industry, 2015, A global Perspective, Production, chemistry, use, specification and occupational exposure, 3rd ed.

Eurobitume, June 2011. Supply Chain Management in the Petroleum Industry: Challenges and opportunities, UK edition, European bitumen association.

Ellram, L. M., (1991). “Supply Chain Management: The Industrial Organization Perspective”, International Journal of Physical Distribution and Logistics Management, 21(1), 13-22.

ERCA (Ethiopian Revenue and Custom Authority),  
[http://www.erca.gov.et/images/Documents/import\\_export/import\\_2018.xlsx](http://www.erca.gov.et/images/Documents/import_export/import_2018.xlsx)

ERA (Ethiopian Road Authority), 2018, <http://apps.export.gov/article?id=Ethiopia-Road-and-Railways>

Firew Abera, 2017. Supply chain modeling for oil companies: In the case of Libya Oil Ethiopia Limited

Gearoid Lohan, 2018, Bitumen Delivery and Storage.

Global Bitumen Market Analysis, <http://rahabitumen.com>.

Hahn, C.K., Pinto, P.A., Brag, D.J., 1983. Just-in-time production and purchasing. Journal of Purchasing and Materials Management, 2–10.

HP Bitumen\_Handbook, Hindustanpetroleum.

Hussain A.H Awad, Mohammad Othman Nassar, April, 2010. A Broader view of the Supply Chain Integration Challenges International Journal of Innovation, Management and Technology, Vol. 1

ICIS, 2012, Bitumen Methodology, <https://s3-eu-west-1.amazonaws.com/cjp-rbi-icis-compliance/wp-content/uploads/2013/08/Bitumen-Methodology.pdf>

Jean-François Arvis, Gael Raballand, Jean-François Marteau, June 2007. The Cost of Being Landlocked: Logistics Costs and Supply Chain Reliability, World Bank Policy Research Working Paper 4258.

Jean-Luc, 2007, Packaging for Bitumen.

John J. Coyle , Robert A. Novak , Brian Gibson , Edward J. Bardi, 2010. Transportation: A Supply Chain Perspective 7th Edition

John Read & Whiteoak, 2003. The Shell bitumen handbook, fifth Ed.

Juri Kondratjev, 2015. Logistics, Transportation and warehouse in supply chain.

Kym Neaylon, 2008, National Technical Leader Bituminous Surfacing, ARRB Group

Li, S., Ragu-Nathan, B., Ragu-Nathan, T.S. and Rao, S.S. (2005), “Development and validation of a measurement for studying supply chain management practices”, Journal of Operations Management, Vol. 23, pp. 618-41.

Liang-Chieh (Victor) Cheng, 2011 Logistics Strategies to Facilitate Long-Distance Just-in-Time Supply Chain System

Marius, 2013. Integrating Innovative Technologies Into Grown Supply Chains: A case study from the asphalt industry by PWC

Max Galarza, 2015, Integrated Logistics.

Martin Christopher, 2000. The Agile Supply Chain: Competing in Volatile Markets, School of Management, UK, Industrial Marketing Management, Vol 29, No. 1, Pf 37-44.

Melaku Mammo, 2017. Challenge of Integration of Fuel supply chain in Ethiopia.

Mentzer, J.T. 2001. Defining Supply Chain Management. Journal of business logistics Vol.22, Issue 2, p.3.

Monczka, Robert & Petersen, Kenneth & Handfield, Robert & Ragatz, Gary. (2007). Success Factors in Strategic Supplier Alliances: The Buying Company Perspective

Nadege Vo Vinh, 2018. Transport of bitumen - ADR Regulation, <https://www.coursera.org/lecture/mastering-bitumen/8-transport-of-bitumen-adr-regulation-n8Ntf>  
Neenu Arjun, 2018, <https://theconstructor.org/transportation/bitumen-road-construction-advantages-pavements/15784/>

Prem Vrat, 2014, Materials Management, An Integrated Systems Approach.

Raed Hussain, Tiravat Assavapokee, Basheer Khumawala, November 2006. Guide to safe delivery of bitumen, International Journal of Global Logistics & Supply Chain Management. vol. 1, no., 1, 90 – 97.

