ADDIS ABABA UNIVERSITY

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DEPARTMENT OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT

Supply Chain Bottlenecks in Coffee Export Logistics: A study of Major Coffee Export Companies in Addis Ababa

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A Final thesis submitted to the department of Logistics and Supply chain Management graduate Studies, School of Commerce, Addis Ababa University for the partial fulfillment of the requirements of a Master of Art degree in logistics and supply chain management.

Advisor: Matiwos Ensermu (Prof.)

May, 2026,

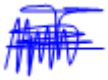
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DECLARATION

I hereby declare that the work which is being presented in this thesis entitled “Supply Chain Bottlenecks in Coffee Export Logistics: A study of major Coffee Export Companies in Addis Ababa” is the original work of my own, has not been presented for a degree in this or other universities and all sources of materials used for this thesis work have been fully acknowledged. All sources of information used in this proposal have been properly acknowledged and referenced. This work has been carried out under the guidance and supervision of my advisor.

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ACKNOWLEDGEMENT

I would like to mention my gratitude to God for giving me the strength to pursue and complete my educational journey. I am very grateful to my advisor, Prof. Matiwos Ensermu, for his continuous support and guidance throughout the course of this research. My appreciation to all participants for their contribution to this study. I would also like to thank my family for their encouragement.

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This thesis has been submitted for examination with my approval as AAU advisor.

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CONTENTS

Declaration iii

Acknowledgement iv

CHAPTER ONE 1

1.INTRODUCTION 1

1.1. Background of the study 1

1.2. Background of the Company 2

1.3. Statement of the Problem 3

1.4. Objective of the Study 4

1.4.1. General Objectives 4

1.4.2. Specific Objectives 4

1.5. Research Questions 5

1.6. Significance of the Study 5

1.7. Delimitation / Scope of the study 6

1.8. Limitation of the Study 6

1.9. Organization of the research report 7

1.10. Operational definition of key terms 7

CHAPTER TWO 8

2.REVIEW OF RELATED LITERATURE 8

2.1. Theoretical Review on Coffee Export Logistics 8

2.2. Review of Empirical literature 9

2.3. Conceptual Framework 10

2.3.1. Coffee Export Logistics 10

2.3.2. Definition of Bottleneck in Coffee Export Logistics 14

2.3.3. Operational Process in Coffee Export Logistics 20

2.3.4. Characteristics of Coffee Export Logistics 22

2.3.5. Classification of Coffee Export Logistics 24

2.3.6. Coffee Supply Chain Bottlenecks 25
2.3.7. Coffee Export Trade Logistics Performance 27
CHAPTER THREE 30
3.RESEARCH METHODOLOGY 30
3.1. Research Approach 30
3.2. Research Design 30
3.3. Population of the Study 30
3.3.1. Unit of Analysis 30
3.3.2. Target Population 31
3.3.3. Population Size 31
3.4. Sampling Design 31
3.4.1. Sampling Technique 31
3.4.2. Sampling Frame 31
3.4.3. Sample Size 31
3.5. Research Instruments and Measurements 33
3.5.1. Data Collection Instruments 33
3.6. Data Collection Procedures 33
3.7. Data Analysis Techniques 34
3.8. Validity and Reliability 34
3.8.1. Validity 34
3.8.2. Reliability 34
3.9. Ethical Considerations 35
CHAPTER FOUR 36
4.RESULT AND DISCUSSION 36
4.1. Response rate 36
4.2. Descriptive Findings 37
4.2.1. Demographic Profile 37

4.3. Reliability and validity 41
4.4. Regression analysis 42
4.4.1. Regression analysis assumptions 42
4.4.1.1.1 Linearity test 42
4.4.1.1.2 Durbin watson test or autocorrelation test 43
4.4.1.1.3 Variance inflation factor VIF test 43
4.4.1.2. Normality Test 44
4.5. Linear Regression Analysis 46
4.5.1 Model Fit and Variance Explained 46
4.5.2 Model Fitness test (ANOVA) 46
4.6 Identification & Categorization of logistics bottlenecks 47
4.6.1 Findings 48
4.6.1.1 The significance of Coordination and communication Failures 48
4.6.1.2. Physical Logistics: Transportation & Port & logistics 48
4.6.1.3. Documentation and Customs: The Variable Bottleneck 49
4.7. Underlying Causes of Logistics Bottlenecks 49
4.7.1. Root Causes in Transportation and Physical Infrastructure bottlenecks 49
4.7.2. Root Causes in port and terminal bottlenecks 50
4.7.3 Root Cause in Warehousing & storage bottlenecks 51
4.7.4. Root Causes in Coordination and Information Flow bottlenecks 52
4.7.5. Root Causes in Documentation and Digital Systems bottlenecks 53
4.8. Impact of Logistics Bottlenecks on Export Performance 54
4.8.1. Statistical Relationship Analysis & model fitness analysis 54
4.8.2 Regression Outcome & Parameter Estimates 55
4.9. Coordination and Information Flow 51
CHAPTER FIVE 58
5.CONCLUSIONS AND RECOMMENDATIONS 58

5.1. Summary of the Findings 58
5.2. Conclusions 59
5.3. Recommendations 60
5.4. Future Research Study 61
References 62
APPENDIX I: 67
LIST OF TABLES X
LIST OF EQUATIONS XI
LIST OF FIGURES XI
Abstract XII
List of Abbreviations and acronyms XI

LIST OF TABLES

Table 3-1: Measurements of Variables 33

Table 4-1: Company Capital 37

Table 4-2: Work Experience of Respondents 38

Table 4-3: Professional Experience 39

Table 4-4: Export Volume 40

Table 4-5: Reliability Statistics 41

Table 4-6: Cuurve Estimation result for Linearity test 42

Table 4-7 Durbin Watson test or autocorrelation test……..43

Table 4- 8 Variance inflation factor test ……44

Table 4-9 Model fitness test (ANOVA)……...47

Table 4-10 Identification & categorization …..……..…….47

Table 4-11: Descriptive Analysis of Transportation and Infrastructure Causes 50

Table 4-12 Descriptive Analysis of Port and terminal Root Causes ……51

Table 4-13: Descriptive Analysis of Warehousing Root Causes 51

Table 4-14: Descriptive Analysis of Coordination & Root Causes 52

Table 4-15: Descriptive Analysis of Documentation Root Causes 53

Table 4-16: Correlation and Regression Summary 54

Table 4-17: Descriptive Statistics for Coordination and Communication 56

LIST OF FIGURES

Figure 1: Conceptual framework that shows the direction of relationship among variables of independent & dependent variable..... 29

Figure 2: Normality plot 44

Figure 3: Normality test histogram 45

LIST OF ABBREVIATIONS & ACRONYMS

SPSS	Statistical package for social sciences
TOC	Theory of constraints
TCE	Transaction cost
Std.Deviation	Standard Deviation
Sig.	Significance
EDR	Ethio – Djibouti Railway system
ECTA	Ethiopian coffee and tea authority
SLA	Service level Agreement
SCM	Supply chain management

LIST OF EQUATIONS

Equation 1: Yamane's Formula 1967 32

ABSTRUCT

This study tried to investigates the serious supply chain bottlenecks at selected Coffee Export Company using a diagnostic framework to identify the weakest links in the export value chain. For this study mixed-methods research approach & explanatory design was employed, structured interviews with quantitative data from 64 coffee exporting companies. The research instrument showed high internal consistency, with Cronbach's Alpha values greater than 0.70.The findings revealed that Coordination and Communication Failures emerged as the most severe bottleneck (Mean = 4.20), followed by transportation and warehousing challenges. Root-cause analysis, identified Customs Clearance Procedures with Mean = 4.45 and Shipping Agent mismatch with Mean = 4.33 one of main setback. Inferential statistical analysis validates very strong negative correlation with r value of -0.828 between overall bottleneck severity and export performance.

Keywords: *Supply Chain Bottlenecks, Coffee Export Logistics.*

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the study

Ethiopia, recognized as the origin of coffee, depends heavily on coffee exports as major driver of its economy. It benefits foreign exchange earnings or revenue and farmers rural lives. The coffee sector involves a complex network of actors like smallholder farmers, cooperatives, exporters, transporters, and government agencies. All parties played a crucial role in moving coffee from farms to international markets. Coffee is at the heart of Ethiopian culture as well as economy, which has portion of 29 – 31% of export earnings of the country. Studies state 4.7 million small-holders directly involved in producing coffee and 25 million people relay on the coffee sector for their livelihoods (CSA, 2015; Taye Kufaet al., 2016). Ethiopian coffee varieties exhibit major genetic diversity. Because of its Arabica coffee, an indigenous kind, and its inherent quality and potential for coffee production. About 25% of the nation's population lives in farming households, and over a million of them depend on coffee exports. It also offer 25% of the GDP, 40% of all export earnings, 25% of jobs for both urban and rural residents, and 10% of all government revenue (MoARD, 2008).

The travel from processing to export involves multiple stages such as harvesting, drying, processing, grading, warehousing, and shipping all of which require coordination and logistical efficiency. Because of inadequate infrastructure, inefficient transportation systems, and regulatory bottlenecks, this multi-layered network often experiences disruptions. It negatively impact flow of coffee exports. Ethiopia has relative advantage in coffee processing and quality, the supply chain from farm to port. But it’s faced with inefficiencies and logistical challenges that limit competitiveness. Here, factors like inadequate transport infrastructure, delays at customs, and lack of coordination among supply chain partners often result in problems. These problems include; higher lead times, high logistics costs, and reduced profit margins for exporters. Additionally, these inefficiencies not only reduce profit margins for coffee exporters but also decrease Ethiopia’s reputation. The reputation for timely delivery and good quality consistency . Thus, these constraints not only discourage Ethiopia’s ability to meet global market

demand efficiently but also weaken its reputation as a reliable coffee supplier. The global coffee trade operates under growing competitive and time-sensitive conditions, where logistics efficiency affects market access.

Exporters those are unable to streamline their supply chains risk losing market share to more efficient competitors from other coffee-producing nations like Vietnam & Colombia. Ethiopia, managing these bottlenecks was not only critical for export earnings but also for sustaining the livelihoods of small scale farmers whose income relies on the smooth operating of the export structure. Understanding the root reason of these logistical challenges and presenting solutions was of strategic importance. Coffee is the largest exported commodity after oil (Murthy & Madhava Naidu, 2012). In international coffee supply chain, Ethiopia, famous for its specialty coffee varieties, was the 7th biggest participant to coffee exports (Capital Newspaper, 2023). About 80 countries of developing nations depend on coffee as a primary source of income. (Worako et al., 2011), confirmed major price variability influence Ethiopian coffee supply chain. 50 % of overall farm / agriculture export of Ethiopia is occupied by coffee. Different studies explain broadening or diversifying, export industry by alternative crops was importance to gain reliability in export revenue (Alwang and Siegel, 1994).

There are different coffee types which have variety from Sidama, Yirgachefe, Hararge (Harar), Gimbi and Limu types (Workafes and Kassu, 2000). Coffee types from Hararge and Yirgachefe have higher price in global markets because of its well-known reputation on quality (ITC, 2002).

1.2. Background of the Companies

This study focused on selected major coffee export companies based in Addis Ababa, Ethiopia, which play a significant role in the country's coffee export industry. These companies are engaged in the procurement, processing, packaging, and export of both raw (green) and roasted coffee beans to international markets across Europe, Asia, and the Middle East. As key participants in Ethiopia's coffee supply chain, they serve as important links between coffee producers and global buyers, ensuring that coffee products meet international quality, safety, and traceability standards. Their operations involve coordinating multiple supply chain activities, including sourcing coffee from farmers and cooperatives, transportation, warehousing, quality inspection, customs clearance, and international distribution. Given their extensive involvement

in export logistics, these companies provide valuable insights into the supply chain bottlenecks that affect the efficiency, competitiveness, and performance of Ethiopia's coffee export sector.

1.3. Statement of the Problem

Although Ethiopia has a competitive advantage in the global coffee market as the origin of Arabica coffee, its coffee export sector continues to face significant supply chain challenges (FAO, 2019; World Bank, 2020; UNCTAD, 2022). The movement of coffee from smallholder farmers to cooperatives, exporters, logistics service providers, and international markets involves a complex network of activities that is vulnerable to disruptions. These disruptions create bottlenecks that hinder the smooth flow of products, information, and financial resources throughout the supply chain. Previous studies have identified weak coordination, limited integration, and poor collaboration among supply chain actors as major causes of logistics inefficiencies in Ethiopia's coffee value chain (Minten et al., 2019; Gebresenbet & Bosona, 2018). Supply chain bottlenecks appear in different forms, including poor road infrastructure, limited transportation services, inadequate warehousing facilities, and weak coordination among supply chain partners. Poor rural road connectivity and the long distance between production areas and export gateways increase transportation costs and delivery times (World Bank, 2019; MoTI, 2021). Similarly, inadequate storage facilities contribute to quality deterioration and post-harvest losses, reducing export competitiveness (FAO, 2020; ECX, 2021). Ethiopia's heavy dependence on Djibouti Port further worsens these challenges, as port congestion, bureaucratic procedures, and weak coordination between logistics operators and port authorities often result in shipment delays and increased costs (World Bank, 2022; African Development Bank, 2023). In addition, weak logistics systems, poor information sharing, and limited collaboration among government agencies, transporters, and exporters reduce overall supply chain efficiency (Bosona et al., 2017; Ayele & Zewdie, 2020).

