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School Of Commerce

The Effect of Road Transport Infrastructure on Logistics Performance: In The Case of Moha Soft Drink Industry SC Plants in A.A.

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This is to certify that the thesis prepared by Meron Mekbib, entitled The Effect of Road Transport Infrastructure on Logistics Performance and submitted in partial fulfillment of the requirements for Master Of Arts In Logistics And Supply Chain Management complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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DECLARATION

I, Meron Mekbib, hereby declare that this thesis entitled ”The Effect of Road Transport Infrastructure on Logistics Performance: The Case of Moha Soft Drink Industry S.C. Plants in Addis Ababa” is my original work. It has not been submitted for a degree in any other university or institution. All source of materials used for this thesis have been duly acknowledged.

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ACRONYMS

ERA - Ethiopian Roads Authority

FMCG – Fast Moving Consumer Goods

FDRE - Federal Democratic Republic of Ethiopia

LPI - Logistics Performance Index

MOHA - Moha Soft Drink Industry S.C.

RSDP - Road Sector Development Programme

SCM - Supply Chain Management

SPSS - Statistical Package for Social Sciences

ABSTRACT

This study examines the effect of road transport infrastructure on logistics performance at Moha Soft Drink Industry S.C., across its Teklehaimanot, Summit, and Nifas Silk plants in Addis Ababa, focusing on five infrastructure dimensions: scheduling, accessibility, safety, efficiency, and route choice. Using a quantitative, cross-sectional design, primary data were collected from 132 logistics and operational staff out of a target population of 170 (77.8% response rate), predominantly drivers with over a decade of experience, and analyzed through descriptive statistics, Pearson correlation, and multiple linear regression in SPSS. Descriptively, respondents agreed that infrastructure deficiencies disrupt MOHA's logistics operations across all five dimensions, though only scheduling showed a strong correlation with logistics performance ($r = .661$, $p < .01$). The regression model was statistically significant ($R^2 = .468$, Adjusted $R^2 = .447$, $F = 22.168$, $p < .001$), explaining 46.8% of the variance in logistics performance, with scheduling emerging as the dominant predictor ($\beta = .681$, $p < .001$) and efficiency also significant but negatively associated with performance ($\beta = -.144$, $p = .034$), while accessibility, safety, and route choice showed no independent predictive power despite being rated as serious operational concerns. The study concludes that scheduling reliability and operational efficiency are the primary drivers of logistics outcomes at MOHA, and that improving infrastructure alone will not automatically translate into better performance, recommending investment in real-time scheduling systems, efficiency-focused cost tracking, and coordinated long-term infrastructure improvements with public road authorities.

Keywords: Road Transport Infrastructure, Logistics Performance, Scheduling, Accessibility, Safety, Efficiency, Route Choice

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

Road transport infrastructure is commonly considered one of the most important accelerators for economic development and supply chain efficiency. This is especially true in Africa where the road network is the major mode for freight transit. In Ethiopia, road transport represents more than 90% of total freight and passenger traffic, therefore the quality and coverage of road infrastructure is a determining element for industrial competitiveness and logistics performance (World Bank, 2022).

Addis Ababa, the political, economic and commercial hub of Ethiopia, has seen significant growth as a city during the past two decades. This has been followed with a large public and private investment in road infrastructure including the expansion of ring roads, inner city expressways and inter regional trunk route . Since 1997, Ethiopian Road Autority (ERA) implemented successive Road Sector Development Programmes(RSDP) which resulted in significant increase in overall road network (ERA, 2022).

Despite these improvements the logistics sector in Ethiopia continues to confront significant issues such as high freight costs long transit periods poor route connectivity and irregular delivery scheduling. Direct expenses for manufacturing firms are imposed by these restrictions and the overall competitiveness of domestic industries is reduced. The beverage business, with its large volumes and time sensitive distribution activities, is especially vulnerable to infrastructure inadequacies.