Roy Cokayne, 2013, Bitumen shortage is a threat to roadwork, <https://www.iol.co.za/business-report/economy/bitumen-shortage-is-a-threat-to-roadwork-1455159>.

Sahay, B & Maini, Anita. (2002). Supply Chain: A Shift from Transactional to Collaborative Partnerships. Decisions. 29. 67-88.

Shivo joy livohi and Seeliger, Andreas 2012. Downstream supply chain performance measurement by the oil marketing companies in Kenya, Relevance of oil prices for mobility today and in the next decades, pp. 35-44, <http://nbn-resolving.de/urn:nbn:de:bvb:473-opus-4017>

Singh, P.J., & Power, D. (2009). The nature and effectiveness of collaboration between firms, their customers and suppliers: a supply chain perspective. Supply Chain Management: An International Journal, 14(3), 189-200. <http://dx.doi.org/10.1108/13598540910954539>.

T. Stein, J. Sweat, Killer supply chains, InformationWeek 708 (9) (1998) 36–46

Temesgen Aklilu, The role of the transport sector in Ethiopia's economic development, journal of Economic Association, vol. 9 no 4

Thatte A.A., (2007). "Competitive advantage of a Firm through Supply Chain Responsiveness and Supply Chain Management Practices", Published PhD Dissertation. University of Toledo.

The Economist, 2011 <https://www.economist.com/graphic-detail/2011/01/06/africas-impressive-growth>

White, Greg. (2016). changes in Australian paving-grade bitumen: are they real and what should Australia do about it?

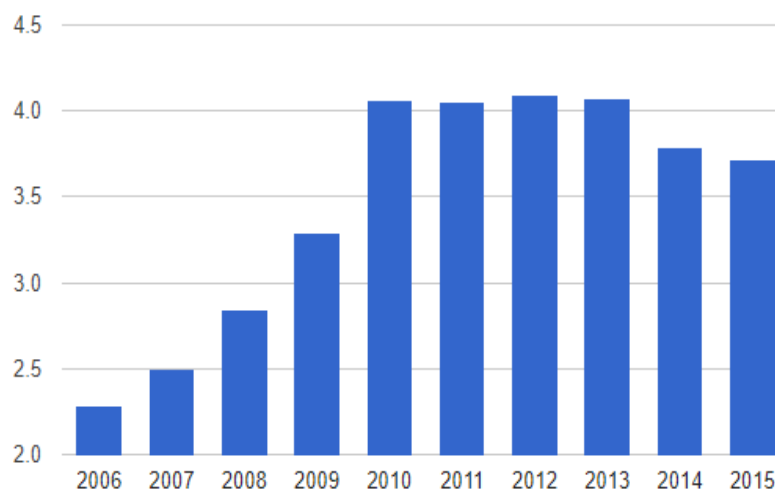
## Appendix 1: List of supplying markets for imported bitumen by Ethiopia

| Exporters                   | 2013                    | 2014                    | 2015                    | 2016                    | 2017                    | 2018                    |
|-----------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
|                             | Imported quantity, Tons | Imported quantity, Tons | Imported quantity, Tons | Imported quantity, Tons | Imported quantity, Tons | Imported quantity, Tons |
| <b>World (Total)</b>        | 76,704                  | 117,222                 | 107,219                 | 129,412                 | 74,699                  | 22,033                  |
| <b>United Arab Emirates</b> | 44,242                  | 66,503                  | 83,713                  | 95,210                  | 51,917                  | 11,915                  |
| <b>Bahrain</b>              | 29,929                  | 37,118                  | 17,517                  | 14,084                  | 13,287                  | 232                     |
| <b>Iran</b>                 | -                       | 4,991                   | 912                     | 16,778                  | 7,886                   | 2,212                   |
| <b>Saudi Arabia</b>         | 977                     | 720                     | 1313                    | 1314                    | 1066                    | 22                      |
| <b>China</b>                | -                       | -                       | 914                     | 94                      | 131                     | 2,223                   |
| <b>Turkey</b>               | -                       | -                       | -                       | -                       | 403                     | 15                      |
| <b>Italy</b>                | -                       | -                       | -                       | -                       | -                       | 1,092                   |

Source: ERCA, 2018

- The table is a shortlist taken from ERCA's archives. There are also other countries not included in the list due to smaller quantities in figure.