Exporters also face difficulties in tracking shipments, forecasting demand, and aligning logistics operations with production schedules. These problems are compounded by customs clearance delays, changing regulatory requirements, repetitive documentation procedures, and slow approval processes (World Bank, 2020; UNCTAD, 2021). As a result, exporters experience

longer lead times, higher transaction costs, and difficulties in meeting delivery commitments. These challenges indicate not only operational inefficiencies but also deeper weaknesses in the governance, infrastructure, and institutional capacity of Ethiopia's export logistics system. Despite the growing body of literature on Ethiopia's coffee value chain, most studies have focused on production, marketing, and general supply chain issues. Limited empirical research has specifically examined logistics-related bottlenecks affecting coffee exporting companies. Previous studies have not adequately identified the most critical bottlenecks, analyzed their root causes, or assessed their impact on export performance. Therefore, a significant research gap exists in understanding how infrastructural, institutional, and managerial bottlenecks influence the efficiency and competitiveness of coffee exporters. Addressing this gap is important because logistics performance directly affects product quality, customer satisfaction, delivery reliability, and export competitiveness. This study seeks to fill this gap by identifying where bottlenecks occur within the export process, examining their root causes, and evaluating their impact on export performance.

1.4. Objective of the Study

1.4.1. General Objectives

The general objective of this study was to analyze the major supply chain bottlenecks affecting the coffee export logistics of the selected major Coffee Export in Ethiopia and to assess their influence/ impact on the company's coffee export performance.

1.4.2. Specific Objectives

While addressing the above general objectives the research also tried to address the following specific objectives:

1. To identify key logistics bottlenecks affecting coffee export logistics performance.
2. To examine the effect of transportation & warehouse bottlenecks on export logistics performance.
3. To assess the effect of port/terminal and customs bottlenecks on export logistics performance.
4. To evaluate the effect of information and coordination bottlenecks on export logistics performance.

1.5. Research Questions

1. How do transportation & warehouse bottlenecks affect coffee export logistics performance?
2. How do port/terminal bottlenecks affect coffee export logistics performance?
3. How do customs & documentation bottlenecks affect coffee export logistics performance?
4. How do information and coordination bottlenecks affect coffee export logistics performance?

1.6. Significance of the Study

This study was significant because it examines the major supply chain bottlenecks affecting coffee export logistics in Ethiopia. Coffee is one of Ethiopia's most important export commodities and a key source of income for the country and millions of smallholder farmers. However, inefficiencies in the export logistics system continue to reduce its competitiveness in the global market. By identifying and analyzing these bottlenecks, this study provided a clearer understanding of the key challenges within the export supply chain.

Academically, the study contributes to the existing literature on supply chain management and export logistics, particularly in developing countries. While many studies focus on coffee production and marketing, fewer have examined logistics-related bottlenecks in detail from the perspective of exporting companies. Therefore, this research helps fill an important empirical gap by providing evidence on transportation, customs, port, and coordination-related challenges and their impact on export performance.

For policymakers and government institutions, the findings of this study were valuable for improving decision-making in the coffee export sector. The study highlights critical areas like infrastructure limitations, inefficiencies in customs procedures, and weak coordination among supply chain actors. These insights can support the development of better logistics policies,

improved regulatory systems, and investments in infrastructure like transport networks, port facilities, and digital supply chain systems.

For coffee exporting companies, the study provides practical insights into the operational challenges that affect efficiency, cost, delivery time, and product quality. By understanding these bottlenecks, exporters can improve their logistics planning, strengthen coordination with stakeholders, and adopt better technologies to enhance performance and competitiveness.

The study was useful for researchers, policymakers, and industry practitioners who are interested in improving the efficiency and competitiveness of Ethiopia's coffee export logistics system. It also serves as a reference for future studies aiming to explore supply chain performance and logistics challenges in agricultural export sectors.

1.7. Delimitation / Scope of the study

This study targeted on inspecting important supply chain bottlenecks that affect major coffee export companies in Addis Ababa, Ethiopia. This research mostly covered varies phases of the export logistics process like consisted of transportation, warehousing, customs clearance, and port operations. Here, the study was restricted to studying how these phases affected overall performance of major Coffee Export regarding the factors like time, cost, and quality.

1.8. Limitation of the Study

This study focused on major coffee export companies in Addis Ababa, Ethiopia; therefore, the findings may not fully represent the experiences of all coffee exporters in the country. Due to time and resource constraints, a single standardized questionnaire was used for all participating companies rather than customized questionnaires tailored to individual firms, which may have limited the identification of company-specific challenges. In addition, the study concentrated on the most critical supply chain bottlenecks affecting coffee export logistics rather than examining all aspects of the coffee supply chain. Future research can address these limitations by including a broader range of exporters, using larger samples, and developing more customized data collection instruments to capture firm-specific logistics challenges.

1.9. Organization of the research report

The research paper was arranged into five sections. First chapter consisted of the introduction. The second chapter contained relevant literature. Third chapter included methodology. The fourth chapter holds the results and discussion and chapter five showed the final conclusion and recommendations of this research.

1.10. Operational definition of key terms

- Coffee Export Logistics**:** Activities involved in moving coffee from producers to international buyers.
- Supply Chain Bottlenecks: Constraints that reduce efficiency of coffee export operations.
- Transportation Bottlenecks**:** Transport-related challenges causing delays and increased costs.
- Infrastructure Bottlenecks: Inadequate facilities and systems affecting export logistics.
- Information Flow: The exchange of logistics-related information among supply chain actors.
- Supply Chain Coordination: Collaboration among stakeholders to improve supply chain performance.
- Regulatory Procedures**:** Rules and requirements governing coffee export activities.
- Coffee Export Performance**:** The effectiveness of coffee export operations.
- Major Coffee Export Companies**:** Selected large coffee exporters operating in Addis Ababa.
- Logistics Efficiency: The ability to perform logistics activities with minimal time and cost.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

2.1. Theoretical Review on Coffee Export Logistics

Several established supply chain and logistics theories are the main theories in which this Theoretical framework for analyzing coffee export logistics was based on. Supply Chain Management (SCM) theory was among the most related theories, which underlined the bringing together and management of material, informational, and financial flows across the supply chain to achieve efficiency and competitiveness (Mentzer et al., 2001). This theory showed the importance of collaboration within parties in the supply chain including exporters, transporters, port authorities, and regulatory bodies. This coordination is done to minimize bottlenecks and improve export performance.

The Bottleneck theory which comes from the Theory of Constraints (TOC) other important theoretical idea which helps formulates the theoretical framework. The research states that system performance is restricted by its most vulnerable link. In order for it to improve, overall performance needs recognizing and arraigning it's vital barriers (Goldratt, 1990). There are many reasons bottle neck can happen, from restricted transport capacity, delayed customs clearance, port congestion, and issues on documentation. Controlling these problems might upgrade performance.

When companies organize administration structure which reduces transaction costs resulting from uncertainty, degree of asset specificity and rate are explained by Transaction Cost Economics (TCE) of exchanges (Williamson, 1985). Relationship between logistics capabilities and trade competitiveness are highlighted by Logistics Performance Theory. Thus, depending on this theory, improvements in infrastructure, service quality, and regulatory effectiveness will help improve a country's capacity to engage in global market (World Bank, 2021).

2.2. Review of Empirical literature

Most supply chain bottlenecks, related to collaboration, infrastructure, and market access are shown in varies empirical study on coffee export logistics in major producing countries. For example, in Brazil, studies mention delays and increased logistics costs occur due to the coffee supply chain relying on overloaded transport corridors and inefficient port operations, mostly on high harvest seasons (da Silva et al., 2021). Additionally, Colombia has international reputation somehow logistical inefficiencies occur because of difficult terrain, high transportation costs, and limited rural infrastructure; they all disrupt the movement of coffee to export terminals (García & Martínez, 2020).

Similar condition like Brazil and Colombia occur in Asia and Africa. These similar patterns occur, often with far greater structural challenges. Vietnam, a country which is one of the main global exporters, faces logistics challenges. These challenges are interlinked seasonal production surges, port congestion, and restricted warehousing capacity as some scholar mentioned (Nguyen et al., 2022). African nations like Uganda and Kenya, have inadequate road systems, insufficient storage facilities, and high inland transportation which costs them greatly. This challenges create delay on the flow of coffee from farms to export markets (Mbabazi et al., 2019; Kamau, 2021).Therefore due to these challenges', it is inevitable that collapsed supply chains and multiple intermediaries that maximize transaction costs and reduce productiveness will occur. The world's coffee supply chain is has many intermediaries. A scholar on his study explained that emerging global regulatory requirements, like sustainability and traceability standards, suggest more challenges. This is due to of cracks in information systems in the supply chain (Abebe et al., 2023).

2.3. Conceptual Framework

Here in this study the conceptual model was based on the understandings of coffee supply chain bottlenecks which logistics happen. This supply chain challenges occur from interrelated challenges across transportation, documentation, customs procedures, communication systems, and port operations.

These framework states that inefficiencies in one stage like truck shortages slow document processing, or poor coordination among exporters, transporters, and government agencies can negatively influence total export effectiveness by maximizing delays and costs. Recognizing bottlenecks and assessing how they affect logistics efficiency, the conceptual framework presents a basis for analyzing the operational realities at coffee export companies & understanding how developments in logistics processes can improve the competitiveness of Ethiopia's coffee exports.

2.3.1. Coffee Export Logistics

Ethiopia produces high quality of coffee Arabica for both domestic and international markets. Regarding employment, the coffee industry plays a role by absorbing 25 % of the employment opportunity for both rural and urban residents & about 10 % of the total government revenue GDP (Siber, 2011).

According to FAO (2016) and the World Bank (2015), in countries such as Ethiopia, Uganda, and Burundi, coffee exports contributed more than 10% of total export earnings in 2013 (Nsabimana & Wondmagegn, 2019).Because of its diverse quality Ethiopian plays an important role in the global value chain. It's recognized for its bright acidity, full body, and unique flavor profile, which includes spicy, wine-like, and sweet notes. It's highly valued for roasting and blending in international markets (Ethiopian Coffee and Tea Authority, 2014).

In addition, foreign export trade of coffee is highly determined by the high dependency on traditional primary agricultural commodities and the world market price fluctuations in addition to the instability peace of the world (Zekarias & Degye, 2019). According to the report made by FAO in 2014, the major challenge faced by the coffee market is the inefficiency resulted from

overvalued exchange rate. The other challenges are the high level of impurities and the weight losses and high transportation costs (Zekarias & Degye , 2019).

In the world of coffee export market practices there are bottlenecks. The major 5 challenges are; the first is unstable international market coffee selling price, the second is that there is extended coffee marketing supply chain (ECX), thirdly, there is a low coffee productivity, the fourth is the inconsistency coffee quality, low value addition and the last but not least is the climate change. The above are listed challenges are the major not all. Therefore we can say that there were so many factors that affect Ethiopian coffee exporting market in international and local market (Hana Mulugeta, 2018). Also, there are certain set of factors where on the practices of coffee export marketing face. These factors are; deforestation and land degradation, loss of genetic diversity. Additionally, erosion, crop replacement by more profitable cash crops, little market promotion and incentive mechanism, inadequate service are the other challenges the coffee export market face (Ethiopia coffee & tea authority, 2017).

Ethiopian economy relies on Agricultural sector. Therefore, one can simply conclude that agriculture serves as the back bone of Ethiopia's economy. Additionally, agriculture also is the sector which again determines the success of all other sectors as well (Zelalem, 2011). It, agriculture, attributes for 36.3% of GDP, 85% of foreign exchange earnings, and also it creates employments for over 79% of labor force in Ethiopia. Additionally, the exports' from the agricultures are very high in both number and quantity (National Bank of Ethiopia, 2017). Ethiopia rank number sixth as a largest coffee producer after Brazil, Colombia, Vietnam, Indonesia and India, and is one of the biggest coffee exporters in the world ranking at seventh place for largest exporter worldwide. Considering Africa Ethiopia is the \ largest coffee producer and exporter. According to report made by FAO in 2016 and report of world Bank in 2015, it is stated that countries such as Ethiopia, Uganda, and Burundi, share of coffee exports relative to total export earnings of the whole country exceeded 10% in 2013 (Nsabimana & Wondmagegn , 2019).

