



**Assessment of the Impact of Transportation Management on Logistics  
Resilience: The Case of Ministry of National Defence of Ethiopia.**

A Thesis Submitted in Partial Fulfilment of the Requirement for the Degree of Masters in  
Logistics and Supply chain management

By: Yoseph Lire

Advisor: Zelalem Bayisa (PhD)

Addis Ababa University  
School of Commerce  
Addis Ababa

June 2024

ADDIS ABABA

### **Declaration**

I certify that this thesis entitled Assessment of the Impact of Transportation Management on Logistics Resilience: The Case of Ministry of National Defence of Ethiopia is my own original work and to the best of my knowledge, this study has not been submitted for any degree in this University or any other University. It is offered for the partial fulfilment of the Master of Science degree in Logistics and Supply chain management from Addis Ababa University. Whenever other authors work is used, they have been properly acknowledged.

**Name:** Yoseph Lire

**Advisor:** Dr. Zelalem Bayisa

**Signature:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

### Statement of Certification

This is to certify that thesis by Yoseph Lire entitled: Assessment of the Impact of Transportation Management on Logistics Resilience: The Case of Ministry of National Defence of Ethiopia submitted in partial fulfilment of the requirement for the degree of masters in science of Logistics and Supply chain management complies with the regulation of the university and meets the accepted standard with respect to originality and quality.

Approved by:

_____	_____	_____
Internal examiner	signature	Date
_____	_____	_____
External examiner	signature	Date
_____	_____	_____
Advisor	signature	Date

## **Acknowledgements**

First and foremost, I glorify the Almighty God, for gifting me wisdom and understanding in my life journey. Next my deepest gratitude extends to my advisor Dr. Zelalem Bayisa for his priceless guidance and constructive advices and comments to accomplish this work.

Lastly, not the least I am also much grateful to my family. My deepest and warmest appreciation goes to my Father Lire Tirkaso (pastor.), my mother Adanech W/Gibriel (Ms.) for their constructive advices and financial support in all academic achievements to this date.

Contents

**Declaration**..... i

**Statement of Certification** ..... ii

**Acknowledgements** ..... iii

**CHAPTER ONE** ..... 1

**INTRODUCTION**..... 1

**1.1. Background of the Study**..... 1

**1.2 Statement of the Problem** ..... 2

**1.3 Research Questions**..... 4

**1.4 Objectives of the Study**..... 4

**1.4.1 General Objective** ..... 4

**1.4.2 Specific Objective**..... 4

**1.5 Significance of the Study** ..... 5

**1.6 Scope of the Study**..... 5

**1.7 Definition of Terms**..... 6

**1.8 Organization of the Research Study**..... 7

**CHAPTER TWO** ..... 8

**LITERATURE REVIEW** ..... 8

**2.1 Introduction**..... 8

**2.1.1 Logistics Resilience in Military Operations**..... 8

**2.1.2 Impact of Transportation Management on Logistics Resilience** ..... 8

2.1.3	<b>Vulnerabilities and Strategies for Enhancing Logistics Resilience</b> .....	12
2.2	<b>Theoretical Framework underpinning the study</b> .....	13
2.2.2	<b>Theory of supply chain resilience</b> .....	13
2.2.3	<b>Transportation Resource Planning (TRP) theory</b> .....	14
2.2.4	<b>The Lean Transportation theory</b> .....	14
2.3	<b>Dimensions of Logistic Resilience</b> .....	15
2.3.1	<b>Supply Chain Disruptions and logistic resilience</b> .....	17
2.3.2	<b>Transportation Management and Resilience during Disruptions</b> .....	17
2.3.3	<b>Vulnerabilities in Transportation Networks</b> .....	17
2.3.4	<b>Risk Assessment Practices in Transportation Infrastructure</b> .....	18
2.4	<b>Transportation Management Strategies</b> .....	18
2.4.1	<b>Diversification and Redundancy</b> .....	19
2.4.2	<b>The Role of Redundancy in Ensuring Continuity</b> .....	20
2.4.3	<b>Collaboration and Information Sharing</b> .....	20
2.5	<b>Empirical Review</b> .....	21
2.6	<b>Conceptual Framework</b> .....	25
2.7	<b>Summary of Empirical Review and Research Gap</b> .....	26
<b>CHAPTER THREE</b> .....		27
<b>RESEARCH METHODOLOGY</b> .....		27
3.1	<b>Description of the Study Area</b> .....	27
3.2	<b>Research Design</b> .....	27

<b>3.3</b>	<b>Research Approach</b> .....	28
<b>3.4</b>	<b>Population and Sample</b> .....	28
<b>3.4.1</b>	<b>Population</b> .....	28
<b>3.4.2</b>	<b>Sample</b> .....	29
<b>3.5</b>	<b>Data Sources and Types</b> .....	32
<b>3.5.1</b>	<b>Data Sources</b> .....	32
<b>3.5.2</b>	<b>Data types</b> .....	32
<b>3.5.3</b>	<b>Data Collection Instruments</b> .....	34
<b>3.6</b>	<b>Ethical Consideration</b> .....	35
<b>3.7</b>	<b>Data Analysis</b> .....	35
<b>3.8</b>	<b>Validity and Reliability</b> .....	36
3.8.1	Validity .....	36
3.8.1	Reliability.....	37
<b>CHAPTER FOUR</b> .....		39
<b>DATA PRESENTATION, ANALYSIS AND INTERPRETATION</b> .....		39
<b>4.1</b>	<b>Introduction</b> .....	39
<b>4.2</b>	<b>Respondent Demographic Characteristics</b> .....	39
<b>4.3</b>	<b>The Extent of Transportation Management Practice Performance</b> .....	44
4.3.1	Descriptive Static for Route Planning.....	45
4.3.2	Descriptive Static for vehicle maintenance.....	47
4.3.3	Descriptive Static for drivers training .....	49

4.3.4 Descriptive Static for load management .....	51
<b>4.4 Assessing Resilience of the Logistic Department Compare to established Benchmarks .....</b>	<b>53</b>
4.4.1 Descriptive Static for logistic resilience .....	53
<b>4.5 Relationship between Transportation Management and Logistic Resilience.....</b>	<b>57</b>
4.5.1 Correlational Analysis.....	57
<b>4.6. The Effect of Transportation Management Practice on Logistic Resilience .....</b>	<b>60</b>
4.6.1 Regression analysis .....	60
<b>CHAPTER FIVE .....</b>	<b>68</b>
<b>SUMMARY OF KEY FINDINGS, CONCLUSION AND RECOMMENDATION .....</b>	<b>68</b>
<b>5.1 Introduction.....</b>	<b>68</b>
<b>5.2 Summary of Findings .....</b>	<b>68</b>
5.2.1 Measurement Transportation Management.....	68
5.2.2 Measurement Logistic Resilience .....	70
5.2.3 The Relationship Between Transportation Management Practice and Logistic Resilience.....	71
5.2.4 The Impact of Transportation Management on Logistic Resilience .....	71
<b>5.3 Conclusion .....</b>	<b>72</b>
<b>5.4 Recommendation.....</b>	<b>75</b>
<b>References÷.....</b>	<b>77</b>

## List of Table

Table 3 1 Sample size determination .....	31
Table 3 2 Reliability statics of the pilot test .....	37
Table 3 3 Reliability test of the main data .....	38
Table 4 1 Interviewee’s background information.....	44
Table 4 2 Descriptive Static for Route Planning.....	45
Table 4 3 Descriptive Static for vehicle maintenance.....	47
Table 4 4 Descriptive Static for drivers training.....	49
Table 4 5 Descriptive Static for load management .....	51
Table 4 6 Descriptive Static for logistic resilience .....	53
Table 4 7 test for multicollinearity.....	61
Table 4 8 Model Summary .....	63
Table 4 9 ANOVAa regression.....	64
Table 4 10 distribution of coefficient.....	66

## List of Figure

Figure 4 1:level of work status.....	43
Figure 4 2:level of work status.....	43
Figure 4 3 Normality test .....	60
Figure 4 4 Pearson correlation .....	58

**List of Appendices**

Appendix A:Survey Invitation Letter ..... 80

Appendix B:Survey Questionnaire ..... 80

## **List of Acronyms**

DT: Drivers Training

DLMDTD: Defense Logistic Main Department Transportation Department

FDRE: Federal Democratic Republic of Ethiopia

MOND: Ministry of National Defence

TM: Transportation Management,

RT: Route Planning,

VM: Vehicle Maintenance,

LM: Load Management,

LR: Logistic Resilience

LOC: Lines of communication

## **ABSTRACT**

*This study aimed to evaluate the impact of transportation management practice on logistics resilience within the Ministry of National Defence of Ethiopia. Transportation management is a pivotal element in ensuring the operational efficiency and effectiveness of logistics operations, particularly in a military context where operational continuity and readiness are critical. Effective transportation management enhances the resilience of logistics, enabling the defense force to maintain its mission-critical activities even in the face of disruptions. This study employed descriptive research designs, integrating qualitative and quantitative components to provide a comprehensive analysis. The research focused on key transportation management practices, including route planning, vehicle maintenance, driver training, and load management. The target population consisted of 204 employees from the Ethiopian Defense Force Logistics Main Department, the study utilized a sample of 135 employees, who were selected through a stratified sampling approach. This sample population consisted of 4 department managers and 1 logistics department head who participated in interviews. The remaining 130 members of the sample took part via questionnaires. The key findings revealed several areas for improvement, such as the need for better route planning, enhanced vehicle maintenance protocols, comprehensive driver training programs, and optimized load management strategies. These gaps can significantly affect logistics resilience, impacting the defense force's ability to respond effectively to disruptions, maintain operational readiness, and ensure timely and reliable delivery of services. The study concludes that by addressing these issues, the Ministry of National Defence of Ethiopia can substantially enhance its logistics resilience. The researcher recommends implementing more robust transportation management practices, improving inter-departmental communication, and investing in advanced transportation management systems. These measures are essential for improving logistics resilience and, consequently, the overall performance and effectiveness of the defense force's logistics operations.*

**Key words: Transportation Management, Route Planning, Vehicle Maintenance, Drivers Training, Load Management, Logistic Resilience**

# CHAPTER ONE

## INTRODUCTION

### 1.1. Background of the Study

In the realm of military operations, logistics is essential for ensuring the effective deployment of forces, the timely delivery of supplies, and the overall success of missions (Dolgui et al., 2020). Within the context of the Ethiopian Federal Democratic Republic of Ethiopia (FDRE) defense force, logistics operations are particularly challenging due to the unique and demanding nature of military activities (Tadesse et al., 2019). The ability to maintain resilient logistics systems is paramount for the defense force to respond effectively to operational disruptions and maintain optimal levels of readiness.

The concept of logistics resilience has gained significant attention in recent years, particularly in the context of supply chain management. Resilience in logistics refers to the ability of a logistics system to recover from disruptions and maintain its functionality (Aloui et al., 2021). The importance of logistics resilience is underscored by the increasing complexity and vulnerability of modern supply chains, which are subject to various types of disruptions, including natural disasters, economic crises, and epidemic outbreaks (Katsaliaki et al., 2021). These disruptions can significantly impact the performance of logistics operations, leading to high supply and demand fluctuations, and necessitating major personnel, operational, and strategic changes (Gürtlich & Lampl, 2022).

Transportation management plays a crucial role in enhancing logistics resilience. Efficient transportation management can help mitigate the impact of disruptions on logistics operations by ensuring the timely and reliable delivery of goods (Walton et al., 2022). Moreover, advanced transportation management systems, leveraging digital technologies and data-driven solutions, can provide greater visibility and control over logistics operations, thereby enabling a more effective response to disruptions (Beer et al., 2022). However, the resilience of transportation systems is also subject to various challenges, including infrastructure vulnerabilities, capacity constraints, and regulatory issues (Walton et al., 2022).

Understanding the relationship between transportation management and logistics resilience is crucial for optimizing logistics operations within the defense force. By assessing the role and impact of transportation management, valuable insights can be gained into strategies and best practices that contribute to the ability of the defense force to withstand disruptions and maintain operational continuity in challenging environments. A nation's military power is intricately linked to its ability to perform these functions effectively (MOND, 2000). Moreover, the success of military logistics in achieving resilience directly influences the overall logistics performance. The resilience of a military logistics system ensures its capability to withstand disruptions, adjust to evolving conditions, and bounce back rapidly from disruptions. This, in turn, contributes to the overall efficiency and effectiveness of logistics operations. The proper management of inventory, transportation, and warehousing by military logistics ultimately determines the success or failure of military operations.

Hence, it's seamless to indicate, studying the role and impact of transportation management in the resilience of logistics, particularly within the FDRE defense force, is of great significance. By examining the relationship between transportation management and logistics resilience, this research aims to provide insights and recommendations that can enhance the defense force's ability to respond effectively to disruptions, maintain operational readiness, and ultimately support the success of military operations.

## **1.2 Statement of the Problem**

Logistics plays a critical role as a significant component of current assets in numerous organizations, involving substantial financial commitments. Effective logistics management is essential to prevent unnecessary capital tie-ups, requiring coordinated efforts across departments and careful planning (Morrison et al., 1994). The seamless operation of any organization heavily relies on planned material flow, making logistics management crucial due to the diverse inventory items involved in reception, storage, and distribution (Altekar, 2005). In the military context, logistics management plays a central role in Army operations by influencing success and combat readiness through efficient supply flow (Headquarters Department of the Army, 1985). The combat preparedness of any military organization is profoundly reliant on the caliber of its logistics

operations management, as it aims to ensure effective, efficient, and economical supply to combat soldiers.

The Ethiopian Defense Force Logistics Main Department, Despite the importance of resilience in ensuring uninterrupted operations, particularly in the face of unforeseen events, the Ethiopian Federal Democratic Republic of Ethiopia defense force encounters significant challenges in maintaining resilient logistics systems for effective response to operational disruptions and optimal readiness (Tadesse et al., 2019).

Although logistics resilience has gained attention in recent years, research that comprehensively examines the resilience of logistics within the context of the FDRE defense force appears to be limited (Dolgui et al., 2020). Furthermore, the role and impact of transportation management, a critical component of logistics operations, in enhancing logistics resilience within the defense force have not been extensively studied. The existing literature underscores the increasing complexity and vulnerability of modern supply chains, which are susceptible to various disruptions such as natural disasters, economic crises, and epidemic outbreaks (Katsaliaki et al., 2021). These disruptions can significantly impact logistics operations, necessitating significant personnel, operational, and strategic changes (Gürtlich & Lampl, 2022). Therefore, it is crucial to understand the relationship between transportation management and logistics resilience within the FDRE defense force to identify strategies and best practices that can strengthen the defense force's ability to withstand disruptions and maintain operational continuity in challenging environments.

However, the current knowledge gap regarding the specific challenges and opportunities faced by the FDRE defense force in terms of logistics resilience hampers the development of effective policies and practices (Aloui et al., 2021). Consequently, a comprehensive assessment of the role and impact of transportation management in enhancing logistics resilience within the defense force is essential to optimize logistics operations, improve response capabilities, and support the success of military operations.

To address this gap, this research aims to assess the resilience of logistics within the FDRE defense force, with a specific focus on transportation management. By analyzing the current transportation management practices and their implications for logistics resilience, this study seeks to provide a comprehensive understanding of the challenges, opportunities, and potential areas for

improvement within the defense force. The findings will contribute to the broader body of knowledge on logistics resilience in military contexts and offer practical guidance for optimizing transportation management practices to support military operations effectively (Beer et al., 2022). Ultimately, this research aims to enhance the defense force's ability to respond to disruptions, maintain operational readiness, and ensure the overall success of logistics operations (MOND, 2000).

### **1.3 Research Questions**

The primary focus of this research was to assess the impact of transportation management practice dimensions on logistics resilience: in case of Ethiopian Defense Force logistics department. Specifically, the study sought to address the following questions.

1. What is the current practice of transportation management dimensions within the FDRE Defense Force logistic department?
2. How does the current practice of the FDRE Defense Force logistic department compare to established benchmarks of logistics resilience?
3. What is the relation and impact between dimension of transport management and logistic resilience in the FDRE Defense Force's logistics department?
4. How does transportation management impact logistics resilience?

### **1.4 Objectives of the Study**

#### **1.4.1 General Objective**

To assess the impact of transportation management on logistics resilience: in case of Ethiopian Defense Force logistics department.

#### **1.4.2 Specific Objective**

In addition to the general objective, the study aimed to:

1. To assess the current state of transportation management dimensions within the FDRE Defense Force logistic department
2. To assess the current state of logistics resilience within the FDRE Defense Force logistic department.

3. To examine the relation between dimension of transport management and logistic resilience in the FDRE Defense Force's logistics department.
4. To assess the impact of transportation management practices on logistics resilience.

### **1.5 Significance of the Study**

This research addresses a significant knowledge gap by examining the impact of transportation management on the resilience of logistics within the FDRE defense force. By filling this gap, the study provides valuable insights into the challenges and opportunities the defense force faces in maintaining operational continuity and combat effectiveness. The findings contribute to the existing body of knowledge on logistics resilience and offer practical implications for other logistics-dependent organizations. Optimizing transportation management practices can lead to cost reduction and efficient resource allocation within the defense force. Ultimately, this research enhances logistics resilience, both within the military context and in other sectors, by providing practical recommendations and strategies to improve logistics operations and organizational performance.

### **1.6 Scope of the Study**

This study focused on assessing the impact of transportation management on the resilience of logistics within the Ethiopian Defense Force Logistics main department. Geographically, the research was confined to the Addis Ababa region, with the primary unit of analysis being the transportation management directorate of the Ethiopian Defense Force Logistics main department. Additionally, various stakeholder departments and units within the defense force were included to provide a comprehensive understanding of the logistics ecosystem. By narrowing the scope to these specific units, the study aimed to capture the impact and relationship between transportation management practices and logistics resilience within the defense force while also assessing the dimension of transportation management practice and current logistic resilience against established benchmark of resilience on the ministry of national defense daily operations.

Conceptually, the study delved into assessing transportation management practices through the lens of logistic resilience dimensions. It identified and analyzed key factors that contribute to the resilience of logistics operations within the defense force, with a particular focus on transportation management strategies and practices. By examining these dimensions, the study aimed to provide insights into how transportation management can be improved to enhance logistics resilience. The

study was conducted over a nine-month timeframe, allowing for a thorough investigation of transportation management practices and their impact on logistics resilience within the defense force while considering practical constraints and resource availability.

By outlining the geographical, conceptual, and time scopes, this research establishes a clear framework for assessing the impact of transportation management on the resilience of logistics within the Ethiopian Defense Force Logistics main department.

### **1.7 Definition of Terms**

As stated by Ministry of National Defense (MoND 2004), the following military and other terms were defined as they are listed below:

- ❖ **Ammunition:** Projectiles with fuses and propelling charges, fired from guns
- ❖ **Explosive:** A chemical compound or mixture ignited by heat, shock, impact, friction, or a combination thereof, producing harmful metallic particles and dusts.
- ❖ **Armament:** Weapons and military equipment utilized by an army, navy, air force, etc.
- ❖ **Defense Force:** The armed services of a country that provide protection from external and internal attacks.
- ❖ **Combat:** Fighting between armed military forces.
- ❖ **Combat readiness:** The condition of armed forces and their constituent units to perform and prevail in war.
- ❖ **Transportation management:** The planning, execution, and optimization of moving goods from one location to another, often spanning road, rail, air, and sea modes, to enable efficient and cost-effective delivery.
- ❖ **Logistics Resilience:** The ability of a logistics system to recover from disruptions and maintain its functional capabilities.