Moha Soft Drink Industry S.C is among the biggest beverage makers in Ethiopia. The company has 8 production plants across the country and 3 factories in Addis Ababa: Teklehaymanot, Summit and Nifas Selk. The company's supply chain consists of raw materials sourcing, inbound logistics, production planning and outbound distribution of finished beverages to the retailers and wholesalers scattered over the city and nearby regions. The company's logistics performance is directly affected by the road transport infrastructure in numerous dimensions, due to the volume of daily vehicle movements that these operations demand.

Logistics performance is a multidimensional construct measuring the ability of as supply chain to move items effectively and reliably from origin to destination . The World Bank Logistics

Performance Index (LPI) framework identifies important factors such as quality of infrastructure, efficient customes clearance, cargo tracking, timeliness and competences of logistics providers(Arvis et al., 2023). For manufacturing firms like Moha Soft Drink, internal logistics performance parameters schedule dependability, accessibility, safety, efficiency and rout choice flexibility are of special relevance.

Empirical research from comparable economies shows that better road infrastructure can decrease logistics costs by 15 to 30 percent and greatly enhance delivery reliability (Donaldson, 2018; Limao and Venables, 2001). Despite the improvements in the infrastructures, there is limited research on the direct impact on the logistics performance of individual businesses such as the beverage manufacturing industry in Ethiopia. However, in the Ethiopian context, the relationship between specific road infrastructure and logistics performance results within business level context is not investigated. This research is trying to study the effect of road transport infrastructure on the logistic performance of Moha's Soft Drink Industry S.C, Teklehaymanot, Summit and Nifas Silk Plants in Addis Ababa.

1.2 Statement of the Problem

Ethiopia has made substantial progress in upgrading its road networks through successive Road Sector Development Programmes, but still scores low on regional and global logistics performance metrics. Ethiopia is ranked 126th out of 139 countries in the World Bank Logistics Performance Index (2023), reflecting ongoing deficiencies in infrastructure quality, reliability of delivery, and cost-efficiency of transport (World Bank, 2023). The problem is compounded by the increasing urbanization within Addis Ababa leading to the density of vehicles, poor traffic management systems and the variable quality of the secondary and tertiary road networks (Gebremedhin and Pant, 2020).

Moha Soft Drink Industry S.C. like other industrial firms operating in Addis Ababa suffers major logistical problems on a regular basis. Distribution vehicles of finished products and collection vehicles of raw materials must travel congested arterial highways, poorly maintained side roads and inadequate loading and unloading facilities at distribution locations. These conditions lead to unpredictable delivery schedules, high transportation expenses, limited flexibility in route selection and longer transit times all of which undermine the company's competitive position and increase operational costs.

However, although the scale and strategic relevance of road transport infrastructure, empirical studies on the specific influence of road transport infrastructure changes on the success of Moha Soft Drink logistics operations are lacking in the academic literature. Most of the existing research on Ethiopian transport and logistics has been on national level or corridor level analysis and rarely does it study the translation of urban road infrastructure improvements into measurable change in firm level logistics performance dimensions such as schedule reliability, accessibility, safety, efficiency and route choice.

Moreover, the lack of empirical evidence on this relationship limits the ability of both public road authorities and private firms to make informed decisions and resources may be misallocated and operational inefficiencies may continue needlessly.

The study so attempts to address the following important research topics. What is the effect of road transport infrastructure growth on the logistics performance of Moha Soft Drink Industry S.C facilities in the city of Addis Ababa in terms of scheduling, accessibility, safety, efficiency and route choice

1.3 Research Questions

1. What is the current state of road transport infrastructure affecting Moha Soft Drink Industry logistics operations?
2. How do the dimensions of scheduling, accessibility, safety, efficiency, and route choice influence logistics performance?
3. To what extent does road transport infrastructure contribute to improved logistics performance at Moha Soft Drink Industry?

1.4 Research Objective

1.4.1 General Objective:

To examine the effect of road transport infrastructure on the logistics performance of MOHA Soft Drink Industry.

1.4.2 Specific Objectives

1. To assess how the conditions of road transport infrastructure influence the logistics performance of Moha Soft Drink Industry S.C.

2. To examine how the road transport infrastructure performance dimensions Scheduling, Accessibility, Safety, Efficiency, and Route Choice affect the logistics performance of Moha Soft Drink Industry S.C.
3. To evaluate how road transport infrastructure contributes to the overall logistics performance of Moha Soft Drink Industry S.C.