As shown by scholars in 2011, overall exports in 2005 were 2.43 million bags, a share of 2.82 per cent of world trade in coffee beans (Siber, 2011). Currently, the coffees global value chain is quickly transforming. This fast pace is due to the shifts in demands and an increasing emphasis on product differentiation in importing countries (Ponte 2002 Daviron and Ponte 2005). Consequently, there is a huge and fast growing readiness to pay for premium; high quality coffee by rich consumers and these made the demand for specialty and certified coffee is on a high rise. Furthermore, over the last decade, international coffee markets have experienced significant price variation. The prices were five times higher in 2011 than in 2002. These changes have important implications for a number of the poorest developing countries. These price changes affect these countries since they are the ones which most coffee production takes place, this is true even if the most coffee consumption is in developed countries (Pendergrast, 2010; Ponte, 2002). Over 4 million primarily smallholder farming households cultivate Coffee (CSA, 2013) and, with those employed in additional activities to coffee production, even more households are dependent on coffee for part of their livelihoods (LMC, 2003). Furthermore, the role that coffee plays is very important in social gatherings and it is important in local consumption. This is shown by that more than half of Ethiopia's coffee production is consumed locally (CSA, 2013). International buyers and consumers are often willing to pay extra for a product, if there is a standard, showing the product origin, holding fair prices to producers, showing the origin and ethical standards of production and processing, having a production process that is environmentally sustainable, and safety and quality safeguards for a product. When one talk about meeting the requirement mentioned above, it is clear to see also that, adhering to those new requirements can be costly. On previous studies made in 2012, it was mentioned that, only 16% of the coffee in the global market is certified. Moreover, recent studies made also showed that this percentage reached over 25 percent by 2015 (Panhuysen and Van Reenen, 2012) .

Both washed and unwashed coffee beans grades of quality are graded using The Coffee Liquoring Unit (CLU). This is done based on physical and cup inspection of the coffee beans. The coffee bean Grades range from 1 to 5. Here, 1 is the best and highest grade and 5 is the worst. The worst quality which expressed as Ungraded (U.G.).

The coffee collectors directly buy the coffee with its pulp (Jenfel coffee) and/or without pulp. After buying it, they sale it to suppliers or private traders for further processing activities and preparation operations to make it fit for the marketing. Traders or suppliers, in turn, purchase coffee from collectors both formal and informal and sell it either to exporters in the Addis Ababa auction market or to international buyers (Abiy, 2016). In Ethiopia, a large proportion of coffee still passes through private traders. Smallholder farmers often operate with limited inputs, traditional production and harvesting methods, low income levels, weak organizational structures, and limited bargaining power, which compels them to sell their produce to private traders and/or primary cooperatives (Mechal, 2013).Government intervention is also present in the export system, where regulatory control is exercised through export licensing, foreign exchange regulations, and customs procedures (Schmitthoff, 1969; MBURU, 2011). Still coffee sector faces challenges across production, processing, and marketing stages. For example, Coffee Berry Disease (CBD) remains a major threat, with an estimated 50–60% of production at risk. The coffee sector suffers from a shortage of improved and location-specific coffee varieties, as well as weak harvesting and post-harvest handling practices that compromise quality. Limited collaboration between universities, extension services, and farmers continues to affect sector development (Petit, 2007).Despite these challenges, coffee remains a key pillar of the national economy.

Despite a long-term decline in international coffee prices, coffee continues to serve as the country's leading export commodity. In most coffee-importing countries, value is added to green coffee beans through processing activities such as roasting, blending, and grinding. The resulting processed products are then re-exported to various global markets (Torok et al., 2018).International coffee supply chain is generally divided into two groups of countries: producing (exporting) countries and consuming (importing) countries. Coffee-producing nations are mainly developing countries located in regions such as South America, Asia, and Africa, whereas importing countries are predominantly developed economies in North America and Europe (Kiwanuka et al., 2013). Coffee production and primary processing in exporting countries are typically labor-intensive activities, while value-added processing in importing countries is more labor, capital and technology intensive (ICO, 2020).

In Ethiopia, Coffee is one of the biggest and important cash crop. This crop impacts the livelihoods of over 10 million Ethiopians either directly or indirectly (Bastin, A & Matteucci, N. 2007). In contrast to different countries, Ethiopia consumes almost half of what it grows (Georgise, F.B.; Mindaye, A.T 2020). In 2020, coffee was the highest contributor to the counties economy though its 28.6% of the country's exports, secondly the coffee was followed by flowers which were at 14.1% and the third was oilseeds at 11.5% (NBE. Annual Report 2019–2020). The major export destinations for Ethiopian coffee are Saudi Arabia, the United States of America, Germany, Belgium and South Korea. These countries import the coffee usually in it green beans form. Even if there are numerous coffee-growing regions in Ethiopia, most coffee production is grown in the Oromia region and in the Southern Nations, Nationalities and Peoples region (SNNPR). Here, the coffee grown in these regions is harvested and then transported to the capital city, Addis Ababa. In Addis Ababa it is processed, quality tested and prepared for export market (Ethiopian Coffee and Tea Authority. 2013).

Global coffee markets are going through fast transformation, influenced by trade liberalization (Russell et al., 2012) as well as rising requirements for quality standards and the expansion of the specialty coffee segment (Lee et al., 2012; Potts et al., 2014). These changes occurring at the downstream level are likely to have significant implications for the total structure and organization of global coffee value chains. This development is important as coffee is one of the most important globally traded agricultural commodities with consumption occurring mostly in developed countries and production in developing ones (ICO, 2014). Coffee value chain and marketing system are key factors that must be considered when designing strategies for sector development (Aklilu Amsalu et al., 2010; Meijerink et al., 2014). Based on this importance, a considerable number of studies have been conducted on agricultural marketing systems in Ethiopia, particularly focusing on coffee. Thus, value chain growth is generally viewed as reliant on and from the relationship between small-scale producers to markets (Labouisse J.P 2008) & (Alemu D. et al 2010).

However, Ethiopia's agricultural markets remains fragmented here and there and poorly interwoven into the broader trading system (Aklilu Amsalu et al 2010) .this lack of connection in-between leads to transaction high cost, stops smallholder farmers from market oriented manufacturing, and also it stifles the development of the value chain (Aklilu Amsalu et al.,

2010).it is known that the government is actively promoting coffee commercialization. Here in Ethiopia coffee serves both the local and international market. The export volume routed through the centralized commodity exchange channel. This channel is managed by the cooperative unions. Thus, to maximize the market efficiency and selling price transparency, it is quite necessary to channel the market though a unified exchange system.

2.3.2. Definition of Bottleneck in Coffee Export Logistics

The Ethiopian coffee challenges can be seen from the systemic point of view. The systemic challenges can be categorized into three categories. These are: structural, policy, and sustainability dimensions. Naturally, the primary structural bottleneck includes very low yield and poor farm production. This severely limits the ability of coffee sales in the international market. This problem compounded by problems in infrastructure to transport the coffee that enables it to reach the market area. The sector is hindered by inadequate support of the system, particularly financial services, and modern value addition processing (Sette, 2012). From a policy perspective, inconsistent regulations, lengthy documentation procedures, and limited institutional coordination often create delays and increase operational costs for exporters. On the sustainability side, factors like climate variability, soil degradation, and limited access to modern farming techniques threaten long-term productivity and quality. All these structural, policy, and sustainability issues significantly affect Ethiopia's ability to fully maximize its competitive advantage in global coffee markets.

In Ethiopia context, rural coffee producers are often spread out across remote areas. And these areas are places in which transportation and communication infrastructure is very weak. The limited scale of commercial activity in these regions also contributes to the reduction of the motivation for private service providers to operate fast and effectively. Thus, this is increasing the risk of market inefficiencies. The coffee export sector of Ethiopia remains vulnerable to such kinds of challenges. This is because the market hugely relies on the frequent unsteadiness of international coffee prices and primary agricultural commodities (Zekarias & Degye, 2019). These challenges have been highlighted in several previous studies.

Different descriptive analysis indicated that farmers who are smallholders face a critical shortage in the investment capital which is required to update their production and productivity. The

major deficit here is the ability to adopt environmentally sustainable farming methods. This constraint is ridden majorly by institutional problems. This problems or barriers include systematic prevention of the smallholder farmer from getting formal agricultural credit.

Prior studies on the Ethiopian coffee supply chain have tried to examine and clarify a different issues. For instance (Worako et al.2011) investigated the volatility of coffee prices in Ethiopia, (Tamru et al.2021) explored issues related to the pricing and foreign exchange controls and (Bastin and Matteucci 2007) explored the challenges and opportunities related to financial services for coffee farmers. A number of researchers have also examined the coffee value chain from different point of views. Beshah et al. (2013) prepared an assessment emphasizing quality issues and value chain dynamics within Ethiopia's coffee supply system. Minten et al. (2019) explained the Ethiopian coffee value chain and recognized both major drivers which support the sector and the major problems faced by producers. Mitiku et al. (2017) provided more perspectives into the functioning and challenges of the coffee value chain in Ethiopia.

Ethiopia has the position of the largest coffee exporter in Africa and earns considerable foreign exchange from this major export commodity. Given that coffee production is mainly carried out by smallholder farmers, any changes in the organization or performance of coffee value chains can have considerable effects for the livelihoods of rural households, many of whom are economically vulnerable. (., AGRER, 2014), earlier research states that instability in Ethiopia's coffee export revenues is because of influenced by fluctuations in the international coffee market (Teressa, 1987).This indicates that global coffee trade is shaped by multiple interconnected factors that affect both price levels and price volatility. Consumption patterns differ significantly across importing countries due to different consumer preferences, as it influence demand conditions. Overall economic, political, social, and environmental factors can modify how these fundamental forces interact and determine price movements over time (USDA, 1999). According to Belay (1998) mentioned that coffee was responsible for about 57% of the variation in Ethiopia's export earnings between 1962 and 1990.

Smallholder farmers in rural regions are typically spread out, with limited access to adequate road networks and communication systems, while the low level of commercial activity discourages private sector participation in service delivery. This creates a high likelihood of

market failures. As a result, weak and poorly developed markets lead to unstable and low prices, ultimately decreasing farmers' profitability (Mulat and Tadele, 2001). The World Bank (1987), (Nega, 2013), in a report entitled Ethiopia: an export action program, have considered exchange rate overvaluation, the low level of investment in the economy, the coffee surtax, the inadequate marketing infrastructure, the high tariffs on imports of raw materials, the unfavorable terms of trade and insufficient adjustment of producer prices as limiting factors to the country's export growth.

The World Bank (1987), as cited in Mechal (2013), identified several key constraints affecting Ethiopia's export performance. These include an overvalued exchange rate, low investment levels, coffee surtax, weak marketing infrastructure, high tariffs on imported raw materials, unfavorable terms of trade, and inadequate adjustments in producer prices. Even though Ethiopia's tariff-free access to major global markets such as the European Union and the United States, and generally lower tariffs in other key destinations compared to those it imposes, the country's small share of global trade and persistent trade deficit are largely explained by domestic economic weaknesses (Nega, 2013).

Scholar named Jose D. Sette, in his 2012 study noted that Ethiopian coffee production and marketing face a lot of challenges. These challenges are categorized into three categories. These are: structural, policy-related, and sustainability issues. The first one which are structural constraints include limited competitiveness weak market access, poor infrastructure, long supply chains, and insufficient access to services, low levels of value addition, and insufficient technology transfer and research. The second one are policy-related challenges which involve low public investment in agriculture, reduced state involvement in production and marketing activities, poorly implemented agricultural reforms, and weak institutional frameworks in many parts of the country (Sette, 2012).

Additionally, Sette in his 2012 mentions that the Ethiopian coffee sector has strong growth prospects. This is true because it is supported by the country's favorable natural endowments, including suitable altitude, adequate rainfall, optimal temperatures, appropriate planting materials, fertile soils, and relatively low labor costs. Hence, these favorable conditions allow Ethiopia to sustainably produce and supply high quality coffee. And also this is done with the

capacity to grow various coffee types comparable to those produced in leading world coffee cultivators. His study also focused on several positive opportunities within the sector. These positive opportunities help in increasing production capacity and yields, enhancing value addition and improving technology transfer.

Bart Minten, Seneshaw Tamru, Tadesse Kuma, and Yaw Nyarko (2014) argued and recommend that strengthening Ethiopia's coffee sector comes to three things: building stronger national brand for the coffee, expanding the programs for certification, and make the coffee traceable. This extremely important move right this time, this is especially true since the world buyers are increasingly asking for certified and sustainable coffee beans. It is very tiresome reality that even though Ethiopia is the origin of coffee Arabica and Ethiopia is also the coffee export powerhouse. At the baseline of this stagnant and slow growth are three main insisting obstacle. This hurdle are; low productivity and production, inconsistent quality and poor returns for the growing farmers. In contrast, competing countries have expanded their export volumes more rapidly by improving production and productivity. Ethiopia's coffee export earnings still recorded total positive growth between 1991 and 2011. There were also visible change in export destinations, with the United States becoming less significant while markets such as Japan, Germany, and Saudi Arabia gained increasing importance (Mechal, 2013). Bart Minten, Seneshaw Tamru, Tadesse Kuma, and Yaw (2014) focused on the importance of promoting coffee washing through appropriate investment incentives, this process results in substantially higher export prices and, increased revenue for the country. Since only a portion of Ethiopia's coffee exports is currently processed as washed coffee, there remains considerable potential for expansion in this area. Tadese (2015) tried to explain factors affecting coffee export performance. The empirical result obtained from his study showed that among the price factor export price and world price of coffee are found with their respective expected sign that is the supply of coffee export responds positively to the change in real export price of coffee and negatively to world supply of coffee. Tadese (2015) found that, among the price related variables in the model, the real exchange rate does not have a statistically significant effect on Ethiopia's coffee exports.