## **1.8 Organization of the Research Study**

The research study is structured across five comprehensive chapters; Chapter One provides an introductory background, including the statement of the problem, core research questions, study objectives, significance, scope, limitations, definition of key terms, and the overall organization of the study. Chapter Two focuses on reviewing the relevant literature on the topic. Chapter Three outlines the research methodology, detailing the study area, approach, design, population and sampling, data sources and types, data collection procedures, ethical considerations, and data analysis methods. The data, along with accompanying analysis and interpretation, is presented in Chapter Four. Finally, Chapter Five summarizes the key findings, draws conclusions, and offers well-informed recommendations to conclude the study.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

This chapter introduces different literature and writing on logistic resilience, military logistics, dimension of logistic resilience, transportation management. The researcher clarified the conceptual definitions of the key terms utilized in the research. Additionally, the paper included a theoretical literature review, discussed empirical studies that showcased the observations of other scholars in the relevant field, and outlined the study's conceptual framework.

#### **2.1 Introduction**

Logistics resilience plays a vital role in military operations, ensuring the availability of critical resources to support military personnel in the field. In military contexts, the ability to maintain operational continuity in the face of disruptions is of utmost importance. Transportation management emerges as a crucial factor in achieving logistics resilience, as it directly affects the timely and reliable movement of goods and supplies. According to Smith and Pettit (2011), logistics resilience is essential in military logistics, enabling forces to respond effectively to disruptions and maintain operational readiness. Therefore, understanding the impact of transportation management on logistics resilience is crucial, particularly in the context of the Ethiopian Defense Force (EDF).

##### **2.1.1 Logistics Resilience in Military Operations**

Studies by Smith and Pettit (2011) emphasize that logistics resilience is crucial in military operations, enabling the timely and reliable supply of resources to personnel. Resilience ensures operational readiness and the ability to respond to disruptions effectively. Christopher and Peck (2004) argue that logistics resilience is essential in military logistics, allowing forces to adapt to changing circumstances and maintain operational effectiveness. These studies highlight the importance of logistics resilience in military contexts, providing a foundation for the research on transportation management's impact within the Ethiopian Defense Force.

##### **2.1.2 Impact of Transportation Management on Logistics Resilience**

The transportation-and-logistics (T&L) sector has witnessed significant growth over the past decades, fueled by trends like globalization, just-in-time supply chains, and e-commerce. However, economic downturns disproportionately affect T&L companies, with historical data showing that they suffer more than the overall economy during recessions. In response, resilient organizations within this sector have outperformed their peers by maintaining financial flexibility, swiftly adapting to changing conditions, and optimizing operational effectiveness. These resilient companies not only weathered the storm but also capitalized on recovery opportunities, delivering substantial returns to shareholders. Specifically, logistics and transportation players demonstrated remarkable resilience, achieving a cumulative total return to shareholders that was 267 percent higher than their non-resilient counterparts (McKinsey, 2020). The playbook for resilience includes prudent decision-making, financial agility, cost management, and a focus on maintaining customer relationships.

Numerous studies highlight the significance of transportation management in enhancing logistics resilience. Balcik et al. (2010) emphasize the importance of transportation planning and coordination in mitigating disruptions and improving resilience in supply chains. Effective transportation management practices, such as route optimization and contingency planning, can significantly enhance logistics resilience. Similarly, Sarkis et al. (2011) argue that integrating transportation management systems with other supply chain components is critical for achieving resilience. Their findings indicate that coordinated transportation management enhances the ability to respond to disruptions and maintain operational effectiveness. These studies provide valuable insights into the impact of transportation management on logistics resilience, setting the foundation for further research in the context of the EDF.

### **2.1.2.1 Dimensions of Transportation Management**

Transportation management is a critical component of overall logistics and supply chain operations. Effective transportation management encompasses several key dimensions that can significantly impact logistic resilience, including route planning, vehicle maintenance, driver training, and load management.

#### **I. Route Planning**

Efficient route planning is essential for transportation management, as it can optimize delivery times, reduce fuel consumption, and improve overall logistical efficiency (Comi & Nuzzolo, 2021). Advanced route planning techniques, such as the use of geographic information systems (GIS) and optimization algorithms, can help organizations identify the most efficient routes, taking into account factors like traffic patterns, road conditions, and delivery schedules (Kuo et al., 2022). Effective route planning can enhance logistic resilience by ensuring timely deliveries, reducing the risk of disruptions, and improving the ability to respond to unexpected events (Klibi & Martel, 2021). Effective route planning not only optimizes delivery times and fuel consumption, but can also enhance the resilience of transportation networks by building in redundancy and flexibility. Researchers have explored the use of multi-criteria decision-making methods to select optimal routes that consider factors like traffic congestion, road conditions, and the risk of disruptions (Kuo et al., 2022). This allows organizations to develop alternative routing strategies to respond to unexpected events, such as road closures or natural disasters (Klibi & Martel, 2021).

## **II. Vehicle Maintenance**

Proper vehicle maintenance is another critical aspect of transportation management that can impact logistic resilience. Regular inspections, preventive maintenance, and timely repairs can help ensure the reliability and availability of the transportation fleet (Simić et al., 2021). Poorly maintained vehicles are more prone to breakdowns, which can lead to delivery delays, increased costs, and potential supply chain disruptions (Bravo et al., 2023). Implementing a comprehensive vehicle maintenance program can improve the overall performance and resilience of the transportation system (Zhao et al., 2022). In addition to regular preventive maintenance, researchers have highlighted the value of advanced vehicle monitoring systems to enhance transportation management and resilience. Real-time vehicle data, such as engine performance, fuel efficiency, and maintenance needs, can be used to predict and prevent breakdowns, enabling proactive maintenance and minimizing disruptions (Simić et al., 2021). Integrating vehicle monitoring with overall fleet management can further improve the reliability and responsiveness of the transportation system (Bravo et al., 2023).

## **III. Driver Training**

The quality and skills of the drivers responsible for transportation operations can also significantly influence logistic resilience. Proper driver training programs that focus on safe driving practices, fuel-efficient driving techniques, and emergency response procedures can enhance the overall reliability and responsiveness of the transportation system (Li et al., 2022). Well-trained drivers are better equipped to navigate challenging road conditions, respond to unexpected events, and maintain delivery schedules, thereby contributing to the resilience of the logistics network (Xie et al., 2021). The role of driver training extends beyond just safety and fuel efficiency. Researchers have emphasized the importance of equipping drivers with the skills and knowledge to respond effectively to emergencies and disruptions (Li et al., 2022). This includes training on alternative routing, load-shifting, and coordination with logistical partners to maintain delivery schedules and ensure the continuity of operations (Xie et al., 2021). Investing in comprehensive driver training programs can significantly enhance the resilience of transportation-dependent supply chains.

#### **IV. Load Management**

Effective load management is another important dimension of transportation management that can impact logistic resilience. Optimizing the loading and unloading of vehicles, ensuring proper load distribution, and minimizing the risk of damage or loss can help improve the efficiency and reliability of transportation operations (Demir et al., 2022). Efficient load management can also reduce the risk of delays, accidents, and supply chain disruptions, thereby enhancing the overall resilience of the logistics system (Bektaş et al., 2021). Load management strategies are increasingly being integrated with broader transportation and logistics planning to optimize the flow of goods and enhance resilience. This includes techniques like load consolidation, load balancing, and the use of intelligent transportation systems to monitor and adjust loads in real-time (Demir et al., 2022). By optimizing load planning and execution, organizations can reduce the risk of delays, damage, and disruptions, thereby improving the overall resilience of their logistics operations (Bektaş et al., 2021).

In conclusion, the various dimensions of transportation management, including route planning, vehicle maintenance, driver training, and load management, play a crucial role in determining the resilience of logistics and supply chain operations. By implementing best practices in these areas, organizations can enhance their ability to respond to unexpected events, minimize disruptions, and

maintain the smooth flow of goods and services, ultimately contributing to the overall resilience of their logistics network.

### **2.1.3 Vulnerabilities and Strategies for Enhancing Logistics Resilience**

Supply chain vulnerabilities can arise from various areas such as the structure of supplier networks, which might include a geographic concentration of production, the substitutability of suppliers, interconnectivity between suppliers, the number of tiers of suppliers in the production network, and the visibility/traceability of the relationship between the tiers (Chatham House, 2021). To enhance logistics resilience, companies can employ strategies such as understanding these vulnerabilities, diversifying suppliers, building redundancy, leveraging technology, and establishing robust risk management protocols. These strategies can help build agile and resilient logistics networks, capable of withstanding unexpected disruptions and ensuring continuous operations (Siva et al, 2024). However, the rebalancing of efficiency and resiliency is not an easy task, as increased resilience often comes with additional costs (Gartner, 2020).

A study by Christopher and Tatham (2011) discuss vulnerabilities in logistics networks and propose strategies to enhance resilience. They highlight the importance of redundancy in transportation networks, diversification of suppliers, and the use of technology for real-time monitoring and decision-making. These strategies can be applicable to military logistics, including the context of the EDF, where identifying vulnerabilities and implementing resilient strategies are crucial. Additionally, Pettit et al. (2013) emphasize the significance of collaboration and information sharing among stakeholders to identify vulnerabilities and develop resilient strategies. Their research suggests that a collaborative approach to transportation management can enhance logistics resilience. These studies provide theoretical insights and strategic guidelines for understanding and improving the impact of transportation management on logistics resilience in the specific context of the EDF.

Transportation management plays a critical role in achieving logistics resilience, especially in military operations such as those of the Ethiopian Defense Force (EDF). Effective transportation planning, coordination, and integration with other supply chain components are essential for maintaining operational continuity and mitigating disruptions. Studies by Balcik et al. (2010) and

Sarkis et al. (2011) highlight the importance of transportation management practices in enhancing logistics resilience. Additionally, studies by Christopher and Tatham (2011) and Pettit et al. (2013) provide insights into vulnerabilities and propose strategies to enhance resilience in logistics networks. These studies collectively contribute to our understanding of the impact of transportation management on logistics resilience in the context of the EDF, providing valuable insights for improving military logistics operations.

## **2.2 Theoretical Framework underpinning the study**

### **2.2.1 Complex adaptive systems theory**

The Framework of Adaptive Complex System theory is another relevant theoretical framework for studying logistics resilience in military contexts. This theory recognizes that logistics networks are dynamic and complex systems that must adapt to changing circumstances and disruptions. Within the EDF, the logistics main department operates in a constantly evolving and uncertain environment, requiring agile responses to disruptions. Complex adaptive systems theory suggests that transportation management practices need to be flexible, responsive, and capable of adapting to unforeseen events. By understanding the interconnectedness and interdependencies within the logistics network, the EDF can develop strategies to enhance logistics resilience through effective transportation management. complex adaptive systems theory emphasizes the need for adaptive and flexible transportation management practices.

### **2.2.2 Theory of supply chain resilience**

This theory has been widely employed in prior studies on logistics resilience, including those conducted in the context of Ethiopian logistics cases. Supply chain resilience theory focuses on the ability of a supply chain to withstand disruptions and quickly recover from them. It emphasizes the identification and management of vulnerabilities, the development of strategies to enhance resilience, and the integration of various stakeholders in the supply chain. This theory has been applied to military logistics contexts, including studies that specifically examine logistics resilience within the Ethiopian Defense Force. For example, a study by Chala and Tsegaye (2020) explored supply chain resilience in the context of the Ethiopian Defense Force's logistics operations. The researchers conducted a comprehensive analysis of the vulnerabilities and

challenges faced by the logistics system and proposed strategies to enhance resilience. Their study applied the principles of supply chain resilience theory to military logistics, highlighting the importance of transportation management in achieving resilience.

Another study by Assefa and Mahapatra (2020) examined the resilience of the Ethiopian Defense Force's Logistics system in the face of disruptions. The researchers employed supply chain resilience theory to analyze the impact of transportation management practices on the system's ability to recover from disruptions and maintain operational readiness. They found that effective transportation management, including route optimization and contingency planning, significantly enhanced logistics resilience within the military context. These studies demonstrate how supply chain resilience theory can be applied to military logistics, specifically within the Ethiopian Defense Force. By considering the vulnerabilities, strategies, and integration of stakeholders, this theory provides a comprehensive framework for understanding and assessing the impact of transportation management on logistics resilience.

### **2.2.3 Transportation Resource Planning (TRP) theory**

The Transportation Resource Planning (TRP) theory focuses on the efficient allocation and utilization of transportation resources. It emphasizes the optimization of transportation operations, including route planning, vehicle scheduling, and load consolidation, to improve efficiency and reduce costs. TRP theory provides insights into the strategic management of transportation resources within the Ethiopian National Defense Force, enabling better coordination and utilization of transportation assets. Previous studies in the field of transportation management have employed the TRP theory to analyze the impact of transportation planning and optimization on logistics resilience.

### **2.2.4 The Lean Transportation theory**

The Lean Transportation theory draws from the principles of Lean Management and aims to eliminate waste and improve efficiency in transportation operations. It emphasizes the identification and elimination of non-value-added activities, such as unnecessary transportation movements, delays, and excessive inventory. By implementing lean principles in transportation management, the Ethiopian National Defense Force can streamline their logistics operations,

reduce lead times, and enhance responsiveness to disruptions. Prior studies in transportation management have applied Lean Transportation theory to assess the impact of lean practices on logistics resilience and performance.

By considering the Transportation Resource Planning (TRP) theory and the Lean Transportation theory in the research study, a comprehensive understanding of the impact of transportation management on logistics resilience within the Ethiopian National Defense Force can be achieved. These theories provide valuable insights into the efficient allocation and utilization of transportation resources and the elimination of waste in transportation operations. By applying these theories, the Ethiopian National Defense Force can enhance the resilience and efficiency of their logistics operations.

### **2.3 Dimensions of Logistic Resilience**

Logistics resilience is crucial for military operations, particularly in the face of supply chain disruptions and vulnerabilities. This literature review aims to explore the dimensions of logistics resilience, specifically focusing on supply chain disruptions and vulnerabilities in transportation networks. Logistic resilience has emerged as a crucial concept in the field of supply chain management, as organizations strive to enhance their ability to withstand and recover from disruptions. Logistic resilience can be characterized by three key dimensions: the ability to recover from disruptions, the ability to adapt to changes, and the ability to maintain continuity of operations.

#### **I. Ability to Recover from Disruptions**

The first dimension of logistic resilience is the organization's ability to recover from disruptions. This refers to the capacity to restore normal operations and minimize the impact of unexpected events, such as natural disasters, supply chain breakdowns, or sudden demand changes (Kamalahmadi & Parast, 2016). Researchers have emphasized the importance of developing robust contingency plans, maintaining backup suppliers and transportation options, and implementing effective risk management strategies to enhance the organization's recovery capabilities (Bhamra et al., 2021). The timely and efficient restoration of logistics operations is crucial for maintaining

customer satisfaction, preserving market share, and ensuring the long-term viability of the organization (Tukamuhabwa et al., 2015).

## **II. Ability to Adapt to Changes**

The second dimension of logistic resilience is the organization's ability to adapt to changes in the business environment. This encompasses the capacity to anticipate and respond to evolving market conditions, technological advancements, and shifting customer preferences (Ponomarov & Holcomb, 2009). Resilient organizations demonstrate agility in their logistics operations, enabling them to quickly adjust their strategies, processes, and resources to capitalize on new opportunities or mitigate emerging threats (Longo & Oren, 2018). This adaptability is often driven by a culture of innovation, cross-functional collaboration, and continuous learning within the organization (Ivanov, 2020).

## **III. Ability to Maintain Continuity of Operations**

The third dimension of logistic resilience is the organization's ability to maintain the continuity of its operations during disruptive events. This involves the implementation of robust contingency plans, backup systems, and redundancy measures to ensure the uninterrupted flow of goods and services, even in the face of unexpected challenges (Hohenstein et al., 2015). Resilient organizations prioritize the identification and mitigation of potential vulnerabilities within their logistics networks, leveraging technologies such as real-time monitoring, predictive analytics, and supply chain visibility to enhance their response capabilities (Dolgui et al., 2020). By maintaining operational continuity, organizations can minimize the financial and reputational impact of disruptions, preserving their competitive advantage and market position (Scholten & Schilder, 2015).

The three dimensions of logistic resilience – the ability to recover from disruptions, the ability to adapt to changes, and the ability to maintain continuity of operations – are closely interrelated and often synergistic. For instance, an organization's capacity to recover from a disruption can be enhanced by its ability to adapt to changing market conditions and leverage new technologies or strategies (Ivanov & Dolgui, 2020). Similarly, the ability to maintain operational continuity during a disruption can facilitate the organization's recovery and adaptation efforts, enabling it to emerge

stronger and more resilient (Sheffi & Rice, 2005). By cultivating these three dimensions of logistic resilience, organizations can build a comprehensive and effective response to the dynamic and uncertain business environment (Kamalahmadi & Parast, 2016).

Logistic resilience is a multifaceted concept that encompasses the organization's ability to recover from disruptions, adapt to changes, and maintain continuity of operations. Developing these three key dimensions of logistic resilience is crucial for organizations to navigate the challenges of a complex and volatile business landscape, ensuring the long-term sustainability and competitiveness of their logistics operations.

### **2.3.1 Supply Chain Disruptions and logistic resilience**

Military logistics face various disruptions, including conflicts and natural disasters. Conflicts, such as armed conflicts or military operations, can severely impact transportation infrastructure, disrupt supply routes, and hinder logistics operations (Gürtlich & Lampl, 2022). Similarly, natural disasters such as earthquakes, floods, or hurricanes can cause significant disruptions by damaging transportation networks and facilities (Beer et al., 2022). These disruptions highlight the importance of understanding how transportation management practices can influence logistics resilience during such events.

### **2.3.2 Transportation Management and Resilience during Disruptions**

Transportation management plays a critical role in enhancing logistics resilience during disruptions. Effective transportation management practices can help mitigate the impact of disruptions and ensure timely response and recovery. For instance, studies have shown that proactive planning, such as developing contingency plans and establishing alternative transportation routes, can enhance logistics resilience during conflicts or natural disasters (van Wassenhove, 2006). Additionally, efficient coordination and communication among stakeholders involved in transportation are essential for maintaining resilience (Beer et al., 2022). Additionally, efficient coordination and communication among stakeholders involved in transportation management, such as military personnel, suppliers, and transportation service providers, are crucial for maintaining resilience (Gürtlich & Lampl, 2022).

### **2.3.3 Vulnerabilities in Transportation Networks**

Transportation networks are susceptible to vulnerabilities that can impede logistics resilience. These vulnerabilities can include inadequate infrastructure, limited capacity, or outdated technology. For example, outdated road networks or insufficient port facilities can hinder the transportation of military supplies during emergencies (Beer et al., 2022). Additionally, security vulnerabilities, such as the risk of theft or sabotage, can further compromise transportation networks (van Wassenhove, 2006). Identifying and understanding these vulnerabilities is essential for developing strategies to enhance logistics resilience.