## Appendix 2: Ethiopia- Road quality



- Scale from 1 (underdeveloped) to 7 (extensive and efficient by international standards).

Source: [https://www.theglobaleconomy.com/Ethiopia/roads\\_quality/](https://www.theglobaleconomy.com/Ethiopia/roads_quality/)

### Appendix 3: Average Wholesale bitumen prices, FOB basis



Source: Argus Bitumen, 2018

### Appendix 4: Iran FOB bitumen Bulk Price per barrel Fluctuations (Mt) during 2017



Source: <http://rahabitumen.com/iran-bitumen-price/>

## Appendix 5- Questionnaire

### Part I: Questions related with Background Information

**Instruction: Please fill in the blank space and put a tick (☐) mark in which you want to select.**

1. Mention the company you are working for

---

2. Mention your highest formal education attended

Secondary education ☐

College Diploma ☐

Undergraduate Degree ☐

Master Degree ☐

Doctoral Degree ☐

3. What is your job title?

---

4. How long have you been working at your company? (In years)

0-5 ☐

6-10 ☐

11-15 ☐

16-20 ☐

21 and above ☐

## Part II: Instruments of Supply chain management practice

| <b>1. Strategic supplier partnership (SSP)</b> |                                                                                                       | <b>Strongly Disagree (1)</b> | <b>Dis-agree (2)</b> | <b>Neutral (3)</b> | <b>Agree (4)</b> | <b>Strongly Agree (5)</b> |
|------------------------------------------------|-------------------------------------------------------------------------------------------------------|------------------------------|----------------------|--------------------|------------------|---------------------------|
| <b>1.1</b>                                     | We consider quality as our number one criterion in selecting suppliers.                               |                              |                      |                    |                  |                           |
| <b>1.2</b>                                     | We regularly solve problems jointly with our suppliers.                                               |                              |                      |                    |                  |                           |
| <b>1.3</b>                                     | We have helped our suppliers to improve their product quality                                         |                              |                      |                    |                  |                           |
| <b>1.4.</b>                                    | We have continuous improvement programs that include our key suppliers.                               |                              |                      |                    |                  |                           |
| <b>1.5</b>                                     | We include our key suppliers in our planning and goal-setting activities.                             |                              |                      |                    |                  |                           |
| <b>1.6</b>                                     | We actively involve our key suppliers in new product development processes.                           |                              |                      |                    |                  |                           |
|                                                |                                                                                                       |                              |                      |                    |                  |                           |
| <b>2. Customer relationship (CR)</b>           |                                                                                                       | <b>Strongly Disagree (1)</b> | <b>Dis-agree (2)</b> | <b>Neutral (3)</b> | <b>Agree (4)</b> | <b>Strongly Agree (5)</b> |
| <b>2.1</b>                                     | We frequently interact with customers to set reliability, responsiveness, and other standards for us. |                              |                      |                    |                  |                           |
| <b>2.2</b>                                     | We frequently measure and evaluate customer satisfaction.                                             |                              |                      |                    |                  |                           |
| <b>2.3</b>                                     | We frequently determine future customer expectations                                                  |                              |                      |                    |                  |                           |
| <b>2.4</b>                                     | We facilitate customers' ability to seek assistance from us.                                          |                              |                      |                    |                  |                           |
| <b>2.5</b>                                     | We periodically evaluate the importance of our relationship with our customers.                       |                              |                      |                    |                  |                           |
|                                                |                                                                                                       |                              |                      |                    |                  |                           |
| <b>3. Level of information sharing (IS)</b>    |                                                                                                       | <b>Strongly Disagree (1)</b> | <b>Dis-agree (2)</b> | <b>Neutral (3)</b> | <b>Agree (4)</b> | <b>Strongly Agree (5)</b> |
| <b>3.1</b>                                     | We inform trading partners in advance of changing needs.                                              |                              |                      |                    |                  |                           |
| <b>3.2</b>                                     | Our trading partners share proprietary information with us.                                           |                              |                      |                    |                  |                           |