Michaely (1967), and Berhanu (2003), examined the relationship between commodity concentration and export price fluctuations using rank correlation analysis. Based on data from

36 countries, the study found a correlation coefficient of 0.404, suggesting a relatively weak association between the degree of export commodity concentration and export price volatility. The coffee sector is highly dependent on international market prices and is significantly influenced by the structure and functioning of the global coffee market. Ethiopia is very much vulnerable to the uncertain high and ups of the world coffee market (Nicolas, 2007). For years, low prices have been steadily and constantly eroding the Ethiopia's production capacity and hindered its forward movement. Due to these reasons and others, it is essential to give farmers the access to the right financial support. This is not only helpful but also very vital to keep the livelihoods of the rural population (Bastin and Matteucci, 2007).

While Ethiopia has massive potential to increase coffee output thanks to its favorable agro-ecological conditions and available labor force. However, its average productivity 0.71 tons per hectare. This output remains lower than that of major producers. For context, Brazil is at 0.78 t/ha, Vietnam is at 1.31 t/ha, and Colombia is at 0.76 t/ha (FAOSTAT, 2020). A combination of different systematic problems keeps the countries's coffee yield low. Adding to this biological pressures from diseases and pests and climate change like drought are depleting the soil potential leading to low yield (Tadesse et al., 2020).additionally, traditional farming practices characterized by limited use and slow adoption of improved coffee varieties and modern agronomic techniques are also the reasons for low yield of coffee Arabica (Jezeer et al., 2018; Amarasinghe et al., 2015).

Despite the long-term decline in international coffee prices, coffee continues to be Ethiopia's leading export commodity. However, in rural areas, smallholder farmers are often widely dispersed, with poor road networks and limited communication infrastructure. The low level of commercial activity in these areas discourages private sector participation in service provision, creating a high likelihood of market failure.

Inefficient and underdeveloped markets will result in low and variable prices by reducing the profitability of farmers (Mulat and Tadele, 2001). It is clear that all African countries except Ethiopia and Uganda had declining coffee production after the period from 1965/66 to 1988/89 (International Coffee Organization, 2015). The most dynamic growth in African production was viewed in Ethiopia, which has recorded an average annual growth rate of 2.2% over the past 50

years, increasing to 2.7% since crop year 1989/90 (ICO, 2013). The country's production is mostly increasing regardless of some downward disruptions, attaining about 6.6 million bags in 2014/15.

Exports diversification has been the concern of Ethiopia since the mid-20th century where the first five-year development plan (1957-1961) was developed by the late Emperor Haile Selassie, which recognized the persistent domination of two-three commodities (Lakew, 2003). The domination of agricultural commodities in general and coffee in particular has not changed to a major extent, and concentration of exports of few commodities is continuing to be a challenge. According to (Lakew, 2003) exports performance could not fill the fiscal gaps to imports, and it has shown lower exports to GDP ratio and declining terms of trade.

2.3.3. Operational Process in Coffee Export Logistics

Agriculture is the dominant sector in the Ethiopian economy. The predominant role of coffee (Coffee Arabica) in the Ethiopian economic, social, and cultural dimensions dates back to several centuries as the country is the primary center of origin and genetic diversity of the plant. Ethiopia is the world's oldest exporter of coffee that predates 1830 (EU, 2014). Coffee exporting business is highly competitive in the quality of the green bean and it demands strategic planning to meet the customer expectations and to outwit the competitors. Strategic planning seeks to develop the performance of a company to achieve strategic objectives along the route to a vision for the future, considering the coffee export business is a future market, long term contracts and agreements make strategic quality managements undeniably important.

Existing processing and value-addition technologies and guidelines are decades old in Ethiopia. There are inadequate guidelines for coffee primary processing (e.g. fermentation process, storage duration, recycling of water, dry processing technology, and target moisture content after drying, and the advantages of dry vs. wet processing). There is also a lack of research knowledge about secondary processing and value-addition (e.g. impurity proportions after secondary processing, prevention of post-harvest losses, roasting and grinding levels, packaging design).

These operational processes are critical in determining export performance, product quality, delivery reliability, and competitiveness in the global coffee market. In coffee producing nations

like Ethiopia, where coffee is a major export commodity, the effectiveness of export logistics operations significantly influences revenue and the means of living of millions of stakeholders (FAO, 2020). Collection, processing, storage, transportation, documentation, customs clearance, and port handling are the operational process in coffee export logistics encompasses a sequence of interrelated activities.

Collection and consolidation are the beginning of coffee export journey. Once the harvest is done, the coffee beans are processed into either washed or unwashed coffee beans. Cooperatives and exporters gather these batches of beans from smallholder farmers and private suppliers so that they can get the maximum volume as possible. It is a clear fact that, handling coffee beans in bulk is a much smarter move to make financially. This is true because it cuts down transportation cost very much (ICO, 2019). But, the timing is very critically here. This is because of delays or sloppy handling at the stage of collection can greatly hurt the quality of the beans. This in turn hurts the investor directly. Additionally, poor rural road infrastructure and highly fragmented supply chain usually drive the complexity and price of the logistics at this stage World Bank (2021). After the coffee beans are collected, the next steps are to move it to processing and quality check. Here, the coffee beans are graded with extreme care; they are sorted, cleaned, and packaged to meet the strict export market standards and specific customer requests. Thus, concerning bodies usually handle the final inspection process so that there will be a guarantee that the shipments are full compliances with the export rules and regulations and the destination lay (UNCTAD, 2018).

Once the beans leave process, it gets into the port handling and shipping. This is the Next phase is coffee export logistics is port handling and shipment. In this phase stuffing containers, handling terminal paperwork, managing gate in procedures and finally loading the cargo into the ship will be done. When there is heavy overcrowdings, container shortage, or slow terminal workflow, shipments can delay for weeks and weeks (Notteboom & Rodrigue, 2020). Thus, for coffee exporters, these port delays are financial crisis. This delay makes the exporter pay additional and unnecessary payments which hurt their profit margins.

2.3.4. Characteristics of Coffee Export Logistics

Coffee export logistic has a distinctive set of features that set it from other agricultural commodities. The first is that it is quality sensitive. It is know that green coffee beans are not inclined to spoiling but they are extremely sensitive to moisture, and temperature changes, bad odor during transit according to FAO report in 2020 (FAO, 2020). Thus, slipups and Improper logistics handling can result in quality deterioration. This will be leading to loss of aroma, mold development, and outright rejection by international buyers, which a massive hit to export competitiveness (ICO, 2019). Another key characteristic of coffee export logistics is its fragmented nature. Here before the coffee pass the country, the bean pass through a lot of places like warehousing, inland transport, customs clearance, port handling and shipping. Here coordinating this involves a huge amounts of stakeholder (UNCTAD, 2018). This creates coordination complexity and the risk of delays and bottlenecks, particularly in developing countries where institutional capacity may be weak. In the 2021 World Bank report, it was shown that poor transport networks and weak port workflows will heavily increase logistic costs especially in low income countries. Additionally, the vigorous export regulation, quality standards, and huge paperwork make the entire process incredibly tiresome (WTO, 2019).

The other major another defining characteristic of coffee export logistics is Seasonality. It is known that Coffee harvesting and export volumes fluctuate during different seasons. This means that to peak periods there will be high logistics demand followed by relatively low activity periods. Hence, congestion at warehouses is created by this seasonality. This congestion will often causes, ports, and transport corridors during peak export months, resulting in delays and increased costs (Notteboom & Rodrigue, 2020). Therefore it is advisable that exporters must manage capacity planning and inventory carefully to tackle seasonal logistics pressures (UNCTAD, 2021).

On the top of being sensitive to quality and passing through many process and procedures, coffee bean export is very brutal financially. This is due to the extreme cost intensity in relative to the actual value of the coffee sold. After paying for warehouses, port handling, documentation, and

insurance, the profit for the exporter will be down very much (World Bank, 2021). These overheads reduce the export profit margin and reduce their pricing power on the world stage. This makes competing in the international market extremely hard and difficult (ICO, 2019).

The global market does not just care the coffee bean. It wants to know its whole history. Buyers demand traceability on origin, quality, and environmental sustainability while growing and fair labor force treatment. As the report made by UNCTAD in 2021, exporters have to keep every and singe recorded about the coffee they send to the export market. This is from the moment the beans leave the farm to final vessel loading. The export market forces the exporters to lean towards modern information system. Thus, if the exporter's coffee tractability system is weak, then there is a risk of rejection (UNCTAD, 2021).

Coffee export logistics is also deeply characterized by institutional and policy dependence. State regulation and policies related to export licensing, quality assurance, foreign exchange protocols, and customs procedures play a central role in indicating overall logistics performance. In many coffee-exporting countries, the export approval process is split across multiple governmental agencies. This is frequently leading to overlap of responsibilities between these bodies. Hence causing delays (WTO, 2019). Thus, these characteristics make coffee export logistics particularly sensitive to regulatory reforms or policy inconsistencies or sudden changes in governmental directives. Coffee export logistic is dependent on third party service givers. Most exporters in Ethiopia give the transportation service to third party transporters which are independent and also they give works of clearing and forwarding to agents. Hence, these third parties control the physical flow of the goods, their performance in doing their work directly dictates export lead times and cost effectiveness (Christopher, 2016). Thus, if there is a limited competition among service providers or weak contractual enforcement, then there will be service quality problems, increasing the likelihood of operational bottlenecks and delays.

2.3.5. Classification of Coffee Export Logistics

Coffee export logistic can be divided into four main variables. The first one is transport mode, the second one is processing level, the third one is organizational structure and the fourth and final one is operational flow. When focusing on transportation, land logistic highly dependent on heavy trucks, while the global distribution depends on ocean transportation (World Bank, 2021). Thus, to optimize this transition costs, modern networks always come to pictures. These modern networks frequently deploy multimodal systems. These systems combine road transport with rail infrastructure. This then improve overall supply chain efficiency.

One can also classify coffee logistic using how much processing happens till shipment proceeds. The coffee journey looks different for different export types like raw beans; semi processed beans, fully packaged beans and or retail ready coffee beans. Here, the logistics requirements vary significantly across these categories, as higher levels of processing demand the stricter will be for the quality control and others factors (FAO, 2020). Hence, countries exporting mainly green coffee tend to focus on bulk handling efficiency. But, exporters of processed coffee emphasize on branding, traceability, and market agility. Additionally, coffee export logistics can also be classified according to organizational structure. These organizational structures include; cooperative based logistics systems, private exporter systems, and state regulated export logistics system.

For traceability different exporters are adopting integrated coffee export logistics systems. These also reduce lead times, and meet sustainability requirements for the international markets. Coffee export logistics can also be classified based on degree of integration beyond basic transportation and organizational classifications.

One can also look coffee logistic in terms of shipment size and packaging. Here, the whole goal is keeping cost as low as possible and move high volumes efficiently. On the other side, specialty coffee logistic needs different scale. This deals with much more smaller batches and customized packing to meet the small niche of market (ICO, 2019). These operational differences highly influence and dictate of planning, inventory management, and transportation choices.

Finally, coffee export logistics can be also be classified based on technological adoption. The technological adoption can ranging from traditional paper based systems to digital systems (World Bank, 2021). Such systems are increasingly important to meet international buyer requirements and improving overall logistics performance in the export market.

2.3.6. Coffee Supply Chain Bottlenecks

Coffee processing and marketing needs to be supported by major actors in coffee industry (Berampu et al., 2019; Nguyen & Sarker, 2018). There is still large number of farmers in the coffee sector / business who be unable to execute the production process correctly (Azis et al., 2022; Bashiri et al., 2021; Meilin et al., 2019). Supply chain members engaged in this sector must make collective efforts. There is still knowledge gap still exists on problem minimizing strategy on supply chain productivity for coffee production (Azis & Irjayanti, 2023).

Most challenges occur at different stages of manufacturing process, and can be because inefficient workflows, insufficient capacity, or improper task allocation. Challenges / bottleneck relate to a condition where work areas have a little capacity rather than what is really needed for production (Heizer et al., 2020). The lateness can happen when demand surpasses work area ability. Different elements, like delayed raw material delivery, Insufficient material handling, machine failures, Build-up of inventory at particular phases of the process, old machinery, not enough machine capacity planning, unskilled labor, and unfavorable working environment, contribute to production problems (Azis et al., 2019; Irjayanti & Azis, 2021; Irjayanti et al., 2016; Tejaningrum et al., 2016). Most researchers have found different strategies to maximize production, lower expenses, and develop total competitiveness level within the coffee industry (Azis & Irjayanti, 2024; Chiaraluce et al., 2024; Khan et al., 2024; Zreik, 2024).