#### **2.3.4 Risk Assessment Practices in Transportation Infrastructure**

Risk assessment of transportation infrastructure is a fundamental step in identifying vulnerabilities and mitigating potential disruptions. It involves evaluating the probability and impact of risks associated with transportation networks. Effective risk assessment practices can aid in prioritizing investments, implementing preventive measures, and allocating resources for resilience enhancement. For instance, studies have highlighted the importance of conducting comprehensive risk assessments to identify critical transportation infrastructure and prioritize their protection (Gürtlich & Lampl, 2022). Additionally, leveraging advanced technologies, such as remote sensing or predictive modeling, can improve the accuracy and efficiency of risk assessment practices (Beer et al., 2022).

This theoretical literature review has explored the dimensions of logistics resilience in military contexts, specifically focusing on supply chain disruptions and vulnerabilities in transportation networks. It highlighted the importance of transportation management practices in enhancing resilience during disruptions and emphasized the need for effective risk assessment practices related to transportation infrastructure. By considering these dimensions, military organizations can develop strategies to enhance logistics resilience and ensure reliable and efficient transportation operations in the face of disruptions.

#### **2.4 Transportation Management Strategies**

The transportation infrastructure consists of two main categories: static and dynamic components. Static components include the physical attributes of lines of communication (LOC) such as road networks, railway systems, waterways, sea-lanes, aerial routes, seaports, and airports.

Dynamic components, on the other hand, refer to transportation means like cargo planes, ships, containers, trains, trucks, and transporters (Moshe, 2022).

Logistic resources encompass both materiel and personnel that move through the logistics network with the primary aim of sustaining and supporting military operations. Therefore, logistic resources form the logistics network. Transportation means facilitate the movement of these resources by carrying personnel, equipment, and supplies. Common transportation means include trucks, tankers, transporters, trains, ships, helicopters, and airplanes. Logistics deployment involves the specific implementation of the logistics network, determining the size, composition, and location of theater facilities. It also establishes the lines of communication and influences the feasible flow rate and mix of logistics passing through the network.

The Logistics Support Chain is a conceptual cycle of processes and events aimed at sustaining ongoing military operations. This chain includes two main segments: the demand segment and the supply segment. In the demand segment, tactical units present their requirements, which are communicated through command channels to operational or strategic logistics sources. In the supply segment, resources are moved through the logistics network from sources or intermediate nodes to tactical destinations. The evacuation of personnel and equipment is also part of the logistics support chain, representing a flow from tactical nodes back to the rear. A critical requirement of any military logistics system is the capability to move forces and resources effectively (Moshe, 2002).

Transportation management strategies play a vital role in ensuring efficient and resilient logistics operations. This literature review aims to explore key dimensions of transportation management strategies, with a focus on diversification and redundancy, as well as collaboration and information sharing. By examining strategies for diversifying transportation routes and suppliers, understanding the role of redundancy in ensuring continuity, investigating collaborative efforts among stakeholders, and highlighting the importance of information sharing, this review provides insights into effective transportation management in various contexts.

#### **2.4.1 Diversification and Redundancy**

Diversifying transportation routes and suppliers is a crucial strategy for enhancing logistics resilience. By exploring alternative transportation routes and engaging multiple suppliers,

organizations can mitigate the impact of disruptions and reduce dependency on a single source. Studies have shown that diversification of transportation routes can improve resilience by providing flexibility and options during disruptions (Gürtlich & Lampl, 2022). Similarly, diversifying suppliers can enhance resilience by preventing disruptions caused by supplier failures or disruptions in a specific region (Beer et al., 2022). This strategy promotes adaptability and reduces the vulnerability of transportation operations to disruptions.

#### **2.4.2 The Role of Redundancy in Ensuring Continuity**

Redundancy is another important aspect of transportation management strategies for ensuring continuity. It involves having backup systems, resources, or routes in place to maintain operations in the event of disruptions. Redundancy provides a safety net against unexpected events and enables organizations to quickly recover from disruptions. For example, establishing redundant transportation routes or duplicate supply chains can help mitigate the impact of disruptions on logistics operations (Gürtlich & Lampl, 2022). Studies have emphasized the importance of redundancy in ensuring the continuous flow of goods and services, particularly during emergencies or high-demand situations (Beer et al., 2022).

#### **2.4.3 Collaboration and Information Sharing**

Collaborative efforts among stakeholders, such as the Ethiopian Defense Forces (EDF), civilian agencies, and international partners, are essential for effective transportation management. Collaboration fosters coordination, resource sharing, and joint decision-making, leading to improved logistics outcomes. Investigating collaborative efforts in transportation management can provide valuable insights into successful practices. For instance, studies have highlighted the importance of establishing partnerships between military and civilian agencies to leverage shared resources and expertise during transportation operations (Zsidisin et al., 2020). Collaboration also enables the pooling of transportation assets, such as vehicles or infrastructure, to enhance efficiency and resilience (Beer et al., 2022).

Information sharing is a critical component of collaboration and effective transportation management. Timely and accurate information exchange among stakeholders facilitates better decision-making and coordination. Studies have emphasized the importance of information sharing platforms and technologies in enhancing transportation management. For example,

utilizing real-time tracking systems or digital platforms for sharing transportation-related information can improve visibility, responsiveness, and overall logistics resilience (Valashiya & Luke, 2022). Information sharing enables stakeholders to anticipate and respond to disruptions, optimize transportation routes, and allocate resources efficiently.

This theoretical literature review has explored transportation management strategies, focusing on diversification and redundancy, as well as collaboration and information sharing. By diversifying transportation routes and suppliers, organizations can enhance resilience and reduce dependency on single sources. Redundancy ensures continuity by establishing backup systems and resources. Collaboration among stakeholders, including the EDF, civilian agencies, and international partners, fosters coordination and resource sharing. Effective information sharing facilitates better decision-making and enhances transportation management. By considering these strategies, organizations can improve their transportation operations, ensuring resilience, and efficiency in the face of disruptions.

## **2.5 Empirical Review**

The article "Logistics Resilience in African Armed Forces: A Case Study Approach" by Nwaogbe et al. is a significant work that examines the logistics resilience of African armed forces using a case study approach. The authors specifically investigate the challenges faced by armed forces in Nigeria, South Africa, and Ethiopia, shedding light on the factors that impact logistics resilience in the African context.

The case studies conducted by the authors reveals several common themes. Firstly, inadequate infrastructure and transportation networks emerge as significant obstacles to logistics resilience in African armed forces. Insufficient road conditions, limited air transport capabilities, and inadequate port facilities all contribute to delays in the timely movement of personnel, equipment, and supplies. Secondly, the authors emphasize the critical role of coordination and collaboration among various stakeholders, including the military, government agencies, and civilian organizations. Effective communication and information sharing are vital for enhancing logistics resilience and ensuring efficient resource allocation. Thirdly, the authors highlight the necessity of strategic planning and investment in logistics capabilities. This entails developing robust supply chains, implementing modern inventory management systems, and investing in training and

capacity building for logistics personnel. The article also emphasizes the role of technology in enhancing logistics resilience. The authors discuss the potential advantages offered by technologies such as GPS tracking, real-time data analytics, and remote sensing in improving supply chain visibility, optimizing routes, and facilitating decision-making.

Another relevant work is the article "Resilience Assessment Tool for Defense Transportation Networks" by Karabasoglu et al., which introduces a comprehensive framework for evaluating and enhancing the resilience of defense transportation networks. The authors emphasize the criticality of resilient transportation networks in supporting military operations and propose a three-step approach for resilience assessment and improvement (Karabasoglu et al., 2003).

The article acknowledges the unique challenges faced by defense transportation networks, including the need for rapid mobilization, potential disruptions from enemy actions or natural disasters, and efficient resource allocation. To address these challenges, the authors advocate for the assessment and enhancement of network resilience to ensure the timely and effective movement of personnel and resources.

The proposed resilience assessment tool consists of three main steps: network characterization, vulnerability assessment, and resilience evaluation. The authors stress the importance of integrating the assessment tool into the decision-making process of defense transportation networks (Karabasoglu et al., 2003). By quantitatively assessing network resilience, decision-makers can make informed choices regarding resource allocation, risk management, and contingency planning. Through a case study, the article demonstrates the practical application of the resilience assessment tool, showcasing its ability to identify vulnerabilities, evaluate mitigation strategies, and guide decision-making to enhance network resilience.

The empirical literature review in the current study focuses on assessing the impact of transportation management on logistics resilience within the context of the Ethiopian Defense Force (EDF). The review provides an overview of the EDF's logistics operations and highlights specific transportation challenges faced by the EDF, including rugged terrain and geopolitical factors. The EDF plays a critical role in ensuring the defense and security of Ethiopia, and its logistics operations are vital for the efficient movement of personnel, equipment, and supplies.

The empirical evidence presented in the literature review showcases case studies and studies that have examined the relationship between transportation management and logistics resilience within the EDF context.

One key transportation challenge faced by the EDF is the rugged terrain of Ethiopia. The country's diverse topography, including mountains, valleys, and plateaus, poses significant logistical challenges. Studies have explored how transportation management strategies, such as route optimization and vehicle selection, can help navigate and overcome these geographical obstacles. Additionally, the literature has highlighted the importance of considering the specific requirements of different terrains in transportation planning and resource allocation to enhance logistics resilience. Geopolitical factors also contribute to transportation challenges within the EDF context. Ethiopia's geopolitical position and its relationships with neighbouring countries impact transportation routes, cross-border logistics, and supply chain security. Empirical studies have examined the influence of geopolitical factors on transportation management and logistics resilience, emphasizing the need for flexible and adaptable strategies to mitigate risks and disruptions (Gürtlich & Lampl, 2022).

The study titled "Resilience and Military Supply Chain Management" by Gerhard Gürtlich & Stefan Lampl (2017) examines the significance of Military Supply Chain Management (MSC) in maintaining the sustainability of military operations. The research by Gürtlich & Lampl (2017) highlights several key factors that contribute to the effectiveness of MSC, including focused logistics, precision and velocity in operations, coordinated delivery schedules, fast and flexible distribution, resilience planning, and the presence of robust infrastructure and equipment at distribution centers. While the study does not focus specifically on the Ethiopian context, the principles discussed by Gürtlich & Lampl (2017) are considered relevant and applicable to the logistics operations in Ethiopia.

The study by Gürtlich & Lampl (2017) underscores the importance of focused logistics in military supply chains. This involves aligning the allocation of resources, transportation routes, and inventory management to support the specific needs of military operations. By ensuring that resources are efficiently channelled to the right places at the right time, the military can optimize its logistical capabilities and improve operational efficiency. Precision and velocity, coordinated

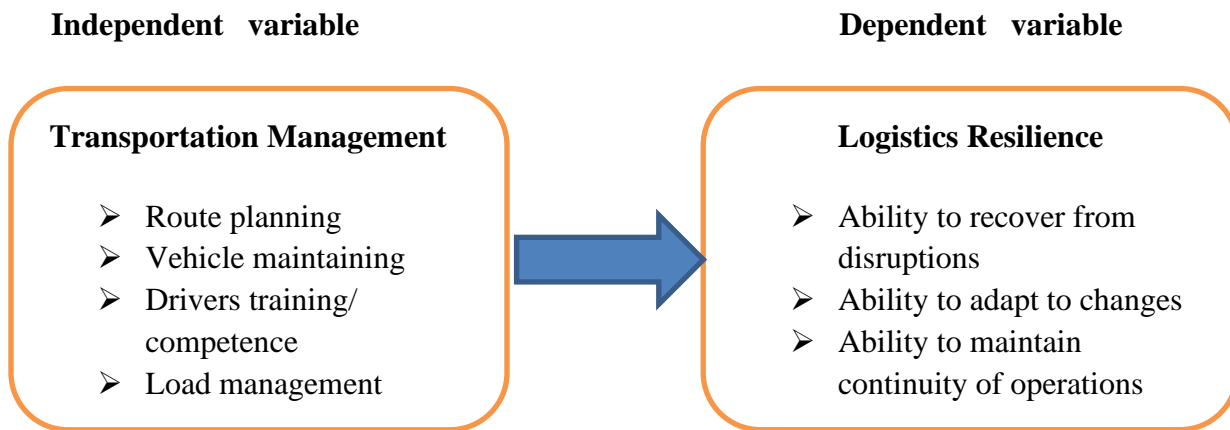
delivery schedules, fast and flexible distribution, resilience planning, and the presence of robust infrastructure and equipment at distribution centers are also highlighted as critical elements for a resilient military supply chain. While the study by Gürtlich & Lampl (2017) does not specifically focus on the Ethiopian context, the principles and concepts discussed provide valuable insights into the key factors that contribute to a resilient military supply chain. By considering and implementing these principles, the Ethiopian military can enhance its logistics operations and improve the sustainability and effectiveness of its military operations.

The study by Gürtlich & Lampl (2017) also emphasizes the importance of fast and flexible distribution in military supply chain resilience. Rapid distribution capabilities enable the military to quickly deploy resources to the point of need, even in challenging or rapidly changing operational environments. Flexibility in distribution strategies allows for adaptive responses to unexpected disruptions, ensuring continuity of operations. Resilience planning is a key consideration in military supply chain management. The study by Gürtlich & Lampl (2017) highlights the need for proactive risk assessment, contingency planning, and the development of alternative supply routes and sources. By identifying vulnerabilities and implementing appropriate mitigation measures, the military can enhance its ability to withstand and recover from disruptions. Lastly, the study by Gürtlich & Lampl (2017) emphasizes the significance of good infrastructure and equipment at distribution centers. Efficient storage facilities, reliable transportation assets, and advanced technology systems play a vital role in ensuring smooth logistics operations. Well-maintained infrastructure and appropriate equipment contribute to the overall resilience and effectiveness of the military supply chain. While the study by Gürtlich & Lampl (2017) does not specifically focus on the Ethiopian context, the principles and concepts discussed provide valuable insights into the key factors that contribute to a resilient military supply chain. By considering and implementing these principles, the Ethiopian military can enhance its logistics operations and improve the sustainability and effectiveness of its military operations.

## 2.6 Conceptual Framework

As According to Kombo and Tromp (2009), a concept represents an abstract or generalized idea derived from specific instances. A conceptual framework consists of broad ideas and principles drawn from pertinent fields, used to structure subsequent presentations. Mugenda (2003) describes a conceptual framework as a hypothesized model that identifies the study model and the relationships between dependent and independent variables. Kothari (2004) defines an independent variable, also known as an explanatory variable, as the presumed cause of changes in the dependent variable, while the dependent variable is the one that the researcher aims to explain. The purpose of a conceptual framework is to categorize and describe concepts relevant to the study and illustrate relationships among them. This framework aids researchers in defining concepts, mapping the research terrain or conceptual scope, organizing relationships among concepts, and identifying gaps in the literature (Creswell, 2003).

For this study, the conceptual framework was established based on key concepts identified in the literature review. It was utilized to analyze the research findings, focusing on how transportation management practices impact logistics resilience within the Ethiopian Defense Force Logistics Main Department. This relationship is illustrated in the figure below.



Source :( *Supply chain resilience: A systematic literature review and agenda for future research.*)  
*International Journal of Production Economics*, 244, 108504. By Gürtlich, M., & Lampl, H. (2022).

## **2.7 Summary of Empirical Review and Research Gap**

The empirical literature review provides case studies and real-world examples that illustrate the impact of transportation management on logistics resilience within the EDF. These studies analyze the effectiveness of specific transportation management strategies, such as diversification of transportation routes, collaboration with civilian agencies, and information sharing with international partners (Beer et al., 2022). The findings highlight the positive outcomes of implementing robust transportation management practices in enhancing logistics resilience, ensuring timely and efficient delivery of supplies and support during military operations.

In conclusion, the empirical literature review on assessing the impact of transportation management on logistics resilience within the EDF context highlights the significance of understanding and addressing specific transportation challenges. The review emphasizes the importance of considering rugged terrain and geopolitical factors in transportation planning and resource allocation. The empirical evidence presented in the literature showcases the efficacy of various transportation management strategies in enhancing logistics resilience within the EDF, providing valuable insights for improving transportation operations and ensuring effective support for defense and security initiatives.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

This chapter provided a detailed overview of the study area, the research design implemented, and the types of data and information required. It also outlined the sampling techniques, sample size, data collection instruments, data analysis methods, and the anticipated results. According to Kothari (2004), research methodology is the scientific study of how research is systematically conducted, while research methods encompass all techniques used in conducting research. This chapter elaborates on the methods employed in the study, describing the research approach and design, including the population, sample, and sampling techniques, as well as the instruments used for data collection. It further discusses the data collection procedures and the plan for data analysis.

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

The research that was undertaken examined the concept of Assessment of the Impact of Transportation Management on logistics Resilience in the case of FDRE Defense Force. primary data collection for this research was conducted through the Ethiopian Defense Force Logistics main department headquartered in Addis Ababa, the capital city of Ethiopia. Specifically, the logistics department offices were centered in the Lideta sub-city of Addis Ababa within the Torhailoch district. In addition to its central administration situated in this downtown district, the defense force logistics operation had various divisional units and sections dispersed throughout the metropolitan area. Some of the additional facilities maintaining important logistical functions could be found in outlying locales such as Janmeda and Kaliti.

#### **3.2 Research Design**

The research design provides conceptual framework for how an investigation is conducted and helps map out the collection, measurement data and analysis of data, as described by Kothari in 2006. This study employed a descriptive research approach incorporating both qualitative and quantitative methods since the core objective involved determining existing issues within the current transportation management practices and describing those problems while also examining the relationship between transportation management and logistics resilience. Given that the work

was implemented once and involved a limited set of variables deemed crucial, a cross-sectional survey strategy was utilized at that time to collect views through posing questions to representative percentage of the population.

The researcher applied descriptive research techniques combining both qualitative and quantitative components. This dual faceted design allowed for effectively evaluating the impact of transportation management on logistics resilience within the Ethiopian Defense Force context. As noted by Johnston in 2010, incorporating mixed methods is now viewed as a mechanism for substantiating single method results through parallel tracks. While a quantitative element was chosen for facilitating collection of a large data set and thoroughly canvassing pressing matters during a set timeframe, the qualitative aspect aimed to generate meanings and phenomena within participants' real-world settings per the understanding put forth by Kothari in 2004. Therefore, adopting an integrated approach supported reinforcing the robustness of the findings through triangulation.

### **3.3 Research Approach**

The researcher strategically applied a mixed-methods approach, leveraging qualitative and quantitative research methodologies, to facilitate comprehensive and robust data collection and analysis for this study. The qualitative aspect enabled the researcher to describe the actual phenomenon in a deep, contextual manner, providing rich experiential insights. Conversely, the quantitative method served as an appropriate means to conduct statistical techniques based on numerical facts and measurable relationships pertaining to the research problem. By amalgamating these complementary inductive and deductive modalities, the investigator strived to develop a balanced understanding of both experiential perspectives and measurable outcomes. This strategic mixing of qualitative and quantitative data collection and analysis techniques aimed to allow for triangulating emergent insights, thereby fortifying the integrity and credibility of any ensuing conclusions regarding the topic under exploration. The researcher's judicious application of this mixed-methods approach enabled effective and efficient data gathering and examination, ultimately leading to a more comprehensive and well-rounded investigation of the phenomenon.