|                                             |                                                                                                                  |                              |                      |                    |                  |                           |
|---------------------------------------------|------------------------------------------------------------------------------------------------------------------|------------------------------|----------------------|--------------------|------------------|---------------------------|
| 3.3                                         | Our trading partners keep us fully informed about issues that affect our business.                               |                              |                      |                    |                  |                           |
| 3.4                                         | Our trading partners share business knowledge of core business processes with us.                                |                              |                      |                    |                  |                           |
| 3.5                                         | We and our trading partners exchange information that helps establishment of business planning.                  |                              |                      |                    |                  |                           |
| 3.6                                         | We and our trading partners keep each other informed about events or changes that may affect the other partners. |                              |                      |                    |                  |                           |
|                                             |                                                                                                                  |                              |                      |                    |                  |                           |
| <b>4. Level of information quality (IQ)</b> |                                                                                                                  | <b>Strongly Disagree (1)</b> | <b>Dis-agree (2)</b> | <b>Neutral (3)</b> | <b>Agree (4)</b> | <b>Strongly Agree (5)</b> |
| 4.1                                         | Information exchange between our trading partners and us is timely.                                              |                              |                      |                    |                  |                           |
| 4.2                                         | Information exchange between our trading partners and us is accurate                                             |                              |                      |                    |                  |                           |
| 4.3                                         | Information exchange between our trading partners and us is complete.                                            |                              |                      |                    |                  |                           |
| 4.4                                         | Information exchange between our trading partners and us is adequate                                             |                              |                      |                    |                  |                           |
| 4.5                                         | Information exchange between our trading partners and us is reliable.                                            |                              |                      |                    |                  |                           |
|                                             |                                                                                                                  |                              |                      |                    |                  |                           |
| <b>5. Internal lean practices:</b>          |                                                                                                                  |                              |                      |                    |                  |                           |
| 5.1.                                        | Our firm reduces process set-up time                                                                             |                              |                      |                    |                  |                           |
| 5.2.                                        | Our firm produces only what is demanded by customers when needed (e.g. JIT)                                      |                              |                      |                    |                  |                           |

### Part III: Challenges of supply chain management

1. What challenges do you experience in managing your supply chain with regard to the following areas? If all, please mark all.

a) Logistics

- ☐ High Transport cost
- ☐ Truck shortage & retention
- ☐ Back ward transport infrastructure
- ☐ High Demurrage cost
- ☐ High Inventory cost
- ☐ High Cost of Product Handling

b) Legislative

- ☐ International Policy changes
- ☐ Government Regulations
- ☐ Lengthy bureaucratic procedures
- ☐ Long lead time in port

c) Economic

- ☐ Foreign currency shortage
- ☐ International Price volatility

d) Technological

- ☐ Lack of integrated system

e) Contractual Challenges

- ☐ Variations to bitumen specifications
- ☐ Delay in solving contractual issues

f) Financial Challenges

- ☐ Shortage of capital
- ☐ Inaccurate cost estimation of bitumen
- ☐ Late arrival of bitumen product
- ☐ Non-arrival of product
- ☐ Product loss
- ☐ Theft

g) Others, Please specify

- ---
- ---
- ---
- ---

2. Do you think that the challenges of supply chain management are avoidable? Please justify your answer.

---

---

---

---

## Appendix 6- Reliability Test

### Strategic Supplier partnership

| Cronbach's Alpha | N of Items |
|------------------|------------|
| .849             | 6          |

### Customer relationship

| Cronbach's Alpha | N of Items |
|------------------|------------|
| .889             | 5          |

### Information Sharing

| Cronbach's Alpha | N of Items |
|------------------|------------|
| .822             | 6          |

### Information quality

| Cronbach's Alpha | N of Items |
|------------------|------------|
| .917             | 5          |

### Internal lean practice

| Cronbach's Alpha | N of Items |
|------------------|------------|
| .812             | 2          |