New studies have shown the necessity for integrated strategy to improving coffee supply chain. They examined the sustainability driver's risks across the global supply chain, highlighting the importance of efficient risk management and data exchange to keep supply chain strength. The utilization of advanced technology has been crucial in improving process line effectiveness. Research has extensively explored how digital technologies can enhance coffee supply chain performance. The results demonstrate that IoT and data analytics facilitate real-time production

monitoring, mitigate bottlenecks, and optimize resource use (Chergui & Kechadi, 2022; Mishra & Tripathi, 2020; Ngenoh et al., 2019; Wei et al., 2023).

Coffee producers, continue to face an imbalanced system from the upstream side. Coffee producers have limited bargaining power, on factors like including time, price, site, and the buyers of coffee beans (Thiruchelvam et al., 2018). The situation leads in to weak integration in the coffee distribution chain, which results in minimized profitability for producers (Sugara & Azis, 2020). Normally dealers acquire the sun dried coffee beans produced by farmers and sell them to wholesalers, who then supply them to manufacturers or exporters. Wholesalers in this scenario have more options that are more profitable in terms of pricing, leading to an uneven distribution of value (profits) throughout the supply chain in this industry (Azis & Irjayanti, 2023; Azis et al., 2022; Irjayanti & Azis, 2023).

To support Ethiopian coffee value chain, logistics function is also an important factor which should be developed in terms of infrastructure, regulation, and operation. The logistics function development mainly relies on the way Ethiopian economy is structurally developed. Ethiopian economy is mainly agriculture driven, which is underdeveloped in terms of many aspects; say low-value addition, low productivity, low mechanization, no automation (backward technology), low irrigation practice (from household to commercial scale or state farm), lack of innovation, small land size holdings by the household farmers with scattered location that hampers large scale production; little to no support by the government in terms of incentives to the household farmers, no subsidies, and no hedging from mostly natural risks to their agricultural products.

This underdevelopment of the sector negatively affected the way Ethiopian economic structure is developed even if sustained double-digit economic growth is registered for more than a decade. This structural flaw in the economic development of Ethiopia is characterized by low value of agricultural products at the production site with low return and low wealth creation for the household farmers. Household coffee farmers are the ones who actually created the commodity value, contrary to no intrinsic value transformation with high wealth creation at the retail end of the agricultural products in Ethiopia. On the other side of the economy, developed agriculture should lead into developed industrialization in terms of transforming the inputs to outputs through value addition at manufacturing sites.

Ethiopian coffee is marketed both at local and international market. The latter mainly operates through the newly established commodity exchange market and specialty market channels of coffee cooperative unions. Before 2001, all Ethiopian coffee should pass through Commodity Exchange Market. Since 2001, however, cooperatives have been granted permission to by-pass coffee auction opening the way for direct export sales. According to (USAID, 2010) the producers under this stage in the coffee value chain of Ethiopia include small-scale farmers, private owned farmers and state firms. The major portion inters of volume of products mobilized, value adding functions, market share and capital owned in coffee value chain of the country is under the hands of producers especially the large-scale private coffee plantations and state farms of coffee plantations. After the coffee is grown and matured, the following value adding activities in the value chain performed by those producers are collecting coffee and transporting to processing areas (USAID, 2010).

2.3.7. Coffee Export Trade Logistics Performance

There is existing literature on coffee export performance in East African countries (see, e.g., Bellemare, Barrett, and Just, 2013; Boansi and Crentsil, 2013; Jaramillo et al., 2011). Factors such as climate variability, price volatility, and declining competitiveness in the international coffee market shown to have contributed to the poor performance of the sector in these studies. Other similar studies have also further highlighted additional structural and institutional constraints affecting export markets. Different researches have analyzed the coffee sector performance from individual country perspectives. This studies has a good data that shows how the absence of quality standards, supply chain constraints, limited presence of cooperatives, and poor coffee quality are key factors of performance (Chiputwa, Spielman, and Qaim, 2015; Minten et al., 2014; Mujawamariya, D'Haese, and Speelman, 2013).

When considering the context of East African countries, the agricultural sector remains the primary source of foreign exchange earnings (Salami, Kamara, and Brixiova, 2010). The Agriculture sector of these countries is mainly dominated by the export of green coffee beans to markets (Nyangito and Omare, 2004). Here in this country coffee bean is dominantly cultivated by smallholder farmers, with the exception of Kenya. In Kenya, large scale coffee farmers are more working on coffee agriculture predominantly (Lukanima and Swaray, 2014).

Farmers typically rely on traditional farming methods with limited use of modern agricultural technologies, whereas estates are generally organized as cooperative or large-scale farms with better access to technology and more efficient production systems.

When the eastern African countries improve coffee trade performance, it could significantly contribute to the national economies of the respective countries. For instance, coffee exports accounted for about 22% and 26% of total export revenues in Rwanda and Ethiopia, respectively, in 2009 (Mafusire et al., 2010). Overall, export earnings from the coffee sector represent a considerable proportion of total foreign exchange income in East African countries. For instance, official statistics from the Food and Agriculture Organization (FAO) indicate that coffee export values increased by 55%, 21%, and 10% in Rwanda, Uganda, and Ethiopia, respectively, between 1998 and 2013 (FAO, 2016). Similarly, during the same period, countries such as Burundi, Kenya, Malawi, Tanzania, and Zambia experienced average coffee export growth rates of 4%, 8%, 4%, 7%, and 1%, respectively.

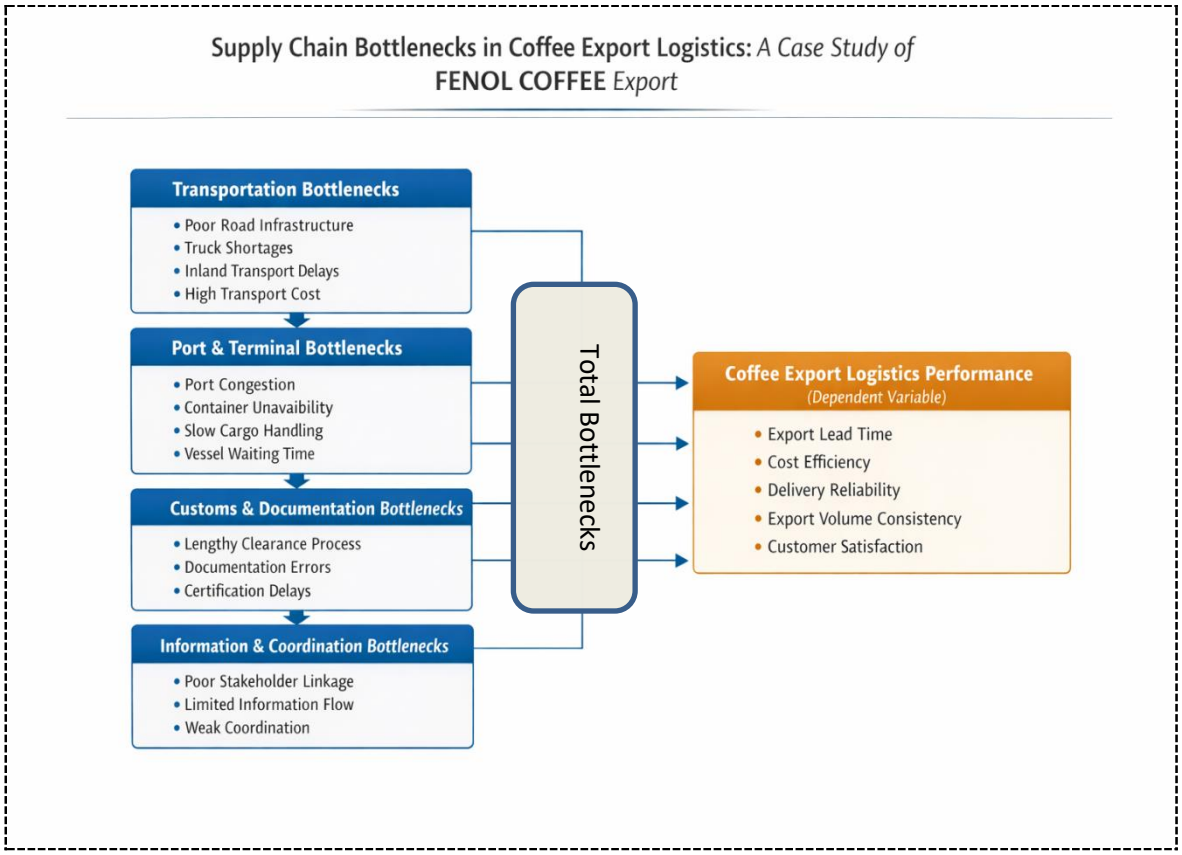


Figure 1: Conceptual framework that shows the direction of relationship among variables of independent & dependent variable

CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1. Research Approach

This research applied quantitative research approach. Quantitative approach was used to measure the prevalence, severity, and effects of supply chain bottlenecks in coffee export logistics using structured questionnaire data. .

3.2. Research Design

This thesis used explanatory design. Explanatory research approach focused on identifying and explaining the cause-and-effect relationships behind a specific challenge. Within the scope of this research Supply Chain Bottlenecks in Coffee Export Logistics, an explanatory approach helps investigate why certain bottlenecks occur and how they impact the flow of coffee from farmers to export destinations.

3.3. Population of the Study

3.3.1. Unit of Analysis

In this research primary unit of analysis consist of different individual parties like ; exporting firm, with data obtained through key informants like coffee exporters, Warehouse owners, coffee cleaners, regulators, financers including BANK and insurance, transporters, port handlers, ship container service providers, Customs, etc. It allowed to gather information which help examine operational procedures and inter-firm dependencies within the export logistics chain, allowing the identification of both common and firm-specific vulnerabilities that impact coffee shipments.

3.3.2. Target Population

For this study the target population included coffee exporters that were representing the community if Ethiopia's coffee exporters. These are approximately 500 in number.

3.3.3. Population Size

The population of this study comprised licensed coffee exporting firms in Ethiopia, primarily headquartered in Addis Ababa, that actively engage in the international export of coffee. An estimated population of 110 firms was considered based on records obtained from relevant industry and regulatory sources. These firms were selected because they represented the major participants in Ethiopia's coffee export sector and are directly involved in key logistics activities, including sourcing, transportation, warehousing, documentation, customs clearance, and international distribution. Since the study aimed to investigate supply chain bottlenecks in coffee export logistics, focusing on these 110 active exporters provided an appropriate and representative population from which reliable data could be collected.

3.4. Sampling Design

3.4.1. Sampling Technique

The thesis employed a non- probability sampling method, specifically Accidental Sampling because the researcher selected respondents who were easily accessible and available at the time.

3.4.2. Sampling Frame

The unit of analysis in this research comprised individuals involved in coffee export logistics, including export staff, logistics personnel. These participants were selected from coffee exporting firms, ensuring representation across key actors in the export supply chain.

3.4.3. Sample Size

Sample size for the quantitative survey was determined using Yamane's (1967) formula, which is widely used for finite populations:

$$n = \frac{N}{1 + N (e)^2}$$

Equation 1: Yamane's Formula 1967

Where:

n = sample size

N = population size (110)

e = margin of error (5% or 0.05)

$$n = \frac{110}{1 + 110 (0.05)^2}$$

$$n = \frac{110}{1 + 110 (0.0025)}$$

$$n = \frac{110}{1.30}$$

$$n = \mathbf{85}$$

Thus, 85 respondents were selected for the quantitative survey.

3.5. Research Instruments and Measurements

3.5.1. Data Collection Instruments

The study used both primary and secondary sources of data collection. It utilized questionnaire. Primary data were gathered. Questionnaire was made of close-ended items rated on a five-point Likert scale, with responses from “strongly disagree” to “strongly agree”, and was prepared to get participant’s views of various supply chain bottlenecks in coffee export logistics.

Variable Category	Measurement Indicators
Transportation Bottlenecks	Delivery delays, vehicle availability, road condition
Documentation & Customs	Clearance time, procedural complexity
Warehousing Challenges	Storage capacity, handling efficiency
Coordination & Communication	Information flow, stakeholder coordination
Port Services	Congestion, loading delays, service reliability

Table 3-1: Measurements of Variables

3.6. Data Collection Procedures

Respondents were notified about the aim of the research. Questionnaires were distributed.

3.7. Data Analysis Techniques

Quantitative data obtained through the questionnaire were processed and assessed using SPSS (Statistical Package for Social Sciences). Descriptive statistical techniques like frequencies, mean, standard deviation and percentages were applied. For the inferential data was presented by correlation, normality assumption test, Linearity, Durbin Watson test ,model fitness test (ANOVA), & Variance inflation factor was conducted.

3.8. Validity and Reliability

3.8.1. Validity

The validity of this research was assessed using content, internal, and external validity. External validity is about with how well the findings of a study can be applied to other environment, and situations. Content validity was confirmed by having experts; including coffee experts and the research advisor, review the research instruments. Internal validity was improved by using triangulation, which involved obtaining both qualitative and quantitative data from different sources.