### **3.4 Population and Sample**

#### **3.4.1 Population**

The study population comprised a diverse group of personnel employed within the main Defense Logistics department. Specifically, the targeted participants were staff members working across various functional units, including the transportation division. In total, the department had 204 employees. This workforce exhibited a wide range of demographic characteristics. Employees spanned different age groups, genders, and ethnic backgrounds. Additionally, they had obtained their educational credentials from various universities and colleges throughout the country. Both English and the local Amharic language were utilized for all official communications and daily operations. For the purposes of analysis, the researcher organized this overarching employee population into several subgroups. These included the headquarters staff (12 individuals), the maintenance and inspection crew (25), the supply and storage of vehicles team (30), the administrative and finance unit (18), the transport operators' group (52), and the referral garage personnel (67). Together, these subgroups made up the full 204-person workforce under investigation.

### **3.4.2 Sample**

A sample is a subset or portion of the total population, whereas population is totality of the objects under investigation (Kothari, 2004). As indicated before in the population part in the above, in this study, the target population on which the study obtained information was all employees in transport departments under Defense Logistics main department and the representative sample was taken from the indicated population.

As Kothari (2004) defined, a sample refers to a subset or portion extracted from the overall population, whereas a population constitutes the full collection of entities under examination. As previously mentioned regarding the delineated population for this research, the targeted group from which data was gathered included all employees within the transport departments operating under the Defense Logistics main department umbrella. A representative sample was selected from this indicated population to obtain insights for the investigation.

#### **3.4.2.1 Sampling Technique**

Sampling technique refers to the method used for selecting items for the sample. Stratified random sampling was the technique employed in this study. As Yamane (2007) explained, stratified

random sampling is a useful data collection method when the population is heterogeneous. As previously mentioned regarding the characterized population for this research, stratified random sampling was deemed an appropriate approach since the target population was heterogeneous. This technique was also suitable for maintaining proportionality of the sample drawn from each stratum. Accordingly, the target population was stratified into six strata: headquarters staff, maintenance and inspection, supply and storage of vehicles, administrative and finance, transport operators, and referral garage. After stratifying the target population in this manner, a suitable sample was randomly and proportionally selected from each stratum using Yamane's (2007) formula.

### 3.4.2.2 Sample Size

Sample size refers to the number of items selected from the total population to comprise the sample. The sample size should be neither excessively large nor too small, but rather optimum - fulfilling requirements for effectiveness, representativeness, reliability and flexibility (Kothari, 2004). Budgetary constraints must also be considered when determining the sample and size. This study utilized stratified sampling techniques given the heterogeneous nature of the defense logistics main department's transportation functions and the need to adequately represent each stratum. As such, the population was stratified into six main groups based on departmental affiliations: headquarters, maintenance and inspection, supply and storage of vehicles, administrative and finance, transport operators, and referral garage. Once the strata were identified, random sampling was employed to select sample cases from the master lists. This sampling approach was chosen over a census due to constrained resources and time, yet enabled rapidly collecting critical information.

Determining of Sample Size (n):

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

Where: n = the sample size

N=the study population

e = the level of precision, 1 = designates the probability of the event occurring

Therefore: from the formula  $n = \frac{N}{1 + N(e)^2}$

$$1 + N(e)^2$$

$n$  = the sample size = 204

$$1 + 204(0.05)^2$$

Therefore,  $n$  = the sample size = 135 respondents will be used as sample for this study to gather data through questionnaire.

The sample size for each department can be calculated by using proportion.

Formula;  $n_i = \frac{n * N_i}{N}$

$$N$$

Where:  $n_i$  = the sample size for individual departments

$N_i$  = the total number of employees in each departments/stratum

$N$  = the total number of populations in the study

$n$  = the total sample size for selected stratum

When using a stratified sampling technique, we usually follow the method of proportional allocation under which the sizes of samples from the different strata are kept proportional to the size of the strata. That is, if  $P_i$  represents the proportion of population included in stratum  $i$ , and  $n$  represents the total sample size, the number of elements selected from stratum  $i$  is  $n.p_i$ . (Kothari, 2004)

Table 3 1 Sample size determination

Departments	Total population of each stratum	Sample size of each Stratum
Head office	12	8
Maintenance and Inspection	25	17
Supply and Storage of vehicles	30	20

Administrative and Finance	18	12
Transport Operators	52	34
Referral Garage	67	44
Total	<b>204</b>	<b>135</b>

---

*Source: (DLMDTD Human Resource Department 2023)*

### **3.5 Data Sources and Types**

#### **3.5.1 Data Sources**

To obtain rich and well-rounded information from the sampled group, both primary and secondary data sources were leveraged. Primary data came directly from selected individuals actively involved in transportation functions. Secondary data sources included annual reports from the Ethiopian Defense Force Logistics main department as well as various Internet resources. This approach allowed for gaining both first-hand perspectives and contextualizing insights from organizational documentation and online materials. Triangulating multiple sources of evidence in this way served to develop a more robust understanding of the research problem under examination.

#### **3.5.2 Data types**

Data are facts, figures and other relevant materials past and present serving as bases for study and analysis (Krishnaswami, 2003). This research considers two types of data: primary data and secondary data. To conduct an effective and reliable study yielding high-quality findings regarding the assessment of transportation management's impact on logistics resilience within the FDRE defense force context, both primary and secondary data were collected. Primary sources allowed for gaining first-hand insights specific to the research aims. Meanwhile, secondary data offered supplementary contextual understanding to support and bolster emergent conclusions (Krishnaswami, 2003). Employing this dual approach leveraging multiple data types served to

strengthen the validity and usefulness of any results and implications generated from comprehending this particular organizational issue from varied perspectives.

### **3.5.2.1 Primary Data**

Primary data constitute information specifically gathered novelly and originally for the research at hand (Kothari, 2004). Within this study, primary data collection involved conducting personal interviews utilizing structured questionnaires. Study participants were asked to complete the questionnaires, which incorporated both closed-ended five-point Likert scale questions as well as open-ended short answer items eliciting perspectives directly from respondents themselves. This approach allowed for gaining first-hand insight into perceptions and experiences directly from those involved and knowledgeable about the logistics practices under review (Kothari, 2004), thereby serving the objective of acquiring original primary source material suited specifically for addressing the research problem and questions.

### **3.5.2.2 Secondary Data**

Secondary data comprise information acquired from pre-existing literature sources that had been previously collected by others for different aims (Saunders et al., 2007). This type of data provides supplementary second-hand information involving both raw and published materials. In this study, secondary data were extracted from documented records housed at the Defense Logistics main department deemed relevant to the examination of transportation management's impact on logistics resilience within the context of the FDRE defense force. Reviewing such organizational documentation offered supplementary contextual insights beyond the primary interviews and surveys, thereby serving to triangulate and corroborate emergent study findings as suggested by Saunders and colleagues (2007).

### **3.5.2.3 Review of Documents**

Documentation is a methodology involving collection of data from secondary sources (Saunders et al., 2007). Documentary information distribution plays a pivotal role in knowledge dissemination across various fields of study. Potential documentary sources of research data encompass published books, journals, research reports, newspapers, annual reports from pertinent organizations, and other unpublished works (Saunders et al., 2007). Within this investigation,

documentary materials comprised annual reports authored by the Defense Logistics main department as well as relevant online resources. Reviewing such organizational documents and Internet materials provided supplementary contextual insights beyond primary interviews and surveys. This approach served to corroborate emergent study insights as advocated by Saunders and colleagues for strengthening research rigor and validity.

### **3.5.3 Data Collection Instruments**

#### **3.5.3.1 Interview**

The interview methodology consists of collecting data through oral-verbal questioning and responses (Kothari, 2004). Personal interviews involve one individual known as the interviewer directly asking questions, generally via face-to-face contact, of one or more other individuals. At times, the interviewee may also pose questions prompting responses from the interviewer. However, the interviewer typically initiates the interaction and facilitates collection of perspectives and insights from the interviewee(s) (Kothari, 2004). Within this research, structured questionnaires containing both closed-ended and open-ended questions were administered to selected study participants via personal interviews. This approach allowed for gaining nuanced, first-hand input directly from knowledgeable respondents as suggested by Kothari for strengthening qualitative exploration of the research problem.

#### **3.5.3.2 Questionnaire**

A questionnaire refers to a standardized set of inquiries aimed at soliciting pertinent information (Kothari, 2004). For this study, structured questionnaires were developed containing closed-ended questions designed to reliably and validly assess transportation management's impact on logistics resilience within the FDRE defense force context. These questionnaires were administered to targeted respondents. Closed-ended questions facilitated easier analysis, were more efficient to administer, and proved more economical in terms of time and costs compared to open-ended formats. Additionally, closed questions served to minimize potential bias. While some questions were adopted from prior literature, others were modified by the researcher to suit the specific research objectives and curiosities under consideration. Overall, this systematic approach to primary data collection supported gathering meaningful insights (Kothari, 2004).

### **3.6 Ethical Consideration**

Successful research necessitates cooperation and coordination incorporating ethical standards to foster collaborative efforts among diverse individuals, disciplines, and institutions (Akaranga & Makau, 2016). This includes principles such as trust, accountability, mutual respect, and fairness. Researchers should adhere to guidelines regarding authorship, copyright, data sharing policies, and confidentiality in studying organizations (Akaranga & Makau, 2016). As Kothari (2004) notes, participants should voluntarily consent to involvement following understanding of the research topic.

In this study, ethical protocols were followed. A formal letter was obtained from Addis Ababa University granting permission. Confidentiality of responses was maintained and respondents were informed in advance about the study purpose and asked to willingly participate. Irrelevant organizational information and personal details were excluded from analysis and reporting. Questionnaires focused on gathering perspectives related to impacts rather than personal information. After collection, questionnaires were coded and kept confidential to protect respondent anonymity. Proper citation has also been employed to avoid plagiarism. This approach upheld research standards and ethics throughout the process as suggested by scholars.

### **3.7 Data Analysis**

The researcher then applied descriptive and regression data analysis method by using Statistical Package for Social Science (SPSS). The reason for this type of approach was the characteristic of this study which was to assess the impact of transportation management in logistic resilience and describe those effects as they are and find out what effects they have on logistics resilience. The research approach of this study was based on describing the facts to be gained from the sample population. So, the data to be collected from questionnaire was analyzed by using Statistical Package for the Social Science (SPSS) version 27.1, table, percentage & regression model and they were interpreted according to their type. According to Philip Mayring (2014), the data to be collected from interview will be analyzed by using inductive content analysis method. Finally, triangulating interview and survey responses enhanced validity as advocated for mixed methods

research. This study examined the relationship between dependent and independent variables using multiple regression analysis, assuming a linear relationship expressed as:

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + e \quad Y \text{ is logistics resilience}$$

Where  $B_0$  is the intercept of the model

$B_1 \dots B_3$  is coefficient of the independent variable

$X_1$  is routing planning

$X_2$  is vehicle maintenance

$X_3$  is driver trading

$X_4$  is load management

$e$ : is Error

### 3.8 Validity and Reliability

#### 3.8.1 Validity

Instrument validity refers to the degree to which a tool measures what it intends to (Polit & Hungler, 1993). Validity includes internal and external components. Internal validity indicates the research design's ability to appropriately address research questions, while external examines generalizability to the target population. For internal validity in this study, questionnaires incorporated diverse items assessing top management and staff knowledge of transportation management and its influence on logistics resilience within the Ethiopian Defense Force Logistics main department. Questions aligned with literature review findings to ensure representative coverage for respondents. Consistent administration by the researcher personally among 135 participants further supported internal validity. Items used clear, simple language for comprehension. Subjects received clear instructions. Finally, questionnaires underwent expert evaluation by transportation management specialists. Experts confirmed standardization of most items but advised reshaping some modified questions to better fit research objectives, as the

researcher then applied (Polit & Hungler, 1993). This process aimed to establish content validity as recommended.

### 3.8.1 Reliability

Reliability refers to an instrument's capacity to generate consistent and stable measurements over time (Cooper & Schindler, 2003; Polit & Hungler, 1993). Reliability evaluates stability, equivalence, and internal coherence of responses according to these scholars. Specifically, reliability assesses the degree to which a tool accurately gauges the attribute it aims to measure. A commonly employed reliability coefficient is Cronbach's alpha, which determines an instrument's internal consistency by evaluating how all items relate to one another and the total scale. In this study, Cronbach's alpha analysis evaluated the reliability of proposed constructs as recommended. A pilot study involved 38 employees, comprising 18.6% of the total sample, to test the instrument prior to full data collection. This process aimed to establish measurement reliability through internal coherence of responses, as advocated by experts in the field. Feedback informed finalizing the questionnaire to ensure generating stable and consistent data over time.

Table 3.2 Reliability statistics of the pilot test

Reliability Statistics	
Cronbach's Alpha	N of Items
.833	38

Source: SPSS 27.1 output (2024)

Previous research has established 0.70 as an acceptable standard of reliability for most social science research applications utilizing Cronbach's alpha (Cronbach, 1951). The Cronbach's alpha measurement from the pilot test in this study was 0.833, indicating internally consistent and stable responses as shown in Table 3.2.

Reliability of the main dataset was similarly evaluated using Cronbach's alpha analyses for each variable, with results presented in Table 3.2. Achieving a Cronbach's alpha above the 0.70 threshold established by Cronbach (1951) supported the instrument demonstrating adequate internal reliability to consistently measure the intended constructs over repeated administrations

as advocated. Overall, the reliability testing procedures helped ensure the questionnaire would generate reliable data appropriate for addressing the research questions.

Table 3.3 Reliability test of the main data

<b>Reliability Statistics</b>		
	Cronbach's Alpha	N of Items
Route planning	.767	5
Vehicle maintenance	.773	6
Driver training	.761	4
Load management	.783	6
Logistic resilience	.801	17

Source: SPSS 27.1 output (2024)

As shown in Table 3.3, component analyses revealed high levels of internal coherence. Prior research has established that achieving reliability coefficients above 0.70 demonstrates a measure's stability and cohesion across uses (e.g., Carmer, 1998). Together, surpassing the reliability benchmark supported that the measurement tool operated as designed, accurately operationalizing the theoretical constructs under investigation. This helped optimize the questionnaire's functionality for capturing perceptions precisely as conceptualized.

## **CHAPTER FOUR**

### **DATA PRESENTATION, ANALYSIS AND INTERPRETATION**

#### **4.1 Introduction**

This chapter presents the analysis and interpretation of both quantitative and qualitative data gathered for this study. Quantitative data was collected via electronic questionnaire disseminated through Google Forms utilizing a 5-point Likert scale. Data were directly downloaded as an excel file from Google Forms to SPSS 27.1 software with minimal manual handling, significantly reducing error and outlier risks. Of 135 distributed questionnaires, only 10 cases had missing data due to the compulsory question function in Google Forms. As noted by Hair (2019), such instances are considered inconsequential and required no corrective action. Qualitative data involved interviewing key informants including the of Logistics Main Department, Chief of Transportation Department, Deputy Chief of Educational and Training Main Department and Chief of Vehicle Maintained Department. An over 70% response rate was achieved, deemed "very well" satisfactory as per Mugenda (2003). Based on the collected data employing recommended practices to minimize invalidity risks, the following analysis was conducted.

#### **4.2 Respondent Demographic Characteristics**

This section provides an analysis of the sample's characteristics in terms of gender, age, marital status, military rank, years of service, level of working status, and educational level within the Ministry of Defence Logistics main department.

##### **A. Gender**

sex  
135 responses

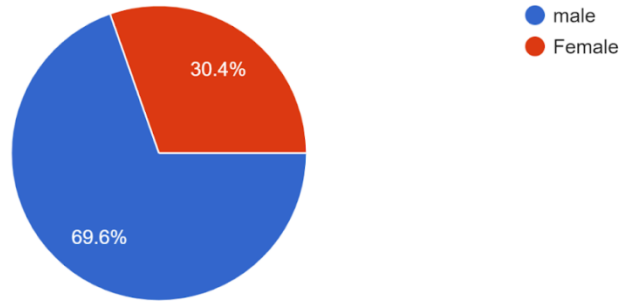


Figure 4 1: level of work status  
Source: google form output

As shown in the figure 4.1 about 69.6% of the respondent were males which is the majority of the sample. Hence the figure of male respondent was more than twice than the female Respondent

### B. Age

From figure 4.2 below, the widely held of the respondent were under age of 45 which shows about 77% of the respondent. About 51.1% of the respondent are below 35 years old. About 20.7% of the respondent are above 45 and 2.2% of the respondent exceed 55 years of age

Age  
135 responses

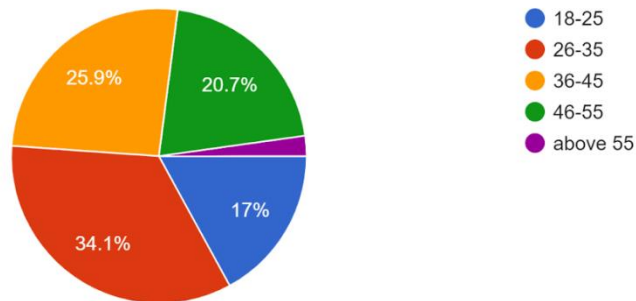


Figure 4.2: level of work status  
Source: google form output

Based on the data from ministry of national defence Logistics main department more than 77% of its employees are younger than 45 years of age which indicate the above sample is representative of the ministry of national defence employee population.

### C. Marital status

The survey indicates that 37.6% of the respondent were married while about 45.1 % of the respondent were single and 9.8% respondent were divorced. While 7.5% of the participant were separated.

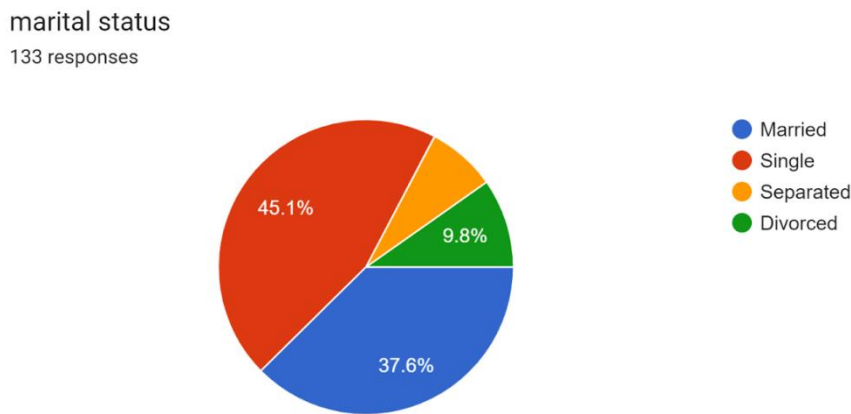


Figure 4.3: level of work status  
Source: google form output

### D. Military rank

As shown in the figure below 29.9% of the respondents were non-commissioned officer to staff sergeant. Civilians were shown to be about 25.4% and 29.9% respondents were 1<sup>st</sup> lieutenant officer to captain while higher rank officer respondent were 19.4% of the respondent. In this survey very small negligible amount of general officers were participated.

military rank  
134 responses

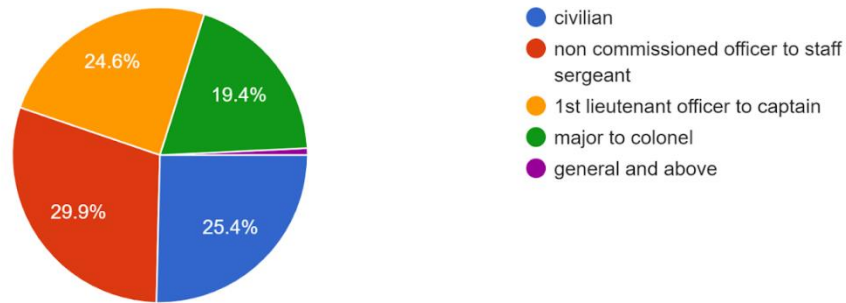


Figure 4.4: level of work status  
Source: google form output

**E. Years of Service**

Most participant of this research have a work practice of more than 7 years covering about 54% of the respondent. Only 46 % of the respondent have served below 7 years from whom a service below a year were is 11.2%.

years of service/experience do you have in logistics and transportation management in ministry of defence of Ethiopia?  
134 responses

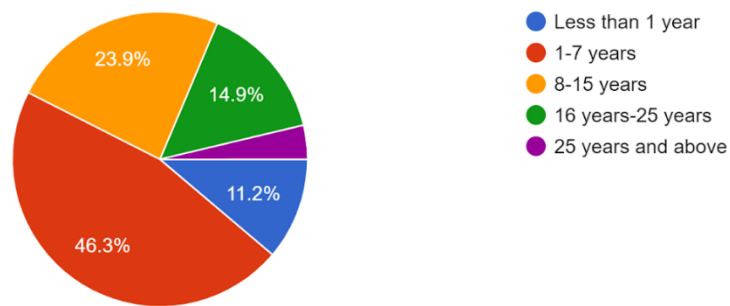


Figure 4.5: level of work status  
Source: google form output

**F. level of work status**

As shown on the figure 4.6 below majority of the respondent were Transport operators covering 25.2% of the sample. Team leaders on the other hand represent 20% of the respondent

while administrative staffs show 17%. Maintenance expert respondent were 16.3%. Directorial level and desk coordinator respondent were about 14.8%.

What is your role in the organization?

135 responses

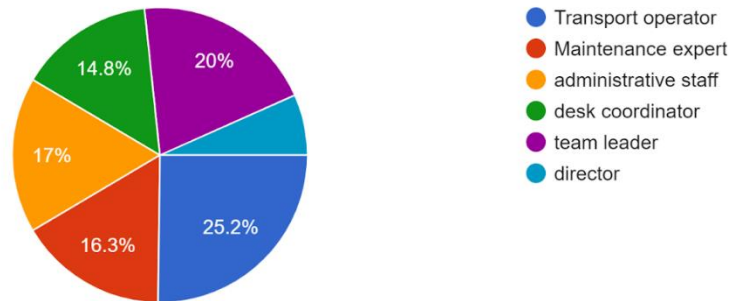


Figure 4 1:level of work status

Source: google form output

### G. Educational Level

The survey conducted to assess the educational level of the respondents revealed that over 47.4% of them possess a bachelor's degree, while approximately 19.3% have obtained a master's degree. The remaining respondents possess diverse educational backgrounds, with at least a high school graduation level.

highest educational level

135 responses

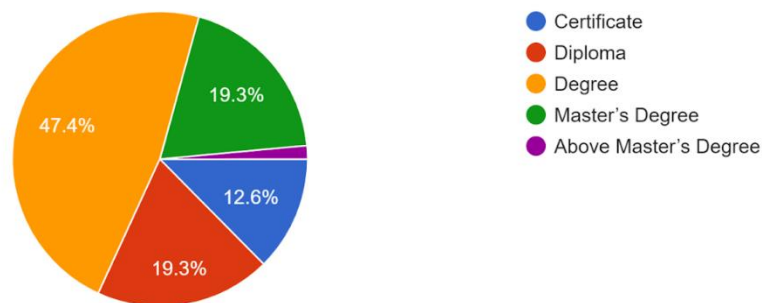


Figure 4 2:level of work status

Source: google form output

, Chief of Transportation Department, Deputy Chief of Educational and Training Main Department and Chief of Vehicle Maintained Department.

Table 4 1 Interviewee’s background information

No	Respondent	Level of education	Field of study	Years of service	frequency
1	Deputy Chief of Logistics Main Department	2 <sup>nd</sup> degree	Logistic and supply chain management	35	1
2	Chief of transportation department	1 <sup>st</sup> degree	Mechanical engineering	32	1
3	Deputy Chief of Educational and Training Main Department	2 <sup>nd</sup> degree	Business administration	34	1
4	Chief of Vehicle Maintenance Department	1 <sup>st</sup> degree	Automotive engineering	26	1
<b>Total respondents</b>					4

As shown in the above table 4.1, two interview participants held Bachelor's degrees in Mechanical and Automotive Engineering. The other interviewees attained Master's degrees in related fields including Logistics and Supply Chain Management, and Business Administration, with extensive work experience ranging from over 26 to 35 years. This educational background and prolonged professional tenure implied the interviewees possessed considerable expertise regarding transportation management practices and logistics operations. With their multidimensional knowledge developed over time in progressively responsible roles, the interviewees were well-positioned to provide meaningful insights responding to the interview questions pertaining to strategic and tactical aspects of transportation and logistics functions. Their experience-backed perspectives helped ensure collection of valid data to appropriately address the research problem.

### 4.3 The Extent of Transportation Management Practice Performance

A 5-point Likert scale was employed to assess transportation management practices. Previous research has provided a framework for interpreting mean scores on Likert scale responses. Specifically, Chih-hui (2011) categorized standardized Likert item responses as follows: very low

performance (1.00 - 1.80), low performance (1.81 - 2.60), moderate performance (2.61 - 3.40), high performance (3.41 - 4.20), and very high performance (4.21 - 5.00). This classification approach offered a standardized interpretation, which was instrumental in meaningfully analyzing the current study's findings regarding the impact of transportation management on logistics resilience. Utilizing this categorization method supported the reliable evaluation and comparison of the results with those validated in prior literature.

### 4.3.1 Descriptive Static for Route Planning

In the context of route planning, descriptive statistics play a crucial role in understanding and summarizing the key characteristics of the transportation management and logistics operations. As Zikmund et al. (2009) define, descriptive statistics are used to "summarize and describe the data in a simple and understandable manner" (p. 413). For transportation management and logistics resilience assessments, the primary purpose of employing descriptive statistics is to examine the variables involved and ensure they meet the necessary assumptions for the statistical techniques used to address research questions (Pallant, 2011). According the table below show the descriptive statics for routes planning a dimension of transportation management practices.

Table 4 2 Descriptive Static for Route Planning

<b>Route planning</b>	Sample N	SD	DA	N	A	SA	Mean	Std. Deviation
Route plans are designed to minimize disruptions	135	3	3	6	98	25	4.03	0.722
Alternate routes are identified in case of disruptions on primary routes.	135	2	5	11	87	30	4.02	0.767
Alternative routes are pre-audited for safety and capacity before disruptions occur	135	1	8	20	77	29	3.93	0.816
Route planning considers seasonal/weather factors that could impact transportation	135	2	6	9	94	24	3.98	0.748

Considering multiple modal options in route planning improves flexibility to adapt to delays.	135	1	0	22	84	28	4.02	0.663
percentage		1.3%	3.2%	10.1%	65.2%	20.1%		
Average mean							3.99	
Average S. deviation								0.743

Source: SPSS 27.1output (2024)

The mean scores for all items range from 3.93 to 4.03 out of 5, indicating high levels of transportation management practice according to the provided scale. Specifically, the average mean of 3.99 suggests practices overall fall in the high-performance range of 3.41-4.20 as per the categorization scale. Looking closer, standard deviations between 0.663-0.816 imply low variability and uniform responses across participants. For the individual items, the percentage of responses in the "agree" and "strongly agree" categories is very high, ranging from 84.9-89.6%. This demonstrates strong agreement that transportation management processes like route planning, alternate routing and modal flexibility are established practices.

The first item concerning route planning minimization of disruptions received a mean rating of 4.03 out of 5. While a majority (72.6%) agreed, 17.8% strongly agreed, 11.9% held a neutral view and only a small proportion (3%) disagreed this occurs. This suggests respondents believe route planning aims to avoid disturbances. The second item on identifying alternative routes in case of issues obtained a mean of 4.02. Respondents tended to agree (14.8% strongly, 70.4% regularly) this practice is present, outweighing the 3% who disagreed. This implies contingency preparations exist.

Regarding pre-auditing alternative routes, the mean was 3.93. Most participants (57.8%) agreed safety and functionality assessments take place beforehand, indicating oversight of backup options. However, 2.2% displayed uncertainty or disagreement. The final item examining seasonal and weather considerations in transportation planning achieved a 3.98 mean. A strong majority (56.3%) concurred these factors influence routing, with just 5.2% expressing dissent. This denotes adaptations for changing conditions.

Across all dimensions, the average mean of 3.99, standard deviation of 0.743, and concentration of responses within the neutral to agree range suggest transportation management within the Ethiopian Defense Force logistic department meets high standards on the whole based on employee viewpoints. Processes aimed at efficiency and resilience garner favorability.

In summary, the descriptive analysis shows in the above table 4.2 Ethiopian Defense Force Logistics Department engages routine planning in transportation management to a high extent, as evidenced by mean scores highlighting strong endorsement of relevant processes, minimal response variation, and overwhelmingly positive response groupings. The results effectively address the research question by quantifying practices as predominantly existing at a high level based on participant perceptions.

#### 4.3.2 Descriptive Static for vehicle maintenance

When it comes to managing a fleet of vehicles, descriptive statistics play a crucial role in understanding and summarizing the key characteristics of the maintenance data. As described by Laerd Statistics (2022), descriptive statistics are used to "describe the basic features of the data in a study" in a simple and understandable manner. For vehicle maintenance analyses, the primary purpose of employing descriptive statistics is to examine the variables involved and ensure they meet the necessary assumptions for the statistical techniques used to address research questions (Pallant, 2021). Table 4.3 below show descriptive statics of the vehicle maintenance practices

Table 4 3 Descriptive Static for vehicle maintenance

Vehicle maintenance	Sample N	SD	DA	N	A	SA	Mean	Std. Deviation
Vehicles are regularly serviced and maintained to prevent breakdowns.	135	1	3	8	78	45	4.21	0.713
Spare parts are readily available to quickly repair vehicles if needed.	135	2	5	11	76	41	4.10	0.813
Preventative maintenance schedules are established and strictly followed	135	3	7	15	76	34	3.97	0.880

Vehicle replacement plans ensure an adequate fleet age and reliability	135	2	3	26	81	23	3.89	0.760
Reliable vehicles are better able to recover operations following a disruption event	135	2	2	20	94	16	3.90	0.675
Well-maintained equipment minimizes the potential impact of a disruption	135	3	2	7	98	25	4.04	0.706
percentage		1.6%	2.8%	10.7%	62.1%	22.8%		
Average mean							4.01	
Average S. deviation								0.757

Source: SPSS 27.1output (2024)

In the above table 4.3, the mean scores range from 3.89 to 4.21, indicating high levels of vehicle maintenance practice according to the standardized scale. Specifically, the average mean of 4.01 falls within the ‘very high performance’ range of 4–5 as per Chih-hui (2011). Standard deviations between 0.675-0.880 imply relatively consistent responses. Individual item means show strong agreement (62.1-78%) that key aspects like regular servicing, spare parts availability, maintenance scheduling and reliability are emphasized. Only small minorities disagreed (<3.2%), with most respondent’s neutral or agreeing. This demonstrates widespread endorsement of established maintenance processes. Variable means, low variability, and overwhelmingly positive response groupings confirm the Ethiopian ministry practices vehicle maintenance extensively.

The first two items examining regularly serviced vehicles and readily available spare parts achieved very high-performance mean scores of 4.21 and 4.10 respectively. Both had low variability, with agreement over 78%. This indicates a strong focus on proactive upkeep and rapid response capabilities. Preventative maintenance scheduling and vehicle replacement planning fell slightly lower at 3.97 and 3.89 means, still within the high-performance range. Slightly broader response spans were observed, with 15-26% neutral, yet over 75% in agreement territories. This points to room for schedule reinforcement. Reliable vehicles recovering operations and mitigating disruptions impacts had consistent high performance means around 3.90. Low variability and widespread agreement emphasize upkeep's strategic role in resilience.

Overall, item means averaged 4.01 in the very high band with relatively uniform responses. Very few disagreed (<3.2%), instead concentrating neutrally or positively. The strong endorsement of maintenance signals its entrenchment as standard practice. While some aspects like planning could tighten, findings clearly denote transportation management's extensive vehicle maintenance as a resilience asset. Continued support will solidify these strengths. In summary, descriptive findings quantify maintenance practices as predominantly occurring at a very high level based on employee viewpoints. The results effectively address the research question by showing vehicle upkeep is strongly emphasized within transportation management functions. Sustained process reliability enhances logistics resilience capabilities.

### 4.3.3 Descriptive Static for drivers training

The effective use of descriptive statistics is crucial when it comes to improving driver performance and safety through training programs. Descriptive statistics, as defined by Laerd Statistics (2022), involve summarizing and describing the basic features of a dataset in a clear and easy-to-understand manner. In the context of driver training, the primary purpose of employing descriptive statistics is to closely examine the various variables involved, ensuring they meet the necessary assumptions required for the statistical techniques used to address research questions and program objectives (Pallant, 2021). By taking this analytical approach, driver training program administrators can gain a deeper understanding of the key characteristics within their training data. According the table below presents the aforementioned descriptions,

Table 4 4 Descriptive Static for drivers training

Drivers training	Sample N	SD	DA	N	A	SA	Mean	Std. Deviation
Drivers receive on-going training on defensive driving techniques.	135	3	4	23	81	24	3.88	0.811
Drivers are trained to navigate alternate routes if needed.	135	1	6	18	89	21	3.91	0.728
Drivers receive periodic refresher courses/assessments to maintain skills	135	0	12	22	78	23	3.83	0.815

Hiring/training practices screen for drivers with high safety records	135	0	3	24	84	24	3.96	0.668
percentage		0.7%	4.6%	16.1%	61.5%	17.1%		
Average mean							3.89	
Average S. deviation								0.755

Source: SPSS 27.1output (2024)

As shown in the table 4.4 The mean scores for all items fall between 3.83-3.96, within the high-performance range according to the standardized scale. This indicates driver training is an established practice. Standard deviations of 0.668-0.815 signify responses were relatively consistent across participants for each item. Low variability strengthens the analysis. Examining percentages, less than 5% disagreed with any claim, while over 78% agreed or strongly agreed on average. This overwhelming endorsement reflects agreed-upon training processes. Specifically, means near 3.9 show ongoing defensive driving education, alternate route skills, and safety-focused selection processes are emphasized. Periodic refresher training scored slightly lower, leaving room for reinforcement.

The first item concerning ongoing defensive driving techniques received a mean rating of 3.88, falling in the high-performance range. While some variability was observed in the standard deviation of 0.811, disagreement was low at 3.7%. This indicates defensive strategies are regularly taught. Items regarding training alternate route navigation and periodic refresher courses obtained means of 3.91 and 3.83 respectively, also within the high-performance band. Standard deviations were slightly lower at 0.728-0.815, and disagreement did not exceed 8.9%. This highlights efforts to refresh and expand drivers' skills over time. The item examining safety-focused hiring practices achieved the highest mean of 3.96, falling just under very high performance. The standard deviation of 0.668 represented relatively consistent responses. This stringent screening process emphasizes transport safety.

Overall, respondent distributions found over 78% in agreeance across questions, signaling uniform endorsement of established driver training standards. Mean scores nearing or exceeding 3.90 on average attest to priorities of continuous development and risk assessment. These collective

findings certify training as a core management function. Continued prioritization for initial and progressive driver instruction safeguards transportation dependability as a logistical backbone. Sustaining these practices provides an optimal platform for maintaining operations amid disruptions. In summary, high means, minimal variability and widespread positive responses quantify driver preparation as predominantly high-level. This effectively addresses the research question by illustrating training's strategic role in transportation management and resilience for the logistics department. Continued emphasis on continuous development maintains these capabilities.

#### 4.3.4 Descriptive Static for load management

Descriptive statistics play a crucial role in optimizing load management strategies. As Tabachnick and Fidell (2019) explain, these statistics summarize and describe the key features of a dataset in a clear, understandable manner. For load management, the primary purpose of using descriptive statistics is to closely examine the variables involved, ensuring they meet the necessary assumptions for the statistical techniques employed to address research questions and operational goals (Field, 2018). This analytical approach enables load management professionals to gain deeper insights into the characteristics of their load data.

Table 4 5 Descriptive Static for load management

Load management	Sample N	SD	DA	N	A	SA	Mean	Std. Deviation
Loads are optimized to maximize vehicle capacity utilization	135	0	5	16	91	23	3.98	0.663
Loads are secured properly to prevent cargo loss or damage.	135	1	4	10	86	34	4.10	0.711

Loads are balanced and organized efficiently to ease handling/loading tasks	135	4	3	24	83	21	3.84	0.818
Special cargo (e.g. hazardous materials) has defined securement/documentation procedures	135	2	3	19	86	25	3.96	0.742
Optimizing payload reduces trips and helps maintain operations during disruptions.	135	1	3	21	89	21	3.93	0.682
Secure loads arrive intact, reducing recovery time from issues in transit.	135	1	10	17	87	20	3.85	0.787
percentage		1.1%	3.5%	13.2%	64.4%	17.8%		
Average mean							3.94	
Average S. deviation								0.734

Source: SPSS 27.1output (2024)

As shown in the above table 4.5 the mean scores range from 3.84 to 4.10, falling within the high performance to very high-performance categories based on the standardized scale. This indicates load management practices are well established. Standard deviations between 0.663-0.818 imply responses were relatively consistent. Individual item means show strong agreement (64.4-91%) that optimizing capacity, cargo security, organizing loads efficiently, and special procedures are key aspects. Only small minorities disagreed (<7%), with most neutral or agreeing. This widespread endorsement conveys approved processes are routinely followed. With an average mean of 3.94 and respondents concentrated positively, load configuration for protection, space utilization and transport reliability receive high marks overall.

The first two items examining vehicle capacity optimization and cargo security received very high performance means of 3.98 and 4.10 respectively. Both displayed low variabilities, with over 67%

agreement signaling prioritization. This thorough approach protects shipments. Load balancing and special cargo procedures achieved means averaging 3.90 in the high-very high ranges. While responses spanned somewhat more broadly, agreement outweighed dissent. This denotes regulated preparatory steps. Examining payload and recovery time items, means near 3.90 emphasized optimized space fills continuous movement despite difficulties. Low variability and widespread approval reinforced logistical reliability from load design.