3.8.2. Reliability

A reliability test checks were carried out on data collection instrument (such as a questionnaire) gives consistent results every time it is used. If the same respondents answer the same questions again under similar conditions, a reliable tool should produce similar responses. Reliability is important because it ensures that the results are trustworthy and not influenced by randomness or errors. For this study, reliability was assessed to ensure that the questionnaire items produced dependable and repeatable results. A reliable instrument increases the credibility of the findings by minimizing measurement errors and ensuring that similar responses would be obtained if the instrument were administered under similar conditions. The internal consistency was assessed, Cronbach's Alpha was used, as it was the most commonly applied reliability test for Likert-scale instruments.

3.9. Ethical Considerations

The participants agreed to be apart in the study as respondent & interviewees. This was done to ensure that the data collected from the participant would not cause any harm in any way.

CHAPTER FOUR

4. RESULT AND DISCUSSION

4.1. Response rate

The research had administered 85 questionnaires to the coffee exporters in Addis Ababa. Form the whole questionnaires distributed, 64 questionnaires were returned. These questionnaires were distributed to respondents. After distributing the questionnaires, a close follow-up and assistance provided during completion. Hence, the study achieved a response rate of 75.3%. Therefore, according to Mugenda's (2003) work, it was noted that a 50% response rate was sufficient for analysis and reporting, while 60% was considered good. Therefore, when the research calculated the response rate it became 75.3%. Hence, the response rate obtained in this study was classified as very good. Overall, we can conclude that the response rate was acceptable, and the majority of respondents completed the questionnaires properly.

The Questions for the study within the questionnaires were arranged to examine Supply Chain Bottlenecks. These bottlenecks were considered as a vital drive for operational performance in addition to the global competitiveness for coffee exporters which resides in Addis Ababa, Ethiopia. Logistics efficiency where looked as a multi-layered framework including infrastructure, regulatory compliance, and coordination within organization.

It was evaluated and found in this research how delays in transportation and port logistics act as major drivers that influence negatively through increasing total costs and makes shipment reliability risky for the exporters. The data collecting tool, the research were able to explore the relation of warehousing capabilities and maintaining quality of coffee. Thus, this inspection helped in presenting various suggestions regarding modern storage facilities are not just utility spaces but also essential protections for the importance of the coffee.

Finally, the researcher has found different results by analyzing digitalization of customs and documentation processes. Here, the study tried to identify how administrative resistance affects the quickness of exporters. The research aimed to show that, reducing these bottlenecks, identified as problems for the industry, through great coordination and supportive government

policy acts as a strategic bridge. This bridge intern will be a route in transforming logistical challenges into a competitive advantage. This transformation help ensure long-term sustainability in the current volatile international coffee market.

The data analysis for this study was conducted using SPSS version 25. The findings were presented in two sections, namely descriptive statistics and inferential statistics, including correlation analysis.

4.2. Descriptive Findings

4.2.1. Demographic Profile

A. Company Capital

Capital Range (ETB)	Frequency	Valid Percent	Cumulative Percent
50,000,000 – 100,000,000	3	4.7	4.7
101,000,000 – 300,000,000	20	31.3	35.9
301,000,000 – 400,000,000	11	17.2	53.1
401,000,000 – 500,000,000	20	31.3	84.4
Greater than 500,000,000	10	15.6	100.0
Total	**64**	**100.0**	

Table 4-1: Company Capital

From the above table 4.1 we can see the distribution of company capital reveals that the export market is within a competitive landscape in Ethiopia specifically Addis Ababa was dominated by

high-capacity exporters. These exporters are 64.1% of respondent firms possessing a capital base exceeding 301 million ETB. Additionally, the data shows a balanced concentration between mid-level exporters (31.3% at 101–300 million) and large-scale exporters (31.3% at 401–500 million).

B. Work Experience of Respondents

The professional longevity of the participants was evaluated to ensure data collected reflects a deep understanding of the both historical or past and current logistical landscape of the coffee industry in Ethiopia.

Experience Range	Frequency	Valid Percent	Cumulative Percent
2 – 8 years	8	12.5	12.5
9 – 15 years	23	35.9	48.4
16 – 25 years	23	35.9	84.4
Greater than 25 years	10	15.6	100.0
Total	**64**	**100.0**	

Table 4-2: Work Experience of Respondents

Above table 4.2 the experience profile of the respondents indicates a high level of professional maturity, with 87.5% of participants possessing more than nine years of experience in the coffee market. We can clearly see that the distribution was heavily concentrated in the mid-to-senior levels, with an equal percentage of respondents (35.9% each) falling into the 9–15 years and 16–25 years of experience in the industry. Additionally, 15.6% of the respondents are industry experienced person with over 20 years of experience. . It was found the result yielding extensive practical knowledge and good observation of the coffee industry trends was due to the high degree of compositions of respondents participated in the study.

C. Professional Experience in the Export Sector

A lot of specific experience within the coffee export sector to examine technical reliability of data gathered concerning international logistics and customs procedures.

Experience Range	Frequency	Valid Percent	Cumulative Percent
2 – 8 years	27	42.2	42.2
9 – 15 years	20	31.3	73.4
16 – 25 years	13	20.3	93.8
Greater than 25 years	4	6.3	100.0
Total	**64**	**100.0**	

Table 4-3: Professional Experience

Looking at the above table 4.3, within the export sector, it was clear and the result showed that the professional profile of a strong mix of mid-level and senior personnel. From the result above, with 57.9% of respondents participated in the study were having nearly 10 years or more of specialized experience in coffee exports sector. The table displayed the second largest group with

a percentage of 42.2% consisted of those with 2–8 years of experience representing. Top operational workforce, which was the remaining 57.8% had a great deal of experience in the export market. We can say that, this distribution was a perfect match for the study as it balances operational insights with a long term strategic perspectives. The rest of 26.6% of participants, had experience above 16 years. These 16 years of experience was on specific export experience ensuring that study was based on a significant professional expertise.

D. Annual Coffee Export Volume

To be more accurate the study analyzed the average annual volume of coffee exported in units expressed as Metric Tons (MT).

Export Volume (MT)	Frequency	Valid Percent	Cumulative Percent
Less than 500 MT	9	14.1	14.1
501 – 1,000 MT	13	20.3	34.4
1,001 – 5,000 MT	22	34.4	68.8
5,001 – 10,000 MT	9	14.1	82.8
Greater than 10,000 MT	11	17.2	100.0
Total	**64**	**100.0**	

Table 4-4: Export Volume

In the above table the data indicates that the sampled organizations represent a significant portion of the Ethiopian coffee export capacity, with 65.7% of the firms exporting over 1,000 MT annually. The largest group of respondents (34.4%) represents companies exporting between 1,001 and 5,000 MT, while 31.3% of the sample consists of high-volume exporters exceeding

5,000 MT per year. Only a minor number of respondents of the sample of about 14.1% consist of small-scale exporters exporting less than 500 MT.

4.3. Reliability and Validity

This part presented the data evaluation and discussion of results arising from information gathered from 64 respondents from different coffee exporters. The analysis was structured to first validate the research instrument before addressing the four research objectives through descriptive and inferential statistics.

Before proceeding with the core analysis, reliability of research instrument has been examined. Reliability indicates the degree of internal consistency. Of the scales used in the questionnaire. Cronbach's Alpha was utilized as the primary metric, where a value of 0.70 or higher was generally found to be acceptable.

No.	Variable / Construct Type	Dimension / Scale	No. of Items	Target Cronbach's Alpha	Reliability Status
1	**Independent Variable (IV)**	Transportation Bottlenecks	4	0.881	Good
2	**Independent Variable (IV)**	Port & Terminal Bottlenecks	3	0.810	Good
3	**Independent Variable (IV)**	Customs & Documentation Bottlenecks	4	0.823	Good
4	**Independent Variable (IV)**	Information & Coordination Bottlenecks	3	0.727	Acceptable
5	**Dependent Variable (DV)**	Coffee Export Logistics Performance	5	0.688	Acceptable

Table 4-5: Reliability Statistics

4.4. Regression Analysis

Multiple linear regression analysis was conducted in this study. This done because it facilitated the examination of how the independent variables affect dependent variable. Prior to conducting regression analysis to examine the effect of total logistic bottlenecks on supply chain efficiency normality tests was made and satisfied. Thus, below results were identified.

4.4.1. Regression Analysis Assumptions

4.4.1.1. Diagnostic Test

Before applying regression analysis and process macro model 1 and model 4, some tests were conducted in order to ensure the appropriateness of data to assumptions of regression analysis. Thus, the result is shown as follows:

4.4.1.1.1. Linearity Test

The assumption of linearity was assessed using curve estimation analysis to determine whether the relationship between Total Bottleneck and Supply Chain Efficiency Score was linear. Both linear and quadratic models were estimated and compared. The results are presented in Table X below.

Table X:

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Linear	.860	.739	.735	.108
Quadratic	.866	.749	.741	.107

Table 4-6: Curve Estimation Results for Linearity Test

As shown in Table 4.6 above, the linear model explained 73.9% of the variation in Supply Chain Efficiency Score ($R^2 = .739$). Although the quadratic model slightly increased the coefficient of determination to 74.9% ($R^2 = .749$), the improvement was minimal. Furthermore, the quadratic term was not statistically significant ($B = -0.109$, $p = .131$), indicating that the nonlinear component did not significantly improve the model fit.

Therefore, the relationship between Total Bottleneck and Supply Chain Efficiency Score can be considered linear. Since the quadratic model did not provide a statistically significant

improvement over the linear model, the linearity assumption required for regression analysis was satisfied. This confirms that linear regression is an appropriate technique for examining the effect of supply chain bottlenecks on supply chain efficiency.

4.4.1.1.2. Durbin Watson Test or autocorrelation test

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.860[a]	.739	.735	.10791	2.337

a. Predictors: (Constant), Total_Bottleneck
b. Dependent Variable: SupplyChain_Eff_Score

Table 4-7: Durbin Watson Test or autocorrelation test

From the above table 9 we can clearly see that the first assumption of regression analysis was met. This assumption is that the Durbin Watson value should be close to 2. Additionally, some scholars argue Durbin Watson value should be between 1.5 and 2.5. Thus, in this case the Durbin Watson value was 2.033, which was very close to 2. So, we can conclude that there was no autocorrelation problem.

4.4.1.1.3. Variance inflation factor VIF test

Second test to do was the VIF test, the variance inflation factor. Here the VIF value should be less than 10. In this case the VIF factor values found were all less than 10, which was well below the guideline of 10 recommended values by Mendenhall and Sincich in his 1993 article. Thus, assumed that there was no multicollinearity which requires attention. For reference, please check table 4.8 below.

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Tolerance	VIF
1 (Constant)	5.584	.130		43.036	.000	5.325	5.843		

Total_Bottleneck	-.428	.032	-.860	-13.265	.000	-.492	-.363	1.000	1.000
a. Dependent Variable: SupplyChain_Eff_Score									

Table 4-8: Variance inflation factor test

Based on the above table Multicollinearity was assessed using Tolerance and variance inflation factor. The VIF value for the primary independent variance was 1, significantly below 10. This confirmed that the data was suitable for multivariate analysis using the process macro.

4.4.1.2. Normality Test

To validate regression model, normality of the residuals was examined. As shown in Normal P-P Plot (Figure 2), thus observed cumulative probabilities closely followed the diagonal line of expected normal probabilities. According to Field (2018), when a P-P plot showed dots following the diagonal without major deviations, and the sample size was robust (N=64), the assumption of normality was satisfied for parametric testing. Please see the following figure.

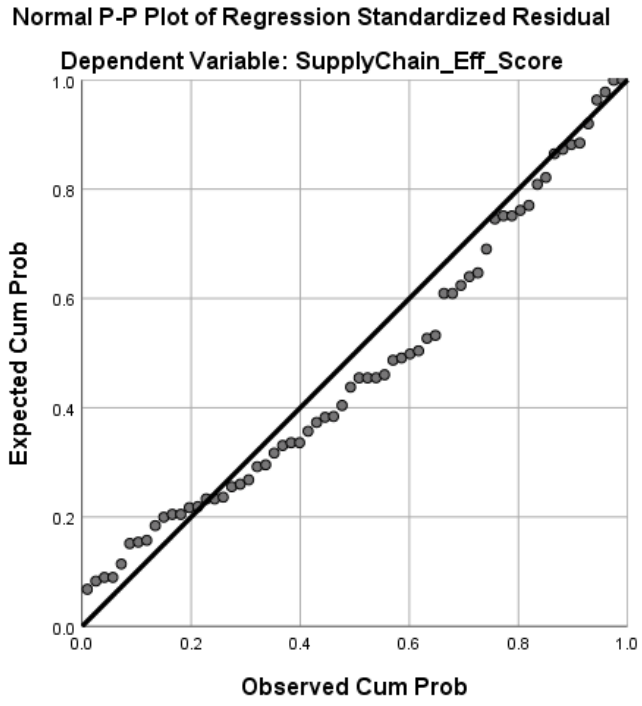


Figure 2: Normality plot

Figure 3 below showed that the normality assumption was satisfied, as the data points closely followed the diagonal line. This indicated that the data were normally distributed.