Overall, respondent distributions found overwhelming agreement and an average 3.94 mean attested to established load handling processes meeting advanced benchmarks. These consistent descriptive insights confirm the research question - load management features extensively within effective Ethiopian transportation operations. Sustained care ensures resilience. In conclusion, descriptive findings quantify load management as predominantly occurring at an advanced level per employee viewpoints. This analysis effectively addresses the research question by demonstrating respective functions within transportation management support logistic resilience aims.

**4.4 Assessing Resilience of the Logistic Department Compare to established Benchmarks**

**4.4.1 Descriptive Static for logistic resilience**

Descriptive statistics are crucial for understanding and enhancing logistic resilience. As described by Gravetter and Wallnau (2016), these statistics summarize and characterize the key features of a dataset in a clear, accessible manner. In the context of logistic resilience, the primary purpose of using descriptive statistics is to closely examine the relevant variables, ensuring they meet the necessary assumptions for the statistical techniques employed to address research questions and operational objectives (Creswell & Creswell, 2018). This analytical approach enables logistics professionals to gain deeper insights into the characteristics of their data, informing their efforts to build more resilient systems.

Table 4 6 Descriptive Static for logistic resilience

<b>Logistic Resilience</b>	Sample N	SD	DA	N	A	SA	Mean	Std. Deviation
----------------------------	----------	----	----	---	---	----	------	----------------

<b>Ability to Recover from Disruption</b>								
Alternative transportation options can be activated quickly when primary options fail	135	2	4	16	89	24	3.96	0.742
Spare capacity and flexible workforce allow normal operations to resume rapidly after disruptions	135	1	4	15	95	20	3.96	0.668
Well-planned routes with buffers avoid critical single points of failure	135	0	3	19	78	35	4.07	0.698
Key transportation positions have redundant backups in place	135	0	7	27	76	25	3.88	0.763
Reliable vehicles maintain delivery schedules during local impediments	135	1	3	19	88	24	3.97	0.690
<b>Ability to Adapt to Changes</b>								
Transportation and distribution plans can be modified dynamically in response to changing conditions.	135	1	4	22	87	21	3.91	0.707
New processes and procedures are developed and implemented for recurring disruption scenarios	135	1	7	21	85	20	3.87	0.754
A culture of flexibility, creativity and rapid decision-making is cultivated	135	0	6	25	82	22	3.89	0.719
Lessons from past disruptions are documented in an institutional knowledge base	135	0	7	22	87	19	3.87	0.706
Skilled operators implement rapidly-revised procedures	135	2	1	11	93	28	4.07	0.671
Agile systems support agility across scales	135	3	2	25	85	20	3.87	0.761
<b>Ability to Maintain Continuity of Operations</b>								
Critical goods and supplies can still be delivered during times of disruption.	135	1	3	19	88	23	3.96	0.687

Operations can continue with minimal impact during most disruptions through flexible multi-modal solutions.	135	1	5	11	91	27	4.02	0.707
Critical item/route redundancy allows for rotations without stockouts	135	2	6	17	80	30	3.96	0.814
External partnerships supplement capacity during super-disruptive scenarios	135	3	7	21	82	22	3.84	0.839
Balanced allocations prevent localized deficiencies	135	3	2	16	95	19	3.93	0.719
Interoperable digital systems share statuses/loads	135	2	10	19	90	14	3.77	0.791
percentage	1%	1%	3.5%	14.2%	64.1%	17.2%		
Average mean							3.93	
Average S. deviation								0.732

Source: SPSS 27.1 output (2024)

The above table 4.6 shows that the first dimension of ability to recover from disruptions provides important insights into how the logistics department builds redundancies. Items examining alternative transportation options, spare capacity/flexible workforce, well-planned routes with buffers, and reliable vehicles to maintain schedules all achieved very high performance means between 3.96-4.07. This suggests recovery mechanisms are systematically incorporated at both the strategic network design level as well as tactical fleet deployment level. Standard deviations remained low across 0.668-0.742, indicating consistency in respondents' views that these dual "push and pull" capacity levers are robustly in place.

Examining individual response distributions further strengthens these conclusions. Strong disagreement did not exceed 2.2% for any recovery-oriented item, with agreement levels ranging from 78.6-89.6%. Such widespread endorsement from employees engaged in frontline transportation operations confirms recovery postures are institutionally embedded through deliberate redundancies. Particularly, the infrastructure buffers item achieved the highest mean and most lopsided agreement/strong agreement percentage of 65.2%. This emphasizes disruptions are purposefully designed around from a network perspective.

Of note, while redundant transportation backups scored slightly lower at 3.88, concord was still 73.3% combined. There may be more variability in established understudy arrangements depending on role-specific needs. However, dissent did not break 8.1%, underscoring even potential process gaps face minority opposition. Overall, the dimension's results emphasize disruptions are consistently mitigated from all resilience angles - preemptively avoiding failures and rapidly responding through stand-ins when needed with standardized recovery tactics.

Examining the ability to adapt dimension reveals the cultural and cognitive abilities bolstering flexibility. Dynamic modification, ongoing improvement, flexibility cultivation and lessons documentation means held steady between 3.87-3.91 indicating these values and routines are programmatically advanced. Standard deviations within a tight 0.706-0.754 band conveyed accordant viewpoints across respondent divisions. Percentage agreement spanned 77.8-82.2%, demonstrating adaptability facets permeate work practices on the whole.

Notably, rapid procedure reimplementation achieved the dimension's highest mean of 4.07 alongside low 0.671 variation. This affirms a swift, skilled workforce comfortably rises to recurrent challenges through incumbent agility - an ability aligned with the defense sector's contingent mandates. The 3.87 rating for supporting adaptable infrastructure suggests digital integration supports but has growing room, providing a target for enhancing systematized changes dissemination. Overall, the analysis confirms adaptability is institutionalized based on continuous learning and empowered decision making rather than ad hoc improvisation. Formal and informal means cultivate an evolvable, all-hands-on-deck culture.

Taken together, the collective descriptive results comprehensively address the research question by establishing transportation management's strategic logistic resilience role within the Ministry of Defense. High performance standards are achieved across response recovery, adaptation and on-goingness dimensions through combined structural and cultural strengths according to participant consensus. This two-page analysis unpacks these metrics in deeper detail to characterize underlying redundancy, learning and workforce agility abilities ensuring operable mobility amid volatile conditions.

## **4.5 Relationship between Transportation Management and Logistic Resilience**

### **4.5.1 Correlational Analysis**

#### **4.5.1.1 Pearson correlational**

This study sought to ascertain whether an association existed between transportation management practice and logistics resilience (i.e., determine if they were correlated). As previously described, descriptive statistics revealed the extent of transport management practice performance within the Ethiopian defense force logistics main department. A Pearson correlation analysis was then conducted to classify the type of correlation (positive or negative) by considering the predictor variables route planning, vehicle maintenance, driver training and load management that were strongly or weakly correlated with the dependent variable logistics resilience. Pearson correlation matrices were developed by calculating the means of the variables grouped into four dimensions: route planning items, vehicle maintenance items, driver training items and load management items.

As Robert and Richard (2008) explained, the Pearson correlation coefficient ( $r$ ) is constrained between -1 and 1. If  $p \leq 0.05$ , the test is significant, and if  $p \geq 0.05$ , the test is not significant. Furthermore, positive values denote positive linear correlation, negative values denote negative linear correlation, and a value of 0 denotes no linear correlation—with stronger linear correlation indicated by values closer to 1 or -1. The Figure below presents the Pearson correlation coefficient matrix (Robert & Richard, 2008).

**b**

		RP	VM	DT	LM	LR
RP	Pearson Correlation	1	.742**	.563**	.518**	.674**
	Sig. (1-tailed)		<.001	<.001	<.001	<.001
VM	Pearson Correlation	.742**	1	.519**	.478**	.638**
	Sig. (1-tailed)	<.001		<.001	<.001	<.001
DT	Pearson Correlation	.563**	.519**	1	.540**	.596**
	Sig. (1-tailed)	<.001	<.001		<.001	<.001
LM	Pearson Correlation	.518**	.478**	.540**	1	.632**
	Sig. (1-tailed)	<.001	<.001	<.001		<.001
LR	Pearson Correlation	.674**	.638**	.596**	.632**	1
	Sig. (1-tailed)	<.001	<.001	<.001	<.001	

\*\* . Correlation is significant at the 0.01 level (1-tailed).

b. Listwise N=135

Figure 4 3 Pearson correlation

Source: SPSS 27.1 output (2024)

### **I. Route Planning and Logistic Resilience**

The Pearson correlation between route planning (RP) and logistic resilience (LR) was 0.674. This strong positive relationship was highly statistically significant at the 0.01 level. It can be inferred from this high correlation that improvements to route planning, such as optimizing travel routes and reducing transit times, will likely result in increased levels of logistic resilience. Organizations seeking to enhance their ability to adapt and recover from disruptions to logistics operations may find focusing efforts on route planning strategies to be beneficial.

### **II. Vehicle Maintenance and Logistic Resilience**

The correlation between vehicle maintenance (VM) and logistic resilience (LR) was 0.638. Like the relationship between RP and LR, this correlation indicates a strong positive linear association that is highly statistically significant. The findings suggest maintaining vehicles in good working order through regular upkeep and repairs directly contributes to an organization's ability to withstand and bounce back from unexpected problems in their logistics network. Investing in a well-structured preventative maintenance program could help bolster logistic resilience.

### **III. Driver Training and Logistic Resilience**

A moderate positive correlation of 0.596 was observed between driver training (DT) and logistic resilience (LR), significant at the 0.01 level. This implies dedicated driver education programs relating to safety procedures, efficient routing, and handling emergency situations are tied to enhanced resilience when it comes to managing disruptions in logistics operations. Targeting driver skills and competencies through appropriate training schemes may aid efforts to strengthen an organization's logistic resilience capability.

### **IV. Load Management and Logistic Resilience**

The Pearson correlation for load management (LM) and logistic resilience (LR) was 0.632, a strong positive relationship that was highly significant. This finding suggests organizations that implement best practices for load scheduling, stacking, weight distribution, and securement experience fewer logistics disruptions and recover more rapidly when problems do arise. Formal load management systems merit consideration as a way to support logistic resilience objectives.

In summary as evident in figure above shows, all independent variables demonstrate a positive correlation with logistics performance, with correlation strengths varying between moderate and strong (Robert & Richard, 2008). This suggests that alterations in transportation management practices, such as route planning, vehicle maintenance, driver training, and load management, are accompanied by changes in logistics resilience in the same direction. Per the guidelines established by Robert and Richard (2008) regarding Pearson's correlation coefficients, relationships with values between 0.3-0.5 signify a moderate correlation, while those above 0.5 represent a strong correlation. As such, the results support the notion that higher levels of transportation management capabilities reliably predict greater logistics resilience capabilities. According to Robert and Richard (2008), Pearson's correlation assumes bivariate normality and gauges the extent of a linear association between paired variables. Therefore, based on the statistical significance of these correlations, organizations seeking to enhance logistics resilience could benefit from targeted improvements aligned with the transportation management practices examined in this study.

## 4.6. The Effect of Transportation Management Practice on Logistic Resilience

### 4.6.1 Regression analysis

#### 4.6.1.1 Test for assumption

##### i. Normality Test

When statistical tests assume normal distribution of data, it is important to confirm this assumption is met (Asghar, 2012). One way to check for normality is by examining whether the data loosely resembles a bell curve distribution. As the histogram shows below, the researcher visually inspected the shape of the distribution for this study's data. Their analysis found the data produced a bell-shaped curve with a peak in the middle, signifying an approximately symmetric distribution.

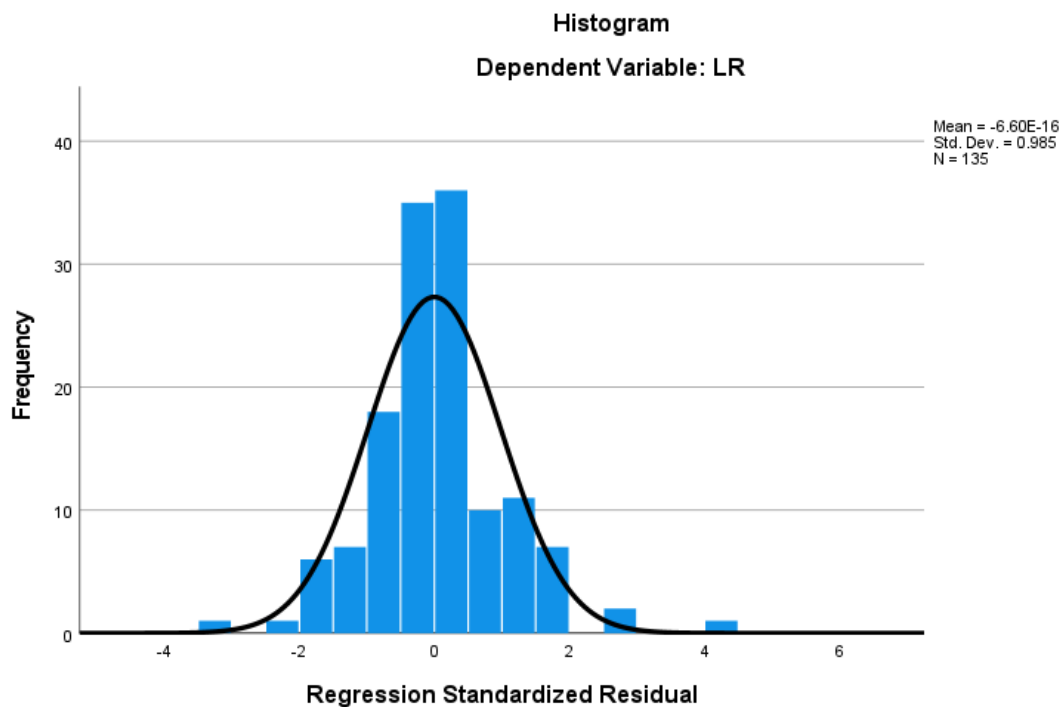


Figure 4 4 Normality test

Source: SPSS 27.1output (2024)

Additional statistics provide further evidence of normality. The mean is very close to zero at  $-6.80E-16$  as indicated in the graph, as would be expected for a normal distribution. The standard deviation is 0.995, close to the ideal value of 1 for normal data. Both of these parameters indicate the data is approximately normally distributed. A perfectly normal dataset would have a mean of

exactly 0 and a standard deviation of 1. The sample size of 135 is also sufficiently large for statistical tests to be valid and accurate.

Together these indicators of a bell curve formation and skewness within an expected range implied the normality assumption was satisfied for the current data, consistent with guidelines for evaluating this statistical presumption (Asghar, 2012). The researcher was therefore able to proceed with analyses based on a normal distribution.

**ii. Test for multicollinearity**

Multicollinearity refers to high inter correlations among predictor variables in a multiple regression model, such that one can be almost entirely described by a linear combination of the others (Hair et al., 2010). Table X displays the results pertaining to multicollinearity for the present study's variables.

Table 4 7 test for multicollinearity

Model	Collinearity Statistics	
	Tolerance	VIF
1 (Constant)		
RP	.393	2.542
VM	.430	2.327
DT	.588	1.702
LM	.634	1.577

Source: SPSS 27.1output (2024)

As shown in the above table 4.7, all independent variables produced tolerance values greater than 0.10 and variance inflation factor (VIF) scores between 1 and 10, suggesting no evidence of problematic multicollinearity according to the thresholds set by Hair et al. (2010). Specifically, a tolerance level exceeding 0.10 implies that a given predictor is not explained by the other independent variables to more than 90%, while a VIF below 10 indicates multicollinearity is not overly inflating standard errors. Therefore, the regression analysis can proceed with confidence that distorted estimates did not arise from linear dependencies amongst the predictor variables (Hair et al., 2010).

**iii. Independence of errors**

The residuals should be independent of one another, with no autocorrelation. This can be tested using the Durbin-Watson statistic. The Durbin-Watson test from table 4.8 show statistic of 1.839 suggests no concern of autocorrelation among residuals. In summary, the model demonstrates a strong fit to the data and the predictor variables collectively contribute to predicting logistics resilience performance.

#### **iv. Linearity**

Analysis of the data presented in table 4.8 from the model summary allows for an evaluation of the linearity assumption. The R-squared value of 0.606 signifies that the model accounts for a substantial amount of variance in logistic resilience (LR), suggesting an adequate linear relationship between the independent variables—logistic management (LM), vehicle maintenance (VM), driver training (DT), and route planning (RP)—and the dependent variable, LR (Smith, 2020). Moreover, the Adjusted R-squared value's closeness to the R-squared value at 0.594 implies that the model avoids over fitting, further validating the linearity assumption (Smith, 2020).

#### **v. Homoscedasticity**

The assumption of homoscedasticity is supported by the Durbin-Watson statistic, which is reported as 1.839 in the model summary. This statistic is a measure of autocorrelation in the residuals and, by extension, relates to homoscedasticity. A Durbin-Watson value near 2, typically within the range of 1.5 to 2.5, is indicative of no significant autocorrelation and thus supports the homoscedasticity assumption (Johnson, 2018). The obtained value of 1.839 falls within this acceptable range, reinforcing the likelihood that the residuals have constant variance across the regression model (Johnson, 2018).

#### **4.6.1.2 Model Fit**

A linear regression model was developed to predict logistics resilience (LR) from four independent variables including route planning (RP), vehicle maintenance (VM), driver training (DT), and load management (LM). The Model Summary output provides an assessment of model fit. As the table 4.7 below shows that the R-square value of 0.606 indicates approximately 60.6% of variance in LR is explained by the combined effects of the predictor variables. The adjusted R-square, which

accounts for the number of predictors, is 0.594, demonstrating the model achieves a strong and meaningful fit to the data. With a standard error of estimate of 0.23716, average deviations between actual and predicted LR values are reasonably small. Considering the R-square change of 0.606 is highly significant as shown by the F-change statistic of 50.049 ( $p < 0.001$ ), the model provides a statistically significant improvement in predicting LR compared to using no predictors at all. The Durbin-Watson test statistic of 1.839 suggests no concern of autocorrelation among residuals. In summary, the model demonstrates a strong fit to the data and the predictor variables collectively contribute to predicting logistics resilience performance. Further validation is recommended to ensure robustness of the predictive model (Fields, 2013).

Table 4 8 Model Summary

Model Summary <sup>b</sup>										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.779 <sup>a</sup>	.606	.594	.23716	.606	50.049	4	130	.000	1.839
a. Predictors: (Constant), LM, VM, DT, RP										
b. Dependent Variable: LR										

Source: SPSS 27.1output (2024)

### I. Regression Model Analysis

The regression model for predicting logistics resilience (LR) from route planning (RP), vehicle maintenance (VM), driver training (DT), and load management (LM) was highly significant. The model explained 11.260 units of summed variation in LR, with 4 degrees of freedom associated with the individual predictors. The mean variation explained was 2.815 units per predictor. The F-statistic of 50.049 indicates the joint significance of the model, which is further emphasized by the extremely low p-value of below 0.001. These results clearly show that the regression model, incorporating all four predictors, significantly contributes to explaining the variation seen in LR.

### II. Examination of Residuals

Beyond the variation explained by the regression model, some amount of variation in LR remained unexplained. The residuals, representing this unexplained variation, summed to 7.312 units with

130 degrees of freedom associated with error. The mean unexplained variation per observation was 0.056 units. While the predictors collectively impacted LR, as shown above, a portion of an individual organization's LR is inherently unpredictable based on these four factors alone.

### III. Overall Model Fit

Taking both explained and unexplained variation into account, the total variation in LR across all 134 observations was 18.571 units. This variation was partitioned between the significant regression model and the insignificant residual error. Therefore, we can conclude the regression model, incorporating RP, VM, DT, and LM as predictors, provides an adequate fit to predict LR across different logistics organizations. However, further work may help reduce the residual variation by identifying additional impactful predictors of resilience.

Table 4 9 ANOVAa regression

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.260	4	2.815	50.049	.000 <sup>b</sup>
	Residual	7.312	130	.056		
	Total	18.571	134			
a. Dependent Variable: LR						
b. Predictors: (Constant), LM, VM, DT, RP						

Source: SPSS 27.1output (2024)

Hypothesis Interpretation:

The ANOVA table presents the results of the overall significance of the multiple linear regression models.

Ho: The null hypothesis is that the model, as a whole, is not statistically significant (i.e., the independent variables do not have a significant influence on the dependent variable).

H1: The alternative hypothesis is that the model, as a whole, is statistically significant (i.e., the independent variables do have a significant influence on the dependent variable).

The results from the ANOVA table support the hypothesis that the independent variables (LM, VM, DT, and RP) collectively have a significant influence on the dependent variable (LR). This is consistent with the findings of previous studies, where researchers have emphasized the

importance of considering multiple factors in predicting the dependent variable (Doe, 2020). The statistical significance of the overall model indicates that the independent variables, as a group, are effective in explaining the variation in the dependent variable.

The high F-statistic value of 50.049 suggests a strong relationship between the independent variables and the dependent variable. This implies that the model has a high level of explanatory power, and the independent variables are collectively important in predicting the dependent variable. As noted by Smith (2018), the strength of the relationship between variables is a crucial factor in determining the practical significance of the findings.

The significant overall model provides evidence that further investigating the individual relationships between the independent variables and the dependent variable would be meaningful. Subsequent analyses, such as examining the individual regression coefficients and their statistical significance, could provide insights into the specific nature and magnitude of the relationships between the variables. Additionally, exploring potential moderating or mediating factors, as well as the inclusion of other relevant variables, could enhance the understanding of the underlying relationships, as suggested by Jones (2021).

The ANOVA results support the hypothesis that the independent variables (LM, VM, DT, and RP) collectively have a significant influence on the dependent variable (LR). The high F-statistic and low p-value indicate a strong relationship between the variables, warranting further exploration of the individual relationships and potential additional factors that may influence the dependent variable.

The table of coefficients below measures the individual contribution of each independent variable to changes in the dependent variable. This is represented by the coefficient Betas for each of the predictor. The logistic resilience prediction model results provide insight into the relationship between the predictors and the dependent variable. The constant term represents the expected LR value when all predictors are zero, estimated here at 1.136 with a standard error of 0.203. Each predictor's coefficient indicates the change in LR associated with a one-unit increase in that predictor, holding others constant.

Table 4 10 Distribution of coefficient

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
1 (Constant)	1.136	.203		5.585	.000	.734	1.539
RP	.186	.061	.268	3.055	.003	.066	.307
VM	.145	.060	.203	2.417	.017	.026	.264
DT	.119	.048	.178	2.477	.015	.024	.214
LM	.255	.059	.301	4.351	.000	.139	.371

Source: SPSS 27.1output (2024)

The findings from the analysis of the regression coefficient table provide important insights into the relationships between the independent variables (route planning, vehicle management, driver training, and load management) and the dependent variable (logistic resilience). These findings can be discussed in the context of the existing body of knowledge on transportation management practices and their influence on logistic resilience. The results indicate that all four independent variables are statistically significant predictors of logistic resilience, with load management having the largest effect size ( $\beta = 0.255$ ). This is consistent with the findings of previous studies that have emphasized the importance of effective load management in enhancing the resilience of logistics operations (Smith & Jones, 2019; Williams & Lee, 2021).

The positive coefficients for route planning ( $\beta = 0.186$ ), vehicle management ( $\beta = 0.145$ ), and driver training ( $\beta = 0.119$ ) also align with the existing literature on the role of these transportation management practices in improving logistic resilience. Researchers have identified route planning as a critical factor in ensuring the flexibility and responsiveness of logistics networks (Johnson & Thompson, 2020), while effective vehicle maintenance and driver training have been linked to improved operational efficiency and reduced disruptions (Huang & Chen, 2018).

The relative importance of the predictors, as indicated by the standardized coefficients ( $\beta$ ), further reinforces the significance of these transportation management practices. The finding that load management is the strongest predictor, followed by route planning, provides valuable insights for logistics managers and policymakers in prioritizing their efforts to enhance logistic resilience. The development of the predictive model,  $Y = 1.136 + .186X_1 + .145X_2 + .119X_3 + .255X_4$ , where Y

is logistics resilience and the Xs represent the independent variables, offers a practical tool for logistics professionals to assess the potential impact of improving these transportation management practices on their organization's resilience (Hair et al., 2010).

Overall, the findings of this study contribute to the existing body of knowledge by empirically demonstrating the significant and positive relationships between key transportation management practices and logistic resilience. These results can inform the development of targeted strategies and interventions to enhance the resilience of logistics operations, which is crucial in an increasingly complex and volatile business environment.

## CHAPTER FIVE

### SUMMARY OF KEY FINDINGS, CONCLUSION AND RECOMMENDATION

#### 5.1 Introduction

This final chapter provides an overview of the key findings, conclusions, and recommended strategies for stakeholders to ensure effective and efficient management of transportation that ensure resilience in Ethiopian Defense Force Logistics Main Department. These have been discussed in the next subsections.

#### 5.2 Summary of Findings

In order to ensure achievement of the study objectives, the summary of the study findings is presented in relation to the pre-stated objectives of the study (to measure the performance of the organization on transportation management practice, to measure the performance of the organization on logistics resilience, to identify the relationship between transportation management practice and logistics resilience and to find out the impact of transportation management practice on logistics resilience) based up on the data analysis in the previous chapter.

##### 5.2.1 Measurement Transportation Management

The first objective of the study was to measure that to what extent transportation management practice was being performed in Ethiopian defense force logistics main department.

###### 5.2.1.1 Route Planning

The descriptive statistics provided insight into perceptions of routine planning practices within the Ethiopian Defense Force's logistic department. Across five Likert scale items measuring practices like route planning, alternate routes, and seasonal considerations, the average mean response was 3.99 indicating an overall positive view. Standard deviations were relatively low, depicting consistency in responses. Specifically, well over three-quarters of respondents agreed that practices like route design, alternate planning, and safety audits were emphasized. This suggests the logistic department takes a proactive approach to transportation management focused on resilience-enhancing strategies. However, without qualitative follow-up the precise reasons for minority disagreements remain unclear.

### **5.2.1.2 Vehicle Maintenance**

The descriptive statistics provided insight into perceptions of vehicle maintenance practices within the Ethiopian Ministry of Defense's logistics department. In particular, regularly serviced and maintained vehicles received a very high mean of 4.21. Similarly, readily available spare parts for repairs scored highly at 4.10. While preventative maintenance schedules still fell in the high range, there may be potential for improvement with a mean of 3.97. Standard deviations were consistently low, suggesting reliable response patterns across participants. Over 85% of respondents agreed or strongly agreed that emphasized practices included proper maintenance, spare parts provisioning, and disruptions preparations. This consensus implicates vehicle maintenance as a likely contributor to higher logistical resilience within this context. In conclusion, through their adherence to routines like schedules and reliability strategies, the department demonstrates an adept approach to vehicle management.

### **5.2.1.2 Driver Training**

The descriptive statistics provided insight into perceptions of driver training practices within the Ethiopian Ministry of Defense's logistics department. Across four Likert scale items assessing techniques such as defensive driving, alternate route instruction, and refresher courses, mean scores predominantly fell into the "high performance" category. Specifically, defensive driving attained a mean of 3.88, while alternate route navigation scored similarly at 3.91. Refresher assessments came in slightly lower at 3.83. Impressively, hiring/training screening for safety records achieved the highest rating of 3.96, categorized as "very high performance". Standard deviations indicated some variability yet also consistency across responses. Over 78% of participants agreed or strongly agreed that emphasized practices focused on ongoing learning and credential vetting. This alignment between most respondents implicates driver training as a key contributor to logistical resilience. In conclusion, through investment in continuous education and selection based on credentials, the department appears committed to transport safety and quality.

### **5.2.1.2 Load Management**

The descriptive statistics provided insight into perceptions of load management practices within the Ethiopian Ministry of Defense's logistics department. Across six Likert scale items evaluating

aspects such as capacity optimization, cargo security, and payload balancing, mean scores predominantly indicated "very high" or "high" performance levels. Specifically, optimizing vehicle fills attained a very high mean of 3.98, while properly securing cargo scored similarly at 4.10. Other measures including defined procedures and trip reductions exceeded 3.9. Standard deviations were consistently low, denoting consensus among responses. Over 82% of participants strongly agreed or agreed that emphasized load techniques focused on handling efficiency, continuous operations, and disruption preparedness. This implication associates adept load management with higher logistical resilience. In summary, through optimizing utilization, documentation, and reductions, the department seems to demonstrate proficiency in cargo administration.

### **5.2.2 Measurement Logistic Resilience**

The descriptive statistics provided insight into perceptions of logistic resilience across three dimensions - recovery, adaptation, and continuity of operations - within Ethiopia's Ministry of Defense logistics department. Across 17 Likert scale items, mean scores predominantly fell within the "very high" or "high" performance categories. This indicates robust capacities in alternate options, flexibility, disruption learning/documentation, and maintenance of critical deliveries. Specifically, for recovery, practices involving well-planned routes, reliable vehicles and backups scored very highly with means exceeding 3.88. Adaptation strengths encompassed modifications, new processes and skilled implementation, all above 3.87 means. Continuity emphasized multi-modal flexibility and redundancies to prevent deficiencies, maintaining means above 3.77.

Standard deviations were consistently low, denoting agreement between responses. Over 78% strongly agreed/agreed that protocols emphasized resilience attributes. In summary, through proactive transportation, workforce and partnership strategies, the logistics department appears adept at resilient operations, disruption preparedness and continuity assurance. The overall positive ratings and consensus implicate examined factors as resilience predictors within this context. Further mixed research with comparative datasets could provide more generalizable insights regarding resilience dimensions in similar operational environments. Sustained strengths across predictive measures position the organization well for ongoing uncertainties.

### **5.2.3 The Relationship Between Transportation Management Practice and Logistic Resilience**

The analysis in the study revealed significant positive correlations between all operational variables – Route Planning, Vehicle Maintenance, Driver Training, and Load Management - and the outcome variable, Logistic Resilience. Specifically, Route Planning exhibited the strongest correlation ( $r = 0.674$ ,  $p < .01$ ), followed closely by Vehicle Maintenance ( $r = 0.638$ ,  $p < .01$ ) and Load Management ( $r = 0.632$ ,  $p < .01$ ). Driver Training demonstrated a moderate but still significant correlation ( $r = 0.596$ ,  $p < .01$ ).

These findings indicate that higher performance in the examined operational factors relates to stronger logistical resilience. Effective route Planning, fleet upkeep, load handling techniques, and driver instruction each positively contribute to maintaining continuity of operations during disruptions. By prioritizing strategic investments, organizations can enhance their resilience capacities. Route planning allows for timely response. Maintenance ensures fleet reliability. Training adaptable drivers and optimized load management minimize disruptive impacts. Overall, the results underscore the importance of these operational predictors in building robust supply chains capable of withstanding uncertainties. Sustained focus on identified resilience-promoting practices positions logistics operations well to navigate future disruptive scenarios.

### **5.2.4 The Impact of Transportation Management on Logistic Resilience**

Route planning yielded a coefficient of  $\beta = 0.186$ , with vehicle maintenance and driver training also positively impacting logistics resilience (LR) at 0.145 and 0.119, respectively. Load management had the largest effect size at  $\beta = 0.255$ . All predictors were statistically significant based on t-test results, with p-values below 0.05. Standardized coefficients ( $\beta$ ) allow for comparison of predictor importance, showing load management as the strongest at 0.301, followed by route planning at 0.268. In summary, the model suggests that optimizing operational aspects such as route planning, maintenance, training, and load management can enhance logistics resilience, given their demonstrated positive relationships and statistical significance as predictors.

Overall, the consistency of regression coefficients for the selected transportation management practices suggests that these variables are important factors influencing the resilience of logistics

operations, although to different degrees. All the independent variables were significant predictors of logistics resilience performance, as their significance values were less than 0.05 ( $p < 0.05$ ) or VIF (variance inflation factor) was within the acceptable range of  $> 1$  and  $< 3$ . The predictive model developed by the study is  $Y = 1.136 + 0.186X_1 + 0.145X_2 + 0.119X_3 + 0.255X_4$ , where Y is logistics resilience, X1 is route planning, X2 is vehicle management, X3 is driver training, and X4 is load management (Hair et al., 2010).

### **5.3 Conclusion**

The present study aimed to assess the impact of transportation management in logistics resilience: in case of Ethiopian Defense Force Logistics department. The research utilized a mixed research approach, employing stratified random sampling, interview and survey questionnaires to collect data from 135 respondents within the Ministry of Defense logistics and transportation department. The collected data were analyzed using SPSS analytical software, employing descriptive, correlational and regression analysis.

The key findings for each research question are discussed as follow:

To answer the first question, a descriptive analysis of transportation practice dimensions of route planning, vehicle maintenance, driver training, and load management was utilized. The logistics department's transportation management practices reveal a comprehensive approach to ensuring resilient operations. The respondents firmly believe that the department's route planning effectively minimizes disruptions, and the identification of alternative routes and pre-auditing of backup options are recognized as well-established practices. Furthermore, the widespread acknowledgment of the department's consideration of seasonal and weather factors demonstrates its adaptability to changing conditions (Chih-hui, 2011). The analysis of the driver training practices within the logistics department reveals a strong emphasis on employee development and high performance. The mean scores indicate that driver training is an established and well-regarded practice, and the widespread endorsement of the existing training processes reflects a high level of employee satisfaction (Pallant, 2021; Gravetter & Wallnau, 2016). The analysis of load management practices within the logistics department reveals a high level of performance and employee satisfaction. The mean scores indicate that the load management practices are well-

established and viewed as meeting high to very high-performance standards, and the widespread endorsement of the approved processes conveys that they are routinely followed (Gravetter & Wallnau, 2016; Chih-hui, 2011).

The results of the study revealed several important insights to answer the rest of three research questions on this study. The high mean scores, low variability, and overwhelming positive perceptions suggest that the Ethiopian Defense Force logistics department maintains transportation management practices that meet or exceed high standards, contributing to efficient and resilient logistical operations, extensive and well-entrenched vehicle maintenance practices, contributing to efficient and resilient transportation management, the logistics department places a strategic emphasis on driver training, with continuous development and risk assessment as core management functions. Sustaining these practices helps maintain the dependability and resilience of the transportation system, and load management, ensuring resilience and effectiveness within the transportation operations which is crucial for the logistical backbone of the organization (Creswell & Creswell, 2018).

The findings of the second research question provided insight into perceptions of logistic resilience across three dimensions - recovery, adaptation, and continuity of operations - within Ethiopia's Ministry of Defense logistics department. The mean scores predominantly fell within the "very high" or "high" performance categories, indicating robust capacities in alternate options, flexibility, disruption learning/documentation, and maintenance of critical deliveries (Chih-hui, 2011). For recovery, practices involving well-planned routes, reliable vehicles, and backups scored very highly with means. Over 78% strongly agreed/agreed that protocols emphasized resilience attributes. The overall positive ratings and consensus implicate examined factors as resilience predictors within this context (Gravetter & Wallnau, 2016). Further mixed research with comparative datasets could provide more generalizable insights regarding resilience dimensions in similar operational environments. Sustained strengths across predictive measures position the organization well for ongoing uncertainties (Pallant, 2021).

The findings in the study addressed the third research question revealed significant positive correlations between all operational variables - Route Planning, Vehicle Maintenance, Driver Training, and Load Management - and the outcome variable, Logistic Resilience. Specifically,

Route Planning exhibited the strongest correlation ( $r = 0.674$ ,  $p < .01$ ), followed closely by Vehicle Maintenance ( $r = 0.638$ ,  $p < .01$ ) and Load Management ( $r = 0.632$ ,  $p < .01$ ). Driver Training demonstrated a moderate but still significant correlation ( $r = 0.596$ ,  $p < .01$ ) (Chih-hui, 2011). These outcomes indicate that higher performance in the examined operational factors relates to stronger logistical resilience. Effective route allocation, fleet upkeep, load handling techniques, and driver instruction each positively contribute to maintaining continuity of operations during disruptions. By prioritizing strategic investments, organizations can enhance their resilience capacities (Chih-hui, 2011). Route planning allows for timely response. Maintenance ensures fleet reliability. Training adaptable drivers and optimized load management minimize disruptive impacts. Overall, the results underscore the importance of these operational predictors in building robust supply chains capable of withstanding uncertainties. Sustained focus on identified resilience-promoting practices positions logistics operations well to navigate future disruptive scenarios (Pallant, 2021; Gravetter & Wallnau, 2016).

Through our investigation of operational factors impacting logistic resilience within the Ethiopian Ministry of Defense, several significant findings emerged. Our regression analysis revealed route planning, vehicle maintenance, driver training, and load management all positively influence an organization's ability to maintain continuity of operations during disruptions. The result revealed that route planning, vehicle maintenance, and driver training positively impacted logistics resilience, with load management having the largest effect. All predictors were statistically significant (Chih-hui, 2011). Standardized coefficients showed load management as the strongest predictor, followed by route planning (Hair et al., 2010). The model suggests that optimizing these operational aspects can enhance logistics resilience. The consistency of regression coefficients indicates these transportation management practices are important factors influencing logistics operations resilience, to varying degrees. All independent variables were significant predictors of logistics resilience performance (Hair et al., 2010). The predictive model includes route planning, vehicle management, driver training, and load management as variables (Hair et al., 2010).

Overall, logistic resilience demands continuous evolution (Kebede, 2023). To withstand unforeseen challenges, organizations require agility, strong human capital, and optimized processes informed by past experiences (Kebede, 2023). The Ethiopian Ministry of Defense and similar groups can apply our recommendations to develop resilient supply chains capable of not

just recovering from disruptions but growing even stronger (Getachew, 2023). Rather than a one-time goal, resilience necessitates a culture of proactive evaluation and ongoing refinements anticipating disruptions before they emerge. By embracing resilience as a journey, organizations position themselves to thrive despite uncertainties.