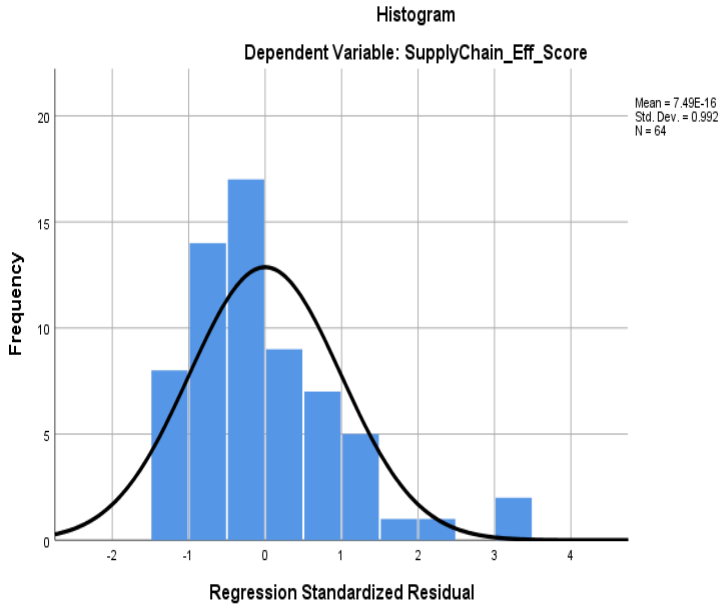


Figure 3: normality test histogram

Diagnostic tests for the regression model confirmed the reliability of statistical findings through assessment of standardized residuals. The Histogram, figure 3, illustrated that the distribution of errors closely follows a normal bell curve with a mean essentially at zero (7.49×10^{-16}) and a standard deviation near unity (0.992), indicating that predictions of the model were free from bias and consistent. . The above numerals were further confirmed by Normal P-P Plot. The plot showed that, the observed data points closely connected with diagonal reference line. This hugging behavior of the observed data was demonstrating residuals followed a normal probability distribution without significant any outliers or skewness. In general, these two above figures provide the necessary empirical evidence to satisfy the assumption of normality. Hence, a clear validation for the use of linear regression to analyze the impact of logistics bottlenecks on Coffee's export performance.

4.5. Linear Regression Analysis

To evaluate the predictive impact of operational constraints on performance, an ordinary least squares (OLS) simple linear regression was conducted with Total Bottleneck as the sole independent predictor and SupplyChain_Eff_Score as the dependent variable (N = 64).

4.5.1. Model Fit and Variance Explained (R^2)

The overall explanatory power of the model was presented in Table 1. The correlation coefficient (R = .860) indicated a strong negative linear association. The coefficient of determination (R^2 = .739) demonstrated that 73.9% of the variance in supply chain efficiency was directly explained by total operational bottlenecks. The adjusted R^2 (.735) confirms the model's high stability, with a low standard error of the estimate (SE = .10791).

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.860[a]	.739	.735	.10791

a. Predictors: (Constant), Total_Bottleneck

b. Dependent Variable: SupplyChain_Eff_Score

4.5.2. Model Fitness Test (ANOVA)

To test whether the model was a statistically valid fit for predicting the dependent variable, an Analysis of Variance (ANOVA) was performed. As shown in Table below, the Model Fitness Test was highly significant, $F(1, 62) = 175.972$, $p < .001$. This result strongly rejects the null hypothesis that the predictor has no effect, confirming that the linear model provided a highly reliable fit for the observed empirical data.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.049	1	2.049	175.972	.000[b]
	Residual	.722	62	.012		
	Total	2.771	63			

a. Dependent Variable: SupplyChain_Eff_Score

b. Predictors: (Constant), Total_Bottleneck

Table 4-9: Model fitness test (ANOVA)

4.6. Identification and Categorization of Logistics Bottlenecks

Primary aim of this research was to identify and categorize key bottlenecks affecting major coffee export logistics at major companies. To accomplish this, descriptive statistics specifically mean scores and standard deviations were computed for each categorized bottleneck dimension. Results were summarized in Table 4.6 below.

Rank	Bottleneck Category	Mean	Std. Deviation	Severity Level
1	Coordination & Communication	4.2031	0.52660	Very High
2	Transportation & Logistics	4.1758	0.59208	High
3	Warehousing & Storage	4.1563	0.65322	High
4	Improvement & Solutions	4.1445	0.57873	High
5	Documentation & Customs	3.8437	0.78560	Moderate-High

Table 4-10: Identification and Categorization

4.6.1. Findings

From the above table in the descriptive analysis, it was revealed that all identified categories were perceived as significant bottlenecks, with mean scores consistently above the neutral point of 3.00.

4.6.1.1. The significance of Coordination and communication Failures

The results in the above table 4.6 indicated that Coordination and Communication represents the most severe bottleneck in the coffee exporting industry supply chain. This was showed by the severity level with highest mean score of 4.2031. This finding suggested that the "poor" infrastructure for the flow of information between exporters, the Ethiopian Djibouti Railway (EDR), shipping agents, and government authorities. Thus, we can conclude that this is the primary point of friction.

The lowest Standard Deviation (0.5266) has been recorded most importantly in this. Therefore, in statistical terms, this showed that there was a high degree of agreement among the 64 participants. Additionally, even if there was a huge difference in the experience in the coffee exporting industry, there was a huge perception that poor coordination leads to logistical delays. This perfectly aligns with the Bullwhip Effect theory. Therefore, this further suggested that, the occurrence of information gaps between supply chain actors lead to inefficiencies and increased cost of operation.

4.6.1.2. Physical Logistics: Transportation and Port and terminal

Again from the table 4.6, transportation and Logistics has Mean of 4.1758 and Port and terminal and Storage (Mean = 4.1563) followed closely as the second and third most severe bottlenecks. The high mean for transportation suggested that road infrastructure limitations and truck shortages remain a big threat to meeting shipment deadlines.

Similar to the transportation problem, the port and terminal score reflects concerns regarding capacity and modern tracking systems. For a case study like coffee exporters in Addis, these

scores indicated that physical movement and storage were not just secondary issues but were nearly as disruptive as the primary bottleneck, coordination failures, affecting the supply chain.

4.6.1.3. Documentation and Customs: The Variable Bottleneck

The least severe bottleneck among the categories, with a mean of 3.8437 was found to be Documentation and Customs Clearance bottlenecks. By being the lease it does not mean it won't hurt the industry. This bottleneck, while still indicating a significant problem, it was notable that this category had the highest Standard Deviation value of 0.7856.

We can see that, when on talks about the logistics bottlenecks he/she can see that it is multi-dimensional. However, in this study, the researcher successfully categorized Coordination and Communication problems/failures as the dangerous risk of supply chain inefficiency. The lack of a synchronized information flow between actors worsens these physical delays by creating a compounded negative effect on export performance by adding to physical bottlenecks in transport and warehousing huge problems.

4.7. Underlying Causes of Logistics Bottlenecks

The research had once identified many bottlenecks. Following the identification of the primary bottleneck categories, the study aimed to examine the specific underlying causes for each major of bottlenecks. Thus, this level by level analysis was very important for moving past the general observations. Therefore, this analysis helped in finding indicative and the exact operational failures creating inefficiency within coffee exporters in Addis Ababa.

4.7.1. Root Causes in Transportation and Physical Infrastructure bottlenecks

The next part of the study was to analyze four major variables to determine why transportation remains a very serious problem. From the data collected, it was revealed that internal resource constraints was less severe than physical infrastructure and administrative delays at the port were more severe drivers of inefficiency.

Specific Root Cause Variable	Mean	Std. Deviation
Delays caused by customs clearance procedures	4.4531	0.56145
Impact of road infrastructure problems on export operations	4.2500	0.71270
Effect of truck shortages on export operations	4.0156	0.67828
General delays in transporting coffee from farm to port	3.9844	0.78664

Table 4-11: Descriptive Analysis of Transportation and Infrastructure Causes

In the above table 4.7 showed that the Customs Clearance Procedures was most significant finding with value of M = 4.45. This value signifies the highest individual mean in the whole transportation domain considered in this study. This was a clear indication that the bottleneck was often administrative rather than being physical. Though, when investigating physical movement, Road Infrastructure had a mean of M = 4.25 and this was seen as a greater cause of delay than the Shortage of Trucks with a value of mean M = 4.01. Therefore, this suggested that even if the fleet capacity was increased, the poor state of roads from Addis to Djibouti has played a greater role by limit the speed of coffee exports to reach their destinations.

4.7.2. Root Causes in Port & Terminal Bottlenecks

In the port and terminal area, the data suggests that technological oldness was a greater problem than simple space availability.

Specific Root Cause Variable	Mean	Std. Deviation

Specific Root Cause Variable	Mean	Std. Deviation
Lack of modern facilities (automation/tech)	4.2969	0.79041
Poor storage/handling affecting coffee quality	4.1250	0.72375
Adequacy of physical warehouse capacity	4.0469	0.78538

Table 4-12: Descriptive Analysis of Port and terminal Root Causes

The Lack of Modern port Facilities (M = 4.29) was recognized as the primary cause of port and terminal delays. This implies that the absence of digital systems/automated tracking in storage is the root failure. This was verified by the high mean for Poor Storage/Handling (M = 4.12), which highlights the risk of quality degradation that directly threatens the international market value of the coffee.

4.7.3. Root Causes in Warehousing and Storage bottlenecks

When looking at the warehousing area, the collected data suggests that outdated technologies were indeed a greater problem than the availability space.

Specific Root Cause Variable	Mean	Std. Deviation
Lack of modern warehouse facilities (automation/tech)	4.2969	0.79041
Poor storage/handling affecting coffee quality	4.1250	0.72375
Adequacy of physical warehouse capacity	4.0469	0.78538

Table 4-13: Descriptive Analysis of Warehousing Root Causes

The data collected were analyzed and the result was shown in the above table. For the table we can see that the Lack of Modern Warehouse Facilities has a mean value of M = 4.29. This result was known as the primary cause of warehousing delays. This implied that the absence of digitalization on the warehouse or digital systems in storage was the root disaster. This was verified by the high mean for Poor Storage/Handling (M = 4.12) value. This clearly highlighted the risk of quality decreased. When quality decreases, it directly threatens the international market value of the coffee.

4.7.4. Root Causes in Coordination and Information Flow bottlenecks

The below table 4.9 displays the reasons for the occurrence of coordination and information flow bottlenecks.

Specific Root Cause Variable	Mean	Std. Deviation
Lack of coordination between shipping agents and actors	4.3281	0.64377
Ineffective communication (Exporters, EDR, and Agencies)	4.2031	0.69419
Satisfaction with port and customs authorities' services	4.0781	0.62500

Table 4-14: Descriptive Analysis of Coordination Root Causes

Result shown in the above table shows that the Lack of Coordination between Shipping Agents and Actors with mean value of M = 4.32 was the major and leading cause. This clearly a huge breakdown in the middle of the export operations. This gap has certainly leaded the exporters to be in a frequent gap of timely information regarding vessel and container availability. Additionally, it showed that the poor infrastructure of the supply chain was currently the weakest

link with high mean for Ineffective Communication, M = 4.20, further supports the idea in above sentences.

4.7.5 Root Causes in Documentation and Digital Systems bottlenecks

Further analysis of documentation processes highlighted current digital infrastructure fragility.

Specific Root Cause Variable	Mean	Std. Deviation
System failures/downtime delaying export process	3.9531	0.95002
Export documents processed within expected timeframe	3.9219	1.01269
Challenges in approval at ECTA & Customs	3.6563	0.76051

Table 4-15: Descriptive Analysis of Documentation Root Causes

The major causes of documentation bottlenecks were shown in the above table 4.10. The findings in the table clearly showed that System Failures and Downtime has a mean value of M = 3.95. This value showed that system failures and downtime were the major factors contributing to documentation bottlenecks. Additionally, this suggested that while policy requirements exist, the technological platforms used by the National Bank or Customs are unstable. This instability is causing unnecessary and forced delays.

Standard Deviation for processing timeframe were found to value at (1.01). This value was the highest in the study, revealing a big irregularity in a shipment approval time. Finally, after the investigation of major drivers of logistics failure, the problems found were not simply a lack of physical resources (like trucks or space). The problems were rather: Administrative problems which include High-impact customs and shipping agent misalignment, Infrastructure Fragility which included Road infrastructure and digital system downtime and Modernization Shortage which include factors like critical lack of modern, digitally automated warehousing systems.

4.8. Impact of Logistics Bottlenecks on Export Performance

The study tried to examine correlation between the Total logistical bottlenecks and the resulting supply chain efficiency on coffee exporters. This thesis tried to use correlation analysis to see the influence of the total bottleneck on effectiveness of supply chain in the case company. Thus, this showed that the study moved beyond descriptive observation and utilized inferential statistics to prove the magnitude and direction of the impact. Thus, the results were shown in the following sections below

4.8.1. Statistical Relationship and Model Fitness Analysis

To evaluate the overall impact of cumulative supply chain bottlenecks on operational efficiency, a composite "Total Bottleneck Score" was calculated in SPSS (N = 64). Because the objective focused on evaluating the macro-level relationship between aggregate constraints and performance outcomes, a two-step statistical approach was used. First, Pearson's bivariate correlation was applied to measure the strength and direction of the linear relationship. Second, a simple linear regression was conducted to assess the predictive power and structural fitness of the model. The direct bivariate correlation between the aggregate variables was detailed in Table 4-14.