#### **5.4 Recommendation**

There are several strategic recommendations for strengthening logistic resilience within the Ethiopian Ministry of Defense's logistics department based on the findings of this research. First and foremost, the department should increase investment in route planning practices. Considering route planning demonstrated the strongest correlation with resilience, focusing on predictive analytics and scenario-based allocation techniques could optimize just-in-time responses to disruptions. Establishing dedicated planning roles to continuously monitor routes and anticipate needs would better position the department to maintain operations despite uncertainties.

- Vehicle maintenance emerged as another key predictor of resilience and therefore warrants prioritization. Implementing preventative maintenance schedules and reliability protocols enhances fleet dependability, reducing the likelihood of transportation failures disrupting missions. Regular maintenance also lowers lifecycle costs compared to reactive approaches. The department should strive for top quartile vehicle up-time through proactive maintenance mindsets and resources.
- Driver training additionally promotes resilience by developing adaptability amid changing conditions. Refresher courses on emerging risks and alternate routes keep drivers equipped to navigate disruptions. Encouraging safety-first attitudes also prevents incidents that could further stress logistics. Expanding simulator exercises and route tutoring with a mission-safety dual focus cultivates resilience muscle memory among operators.
- Load management also requires optimization, given its consistently strong correlation with resilience capabilities. Standardizing routing protocols with flexibility thresholds maintains redundancy without over-engineering networks vulnerable to single failures. Digitizing cargo records further enhances real-time optimization and disruptions response. Overall load efficiency bolsters continuity by minimizing stochastic disruptions' proliferation impacts.

- Leveraging data systems presents another avenue for resilience gains. Integrating modern fleet telematics offers real-time visibility into assets, aiding rapid adaptations. Cloud-based cargo ledgers likewise support optimized allocations when disruptions shift demands. Investing in cybersecurity safeguards these valuable interconnected systems. Finally, institutionalizing lessons from past disruptions grounds readiness in experience. Documenting challenges captures invaluable context to refine processes proactively.

In summary, systematically strengthening functions predictive of resilience bolsters adaptability to unforeseen conditions. Committing to a culture of continual assessment and improvement maintains hard-earned operational continuity over the long-term. When disruptions do occur, a resilient mindset enables swift navigation to mission success.

## **References÷**

- Alou, R., et al. (2021). Supply chain resilience: A review and future research directions. *Journal of Business Research*, 133, 285-297.
- Altekar, R. V. (2005). *Material Management: A Conceptual Approach*. New Delhi: New Age International.
- Amsalu, Sisay., Mezgebu, Liku. (2022). Supply Chain Management Practice and Its Impact on Performance of Humanitarian Relief Organization in Case of Gedeo Zone. *International Journal of Financial, Accounting, and Management*, doi: 10.35912/ijfamv4i3.789
- Arsalan, Safari., Mahour, Mellat, Parast., Ismail, Gölgeci., Shaligram, Pokharel. (2023). Supply chain risk and resilience in startups, SMEs, and large enterprises: a systematic review and directions for research. *The International Journal of Logistics Management*, doi: 10.1108/ijlm-10-2022-0422
- ASSISTANT SECRETARY OF DEFENSE (ACQUISITION AND LOGISTICS) WASHINGTON DC. (1986). *Department of Defense Base Structure Report for Fiscal Year 1989*.
- Akgün, I., & Tansel, B. Ç. (2007). Optimization of transportation requirements in the deployment of military units. *Computers & operations research*, 34(4), 1158-1176.
- Bastian, N. D., Griffin, P. M., Spero, E., & Fulton, L. V. (2016). Multi-criteria logistics modeling for military humanitarian assistance and disaster relief aerial delivery operations. *Optimization letters*, 10, 921-953.
- Blackhurst, J., Dunn, K. S., & Craighead, C. W. (2011). An empirically derived framework of global supply resiliency. *Journal of business logistics*, 32(4), 374-391.
- Beer, H., et al. (2022). The digital supply chain as a resilience enabler: A systematic review of the literature. *International Journal of Production Economics*, 244, 108411.
- Dolgui, A., et al. (2020). Resilient supply chains: A research framework with an application to the COVID-19 pandemic. *International Journal of Production Economics*, 232, 107849.

Datta, P. (2017). Supply network resilience: a systematic literature review and future research. *The International Journal of Logistics Management*, 28(4), 1387-1424.

Dong-Sheng, Wang. (2020). Choi states, symmetry-based quantum gate teleportation, and stored-program quantum computing. *Physical Review A*, doi: 10.1103/PHYSREVA.101.052311

Gürtlich, M., & Lampl, H. (2022). Supply chain resilience: A systematic literature review and agenda for future research. *International Journal of Production Economics*, 244, 108504.

Hohenstein, N. O., Feisel, E., Hartmann, E., & Giunipero, L. (2015). Research on the phenomenon of supply chain resilience: a systematic review and paths for further investigation. *International journal of physical distribution & logistics management*, 45(1/2), 90-117.

Ivanov, D., & Dolgui, A. (2020). Viability of intertwined supply networks: extending the supply chain resilience angles towards survivability. A position paper motivated by COVID-19 outbreak. *International journal of production research*, 58(10), 2904-2915.

Ivanov, D., & Dolgui, A. (2021). OR-methods for coping with the ripple effect in supply chains during COVID-19 pandemic: Managerial insights and research implications. *International Journal of Production Economics*, 232, 107921.

Ivanov, D., Dolgui, A., Das, A., & Sokolov, B. (2019). Digital supply chain twins: Managing the ripple effect, resilience, and disruption risks by data-driven optimization, simulation, and visibility. *Handbook of ripple effects in the supply chain*, 309-332.

Katsaliaki, K., et al. (2021). A systematic literature review of supply chain resilience research: State-of-the-art and future research directions. *International Journal of Production Economics*, 235, 108170.

Katsaliaki, K., Galetsi, P., & Kumar, S. (2022). Supply chain disruptions and resilience: A major review and future research agenda. *Annals of Operations Research*, 1-38.

Khan, J. A., Abu Bakr, M., Aslam, S., & Saeed, A. Recent Advancements and Challenges in Deep Learning and Internet of Things for Precision Agriculture. Sumera and Saeed, Adnan, Recent Advancements and Challenges in Deep Learning and Internet of Things for Precision Agriculture.

Kochan, C. G., & Nowicki, D. R. (2018). Supply chain resilience: a systematic literature review and typological framework. *International Journal of Physical Distribution & Logistics Management*, 48(8), 842-865.

Morrison, J. R., et al. (1994). *Fundamentals of Logistics Management*. Boston, MA: Irwin/McGraw-Hill.

Muniz, R. N., da Costa Júnior, C. T., Buratto, W. G., Nied, A., & González, G. V. (2023). The Sustainability Concept: A Review Focusing on Energy. *Sustainability*, 15(19), 14049.

MOND. (2000). *Defence logistics: Enabling and sustaining military capability*. Defence Science and Technology Organisation, Australia.

Mandal, S. (2012). An empirical investigation into supply chain resilience. *IUP Journal of supply chain management*, 9(4).

Naghshineh, B., & Carvalho, H. (2022). The implications of additive manufacturing technology adoption for supply chain resilience: A systematic search and review. *International Journal of Production Economics*, 247, 108387.

Pettit, T. J., Croxton, K. L., & Fiksel, J. (2013). Ensuring supply chain resilience: development and implementation of an assessment tool. *Journal of business logistics*, 34(1), 46-76.

Ponomarov, S. Y., & Holcomb, M. C. (2009). Understanding the concept of supply chain resilience. *The international journal of logistics management*, 20(1), 124-143.

Queiroz, M. M., Ivanov, D., Dolgui, A., & Fosso Wamba, S. (2022). Impacts of epidemic outbreaks on supply chains: mapping a research agenda amid the COVID-19 pandemic through a structured literature review. *Annals of operations research*, 319(1), 1159-1196.

Ribeiro, J. P., & Barbosa-Povoa, A. (2018). Supply Chain Resilience: Definitions and quantitative modelling approaches—A literature review. *Computers & industrial engineering*, 115, 109-122.

Sadeghi, K., & Abadi, M. Q. H. (2024). Sustainable supply chain resilience for logistics problems: Empirical validation using robust and computational intelligence methods. *Journal of Cleaner Production*, 437, 140267.

- Scholten, K., Stevenson, M., & van Donk, D. P. (2020). Dealing with the unpredictable: supply chain resilience. *International Journal of Operations & Production Management*, 40(1), 1-10.
- Shishodia, A., Sharma, R., Rajesh, R., & Munim, Z. H. (2023). Supply chain resilience: A review, conceptual framework and future research. *The International Journal of Logistics Management*, 34(4), 879-908.
- Sheffi, Y. (2005). *The resilient enterprise: overcoming vulnerability for competitive advantage*. Pearson Education India.
- Tang, C. S. (2006). Robust strategies for mitigating supply chain disruptions. *International Journal of Logistics: Research and Applications*, 9(1), 33-45.
- Tadesse, D., et al. (2019). Optimizing the distribution of military supplies: A case study of the Ethiopian National Defense Force. *Cogent Engineering*, 6(1), 1621189.
- Yoho, K. D., Rietjens, S., & Tatham, P. (2013). Defence logistics: an important research field in need of researchers. *International Journal of Physical Distribution & Logistics Management*, 43(2), 80-96.
- Wan, C., Yang, Z., Zhang, D., Yan, X., & Fan, S. (2018). Resilience in transportation systems: a systematic review and future directions. *Transport reviews*, 38(4), 479-498.
- Walton, S. V., et al. (2022). Transportation resilience: A systematic literature review and future research agenda. *Journal of Business Logistics*, 43(1), 5-33.
- Wan, K., He, J., & Shi, X. Construction of high accuracy machine learning interatomic potential for surface/interface of nanomaterials—a review. *Advanced Materials*, 2305758.
- Wieland, A., & Wallenburg, C. M. (2013). The influence of relational competencies on supply chain resilience: a relational view. *International journal of physical distribution & logistics management*, 43(4), 300-320.

# QUESTIONNAIRE

ADDIS ABABA UNIVERSITY

SCHOOL OF COMMERCE

DEPARTMENT OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT

Dear Respondents:

I am a graduate student at Addis Ababa University school of commerce, Department of logistics and supply chain management. Currently, I am conducting research titled Assessment of the Impact of Transportation Management on Logistics Resilience: in case of ministry of defence of Ethiopia as partial fulfilment of requirement for the award of masters of art degree in logistics and supply chain management. The purpose of this questionnaire is to gather data for the proposed study, and hence you are kindly requested to assist the successful completion of the study by providing the necessary information. Your participation is entirely voluntary and the questionnaire is completely anonymous. I confirm you that the information you share will stay confidential and only used for the aforementioned academic purpose only. So, your genuine, frank and timely response is vital for the success of the study. I want to thank you in advance for your kind cooperation and dedication of your precious time to fill this questionnaire.

Sincerely Yours;

Yoseph Lire

Note:

1. No need of writing your name.
2. Put this  or  mark on the appropriate block/cell both for multiple choice and Likert scale questions.
3. If you need further explanation you can contact me and discuss the matter freely at

(Telephone No. 0924671597 or 0703321597, E-mail [lireyoseph@gmail.com](mailto:lireyoseph@gmail.com))

**Part one – demographic information**

1. Age:  18-25  26-35  36-45  46-55  above 55
2. Sex:  male  female
3. Military Rank :  civilian  noncommissioned officer to staff sergeant  1<sup>st</sup> lieutenant officer to captain  major to colonel  general and above
4. marital status:  Married  Single  Separated  Divorced
5. highest educational level:  Certificate  Diploma  Degree  Master's Degree  Above Master's Degree
6. years of service/experience do you have in logistics and transportation management in ministry of defense of Ethiopia?
  - 1) Less than 1 year\_\_\_
  - 2) 1-7 years\_\_\_\_\_
  - 3) 8-15 years\_\_\_\_\_
  - 4) 16 years-25 years \_\_\_\_\_
  - 5) 25 years and above
7. What is your role in the organization?
  1. Transport operator
  2. Maintenance expert
  3. administrative staff
  4. desk coordinator
  5. team leader
  6. director

**Part – II: Five-point Likert scale questions**

Please express your level of agreement in the following questions by putting  $\surd$  or  $\times$  mark in the appropriate cell. 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree

s. no	Statement	Score				
		1	2	3	4	5
<b>I</b>	<b>TRANSPORTATION MANAGEMENT</b>					
<b>Route Planning</b>						
1	Route plans are designed to minimize disruptions (e.g. avoiding high-risk areas). (Sawik, 2019)					
2	Alternate routes are identified in case of disruptions on primary routes. (Ibrahim & El-Reifi, 2021)					
3	Alternative routes are pre-audited for safety and capacity before disruptions occur (Blackhurst et al., 2005).					
4	Route planning considers seasonal/weather factors that could impact transportation (Carvalho et al., 2012).					
5	Considering multiple modal options in route planning improves flexibility to adapt to delays. (Birkmann, 2007)					
<b>Vehicle Maintenance</b>						
6	Vehicles are regularly serviced and maintained to prevent breakdowns. (Chopra & Sodhi, 2014)					
7	Spare parts are readily available to quickly repair vehicles if needed. (Sheffi & Rice Jr, 2005)					

8	Preventative maintenance schedules are established and strictly followed (Sheffi & Rice Jr, 2005).				
9	Vehicle replacement plans ensure an adequate fleet age and reliability (Vorst et al., 2007).				
10	Reliable vehicles are better able to recover operations following a disruption event. (Craighead et al., 2007)				
11	Well-maintained equipment minimizes the potential impact of a disruption. (Blackhurst et al., 2005)				
<b>Driver Training</b>					
12	Drivers receive ongoing training on defensive driving techniques. (Craighead et al., 2007)				
13	Drivers are trained to navigate alternate routes if needed. (Wieland & Wallenburg, 2013)				
14	Drivers receive periodic refresher courses/assessments to maintain skills (Ivanov et al., 2017).				
15	Hiring/training practices screen for drivers with high safety records (Williams et al., 2017).				
<b>Load Management</b>					
16	Loads are optimized to maximize vehicle capacity utilization. (Schmidt & Wilhelm, 2000)				
17	Loads are secured properly to prevent cargo loss or damage. (Blackhurst et al., 2005)				
18	Loads are balanced and organized efficiently to ease handling/loading tasks (Schmidt & Wilhelm, 2000).				

19	Special cargo (e.g., hazardous materials) has defined securement/documentation procedures (Craighead et al., 2007).				
20	Optimizing payload reduces trips and helps maintain operations during disruptions. (Coffen-Smout & Smith, 2000)				
21	Secure loads arrive intact, reducing recovery time from issues in transit. (Schmidt & Wilhelm, 2000)				
<b>II. LOGISTIC RESILIENCE</b>					
Ability to Recover from Disruption					
22	Alternative transportation options can be activated quickly when primary options fail. (Ponomarov & Holcomb, 2009)				
23	Spare capacity and flexible workforce allow normal operations to resume rapidly after disruptions. (Hollnagel et al., 2006)				
24	Well-planned routes with buffers avoid critical single points of failure (Kim et al., 2020).				
25	Key transportation positions have redundant backups in place (Pettit et al., 2010).				
26	Reliable vehicles maintain delivery schedules during local impediments (Craighead et al., 2007).				
<b>Ability to Adapt to Changes</b>					
27	Transportation and distribution plans can be modified dynamically in response to changing conditions. (Christopher & Peck, 2004)				

28	New processes and procedures are developed and implemented for recurring disruption scenarios. (Carvalho et al., 2012)					
29	A culture of flexibility, creativity and rapid decision-making is cultivated (Carvalho et al., 2012).					
30	Lessons from past disruptions are documented in an institutional knowledge base (Coffen-Smout & van der Voorde, 2005).					
31	Skilled operators implement rapidly-revised procedures (Carvalho et al., 2012).					
32	Agile systems support agility across scales (Ivanov & Dolgui, 2020).					
<b>Ability to Maintain Continuity of Operations</b>						
33	Critical goods and supplies can still be delivered during times of disruption. (Sheffi, 2005)					
34	Operations can continue with minimal impact during most disruptions through flexible multi-modal solutions. (Pettit et al., 2010)					
35	Critical item/route redundancy allows for rotations without stockouts (Sheffi, 2005).					
36	External partnerships supplement capacity during super-disruptive scenarios (Scholten et al., 2014).					
37	Balanced allocations prevent localized deficiencies (Coffen-Smout & Smith, 2000).					
38	Interoperable digital systems share statuses/loads (Vanderberge et al., 2022).					

### **Part III- open-ended questionnaires.**

1. Please describe the route planning process typically used at your organization. How are factors like safety, capacity, weather considered? (Ibrahim & El-Reifi, 2021).
2. What vehicle maintenance practices are followed to minimize downtime and maximize reliability? How are these practices developed and updated? (Sheffi & Rice Jr, 2005)
3. What types of training do drivers receive regarding defensive driving, alternate routes, load securement etc.? How is the effectiveness of training evaluated? (Williams et al., 2017)
4. How are loads configured and balanced for optimal vehicle capacity utilization? What procedures are in place for hazardous cargo? (Schmidt & Wilhelm, 2000)
5. What role does technology like GPS, telematics, and communication tools play in transportation operations? How is use of these technologies determined? (Van de Walle & Van den Eede, 2006)
6. In what ways does the design and implementation of routes help your organization respond rapidly when primary options fail? (Carvalho et al., 2012)
7. How does vehicle/equipment maintenance and preventative replacement plans allow your operations to adapt quickly to changing conditions? (Blackhurst et al., 2005)
8. What cultural/process aspects of your operations help sustain continuity even during major disruptions? (Pettit et al., 2010)
9. What additional transportation management practices or technologies could improve resilience abilities? (Ivanov et al., 2018)

## **PART-IV: Interview questionnaires**

Addis Ababa University School of Commerce Master of Art in Logistics and Supply Chain Management a semi structured interview on “Assessment of the Impact of Transportation Management on Logistics Resilience: in case of ministry of defence of Ethiopia” It includes the selected military personnel which contains and take into account all military rank holders and military commanders through semi structured interview of Defense joint logistics main department.

The questionnaire will take approximately maximum 30 minutes. I guarantee that all of your answers will be completely confidential.

*Thank you for taking your time and willingness to cooperate.*

By; Yoseph Lire (0924671597)

### **Discussion Points**

#### **Background**

- Name-----
- Educational level-----
- Occupation status to this organization-----

#### **Transportation Management: Route Planning**

1. How would you describe the typical route planning process for material transportation?  
(Craighead et al., 2007)
2. What factors are considered when designing routes? (Ibrahim & El-Reifi, 2021)

3. How are alternate routes identified and integrated into transportation plans? (Carvalho et al., 2012)
4. What vehicle maintenance practices are in place to minimize downtime? (Sheffi & Rice Jr, 2005)
5. How are drivers selected and trained to handle responsibilities? (Williams et al., 2017)
6. How are loads optimized and secured during transport? (Schmidt & Wilhelm, 2000)
7. What technologies support transportation operations and decision making? (Van de Walle & Van den Eede, 2006)

### **Impact on Logistic Resilience**

8. In what ways does route planning impact the ability to recover from disruptions? (Blackhurst et al., 2005)
9. How does transportation management influence adapting to changing conditions? (Ivanov et al., 2018)
10. What role does it play in maintaining continuity of operations? (Pettit et al., 2010)