Correlations

		SupplyChain_Eff_Score	Total_Bottleneck
SupplyChain_Eff_Score	Pearson Correlation	1	-.860**
	Sig. (2-tailed)		.000
	N	64	64
Total_Bottleneck	Pearson Correlation	-.860**	1
	Sig. (2-tailed)	.000	
	N	64	64

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

Table 4-16: Correlation and Regression Summary

The correlation analysis reveals an exceptionally strong negative linear relationship between the two variables ($r = -0.860$, $p < .001$). This finding confirms that as the severity of operational and logistical bottlenecks intensifies, there is a sharp and highly significant drop in the efficiency of coffee exporters in Addis operations. Empirically, this indicates that internal supply chain

constraints act as a primary driver of performance loss within the organization's immediate logistics framework.

4.8.2 Regression Outcome and Parameter Estimates

The final regression outcome showing the directional effect and significance weights was detailed in Table 3. The unstandardized constant was 5.584 ($t = 43.036$, $p < .001$). The unstandardized coefficient for Total_Bottleneck was statistically significant and negative, $B = -.428$, $t(62) = -13.265$, $p < .001$, with a standardized beta weight of beta = -.860.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	5.584	.130		43.036	.000
	Total_Bottleneck	-.428	.032	-.860	-13.265	.000

a. Dependent Variable: SupplyChain_Eff_Score

This confirmed that an increase of one bottleneck unit resulted in a predictable decrease of 0.428 units in the supply chain efficiency score. The final predictive regression equation was operationalized as:

SupplyChain_Eff_Score = 5.584 - 0.428 (Total_Bottleneck)

4.9 Coordination and Information Flow

This section evaluates information infrastructure of the supply chain. In this evaluation synchronization of activities and quality of information exchange among stakeholders were studied and the following result was found.

Coordination Attribute	Mean	Std. Deviation	Severity Level	Interpretation
Lack of coordination causing delays	**4.3281**	0.64377	**Critical**	Strongest contributor to delays
Effectiveness of actor communication	**4.2031**	0.69419	**High**	Perceived as effective but reactive
Satisfaction with port/customs services	**4.0781**	0.62500	**High**	Moderate satisfaction with service quality
Overall Mean Score	**4.2031**	**0.65432**	**High**	**Significant Systemic problem**

Table 4-17: Descriptive Statistics for Coordination and Communication

In the above table 4.12 the descriptive analysis revealed a high degree of agreement regarding the coordination challenges facing coffee export and most of the coffee exporters in Ethiopia.

- **Critical Bottleneck:**

The Lack of coordination between stakeholders like shipping companies/agents and different actors reached a Critical Severity Level (M = 4.33). This clearly indicates that the interface between land based logistics and maritime shipping was the most unpredictable and volatile point in the supply chain.

- **The Communication Paradox:**

While the effectiveness of communication was rated as High (M = 4.20), its impact remains problematic. In the context of the result got from the study r = -0.828 correlation result in the above table 4.12 suggests that while information is flowing, it was not integrated. Actors are talking, but they are not working in a way that prevents bottlenecks.

- **Institutional Satisfaction:**

Concerning the satisfaction on port and customs authorities, the data showed they received a High (M = 4.08) satisfaction rating. Hence, this a very important finding that it implied that the logistics bottlenecks were rather caused by the structural coordination gaps between different organizations but not by poor service from individuals working at the institutions.

CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of the Findings

Principally the major and primary aim of this research was to identify and evaluate logistics bottlenecks affecting major Coffee Export and their impact on supply chain performance. Based on the analysis of the collected data from 64 participants in the coffee export industry, the following major findings were found:

- **Systemic Bottleneck Hierarchy:** The study successfully categorized five major bottleneck dimensions. Here, from all bottlenecks analyzed, **Coordination and Communication** emerged as the most severe (**M = 4.20**).the second place goes to Transportation and Logistics with value of mean (**M = 4.17**). The low standard deviation value of **0.52** in coordination and communication confirmed that there is a high degree of agreement among exporters that poor information flow infrastructure is the primary problematic point to look into.
- **The Root Causes analysis:** Item level analysis, it was easily found specific failures. Among these specific failures identified, Customs Clearance Procedures with mean value **M = 4.45** and Lack of Coordination with Shipping Agents with mean value of M **= 4.33** were identified as the most critical drivers of delay. These problems are the root cause for transportation and coordination bottlenecks respectively. Additionally, the lack of modern, automated warehousing (**M = 4.29**) and digital system downtime (**M = 3.95**) represented as the root cause for warehousing and documentation bottlenecks respectively.
- **Empirical Impact on Efficiency:** correlation analysis revealed a **very strong negative correlation (r = -0.828, p < .001)** exists between bottleneck harshness and export efficiency. The regression model (B = -0.534) proves that logistical friction explains approximately **68%** of the variance in companies operational success.
- **The Paradox of Communication:** one of the most critical finding of the study was the gap between communication and synchronization. While respondents rated communications a bottleneck with High mean value of **4.20**, they also simultaneously rated the lack of

coordination as Critical root cause that result poor information flow and communication with a mean of **4.33**. This indicates that stakeholders are talking frequently, but the information is reactive (problem-solving) rather than proactive (solving problem through prediction before it happened).

5.2 Conclusions

Following conclusions emerged from empirical evidence & discussion of results found in the study;

- **Process Fragmentation over Individual Incompetence:** it was found that the high satisfaction with port and customs personnel suggests that the bottlenecks were not caused by the staff, rather by **fragmented processes**. It was also clear to see that the logistics environment is delayed due to the some coordination failure.
- **Logistics as a Determinant of Competitiveness:** in the result it was seen that There was strong negative correlation (**-0.828**) that leads to the conclusion that export performance was highly affected by its logistical obstacles. Regardless of product quality or capital investment that the case company made or have, the company cannot achieve its full potential in the global market until these bottlenecks were reduced.
- **The Middle-Mile Vulnerability:** in the study it was found that the transition point between inland transportation and maritime shipping agents was the weakest link in the supply chain. The lack of real-time synchronization or real time data observation at this stage transforms minor inland delays into major vessel-missing events, significantly increasing costs to companies.

5.3 Recommendations

The study had found different bottlenecks. Thus, to bridge the Gap resulted by the bottlenecks and recover the efficiency lost to these bottlenecks, the following actions were recommended:

- **Strengthen Multimodal Transport Integration**

Major Coffee Exports should adopt a multimodal transport strategy by increasing the use of the Ethio-Djibouti Railway alongside road transportation. The study identified transportation delays and poor road infrastructure as major bottlenecks affecting export efficiency. Establishing long-term Service Level Agreements (SLAs) with railway operators and logistics providers would improve transit reliability, reduce transportation costs, and minimize delays at the port corridor.

- **Improve Digital Supply Chain Information Systems**

The major coffee exporters should invest in integrated digital logistics and tracking systems to improve information sharing among exporters, freight forwarders, transport operators, customs authorities, and port agents. Real-time visibility of shipments would enhance coordination, reduce communication gaps, and support faster decision-making throughout the export process. The implementation of digital documentation and electronic tracking systems can also reduce administrative delays and improve operational transparency.

- **Investment in Smart Warehousing and "Dry-Port" Integration**

The study had found out there is a modernization deficit. Thus, the company should invest in automated tracking system and climate-controlled storage/warehouse facilities. Hence, the following action and impact is recommended;

- **Action:** the case company and any coffee exporting company should consider to implement digital tracking systems to monitor coffee moisture and quality in real-time during storage delays.
- **Expected Impact:** if the above digital system is integrated in the warehouse, it will safeguard the economic value of the coffee. Additionally it will be a mitigating method for the quality-degradation risks identified in the previous objectives.

- **Formalizing Operational Coordination through Service level agreements (SLAs)**

The finally recommendation was for solving the Communication Paradox. To get a win-win result with the shipping agent, the coffee exporters should implement legally binding Agreements with shipping agents. Hence the following action and impact was recommended;

- **Action:** the case company and the agent should define mandatory timelines for booking confirmations and document hand-offs, with penalties for coordination-driven delays.
- **Expected Impact:** this would result in a transition from reactive talk to accountable management for both sides especially in the agent side.

5.4 Future Research Study

It was clear to see that Critical logistics activities were prioritized in this research. Thus, Future studies should broaden the scope to incorporate: a full supply chain audit. And should do studies on examining the integration between upstream producers (farmers/washing stations) and downstream logistics (international shipping and port operations at Djibouti).

Future studies should be made that could track logistics performance metrics over a longer period to see if seasonal fluctuations, market volatility, and the impact of evolving government trade policies have different effect or impact on supply chain efficiency the coffee exporting company.

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APPENDIX I: Questions

ADDIS ABABA UNIVERSITY SCHOOL OF COMMERCE DEPARTMENT OF LOGISTICS AND SUPPLYCHAIN MANAGEMENT

Serial No of Participant: _____

CONCSENT OF PARTICIPANT

My name is Gabriella Belay; I am an MBA student in Addis Ababa University, in Addis Ababa, Ethiopia. I am currently working on my MBA research on "***Supply Chain Bottlenecks in Coffee Export Logistics: A Study of major coffee export in Addis Ababa***". This questionnaire was designed for preparing a senior essay in the title of "Supply Chain Bottlenecks in Coffee Export Logistics: A study of major coffee export companies in Addis Ababa ".The outcome of the study will be used in order to suggest possible solutions for problems identified while conducting the study. I kindly request you to fill the questionnaire as frank as possible and responsibly. I would like to inform you that the information you provide will be consumed for academic purpose only. The information you disclose is confidential. Therefore, you are not expected to write your name or identification.

Thank you in advance for your cooperation.

SECTION ONE: Demographic and Company Profile

1) **Capital of the Company.**

   A. 50,000,000 – 100,000,000 ETB ☐
   B. 100,000,000-200,000,000 ETB ☐
   C. 300,000,000-400,000,000 ETB ☐
   D. 400,000,000-500,000,000 ETB ☐

E. above 500,000,000,000 ETB ☐

2) **Years of experience in the coffee business.**

A. 2 -8 years ☐
B. 9 - 15 years ☐
C. 16 -25 years ☐
D. above 25 years ☐

3) **Years of professional experience in the coffee export sector.**

A. 2 - 8 years ☐
B. 9 - 15 years ☐
C. 16-25 years ☐
D. above 25 years ☐

4) **What is the average annual volume of coffee exported by your organization?**

A. Less than 500 MT ☐
B. 501 – 1,000 MT ☐
C. 1,001 – 5,000 MT ☐
D. 5,001 – 10,000 MT ☐
E. above 10,000 MT ☐

SECTION TWO: Survey Questionnaire Items and Measurement Scales

Instruction: Indicate your level of agreement with the following statements (1 = Strongly Disagree, 5 = Strongly Agree).

no	***Transportation & Logistics***	**5**	**4**	**3**	**2**	**1**
1.	To what extent your organization experience delays in transporting coffee from the farm, processing site to the port of lading (POL)?					
2.	To what extent road infrastructure problems significantly affect your export operations?					

3.	Our export operations are frequently affected by truck shortages for transporting coffee?					
4.	To what extent customs clearance procedures delay your export shipments?					
	Warehousing & Storage	**5**	**4**	**3**	**2**	**1**
1.	Is warehouse capacity adequate for storing processed coffee before export?					
2.	To what extent poor storage or handling affect coffee quality before export?					
3.	To what extent you think lack of modern warehouse facilities cause delays?					
	Documentation & Customs Clearance	**5**	**4**	**3**	**2**	**1**
1.	To what extent export documents (e.g., ECTA, customs, NBE) processed within the expected timeframe?					
2.	The documentation approval process at ECTA & customs is challenging for our export operations?					
3.	Do you think system failures or downtime (e.g., customs system, ECTA system) delay your export process?					
	Coordination & Communication	**5**	**4**	**3**	**2**	**1**
1.	Communication between exporters, transporters, Ethiopian Djibouti Railway (EDR) and government agencies is effective?					
2.	To what extent lack of coordination between SHIPPING company's/Agents & different actors cause shipment delays?					
3.	Is your organization satisfied with the service provided by port and customs authorities?					
	Supply Chain Efficiency	**5**	**4**	**3**	**2**	**1**
1.	To what extent your organization face frequent bottlenecks that increase logistics costs?					
2.	Logistics bottlenecks significantly affect our ability to meet shipment deadlines?					

3.	To what extent bottlenecks affect your company's coffee quality or competitiveness in the international market?					
	Improvement & Solutions on Supply Chain Efficiency	**5**	**4**	**3**	**2**	**1**
1.	Are current government policies and regulations supportive in improving export logistics efficiency?					
2.	To what extent you believe improvements are needed to reduce coffee export logistics bottlenecks?					
3.	To what extent your organization receive adequate technical or advisory support from relevant authorities to improve export logistics performance like the coffee association?					
4.	To what extent would the adoption of advanced digital logistics systems improve efficiency in coffee export operations?					