1.5 Significance of the Study

The study is very important at academic, management and policy levels and adds a lot to the different stakeholders. Academically, the study contributes to the growing body of empirical literature on transport infrastructure and logistics. For Moha Soft Drink Industry S.C., the findings will provide management with empirical evidence on the specific dimensions of road transport infrastructure that have the most significant impact on logistics performance and address it. From a policy perspective, relevant urban planning bodies will benefit from firm level evidence demonstrating how road infrastructure translate into measurable logistics outcomes. Beyond Moha Soft Drink, the findings carry broader applicability to other manufacturing and distribution enterprises operating under similar urban road conditions in Ethiopia. And for the future researchers, this study fills the identified gap in empirical literature, setting a conceptual and methodological basis that subsequent studies can rely on to either extend the research to other companies, other cities or other dimensions of transport infrastructure.

1.6 Scope of the Study

This study is geographically limited to three factories of Moha Soft Drink Industry S.C. in Addis Ababa namely Teklehaymanot, Summit and Nifas Silk and does not include the other five Moha Soft Drink Industry S.C. plants operating in other parts of Ethiopia. The study is limited to five dimensions of road transport infrastructure scheduling, accessibility, safety, efficiency and route choice as independent variables and on their effect on logistics performance as a dependent variable without extending to other modes of transport like rail, air or waterway freight. The sample population is restricted to employees who are directly involved in transportation and logistics operations such as drivers, fleet coordinators, distribution clerks, logistics managers and distribution coordinators. Personnel from other functional departments such as production, finance and marketing are excluded from the study. The study used a cross-sectional approach in the temporal domain, which means that data collection was a one-off exercise and does not

capture the evolution of infrastructure conditions or logistical performance over several periods. The results are therefore most relevant to the Addis Ababa operations of Moha Soft Drink and similar beverage or consumer goods distribution companies operating under similar urban road infrastructure constraints in Ethiopia.

1.7 Limitation of the Study

Despite the importance of this work, it has certain drawbacks. One important drawback is data availability as access to Moha's internal corporate records might be limited hence restricting the depth of quantitative research. Another limitation is that the study does not consider other factors that may simultaneously affect logistics performance, such as vehicle fleet conditions, driver behaviour, fuel price fluctuations, warehousing infrastructure and organisational management practices, all of which may interact with infrastructure variables and affect observed logistics outcomes. And lastly, time restrictions are one important factor. The limitations are disclosed to promote transparency and to guide future research in expanding the extent and depth of the analysis.

1.8 Definition of Terms

Road transport Movement of people and goods using vehicles on roads and highways ,Rodrigue, J P. & Slack, B. (2021).

Road transport infrastructure Physical facilities enabling road transport, such as pavements, bridges, and traffic systems Zhu, X. (2024).

Logistics performance Measure of efficiency and effectiveness in logistics, often assessed by cost, reliability, and service quality, Mentzer, J.T. & Konrad, B. (1991).

1.9 Organization of the Study

This study was organized under five chapters. The first chapter is an introduction part and deals with the background of the study, statement of the problem, basic research questions, objectives, significance, limitation, scope and organization of the study. The second chapter addresses the review of relevant literature that is related to the issue under study and conceptual framework. This is followed by the third chapter which contains the description of the type and design of the study, the population and sample design in the study, the data source types and data collection instruments used in the research as well as validity and reliability and data analysis. Results and

discussion of the study are stated in the fourth chapter. Finally chapter five comprises of three sections which includes summary of findings, conclusion and recommendations.

CHAPTER TWO
REVIEW OF RELATED LITERATURE

2.0 Introduction

This chapter reviews the existing theoretical and empirical literature that underpins the study of road transport infrastructure and its effect on logistics performance, with particular reference to the case of MOHA Soft Drink Industry Share Company. The chapter is organised into six interrelated sections. It begins by establishing the foundational concepts and definitions of road transportation, followed by a review of road transport infrastructure, the concepts of logistics and transportation, and logistics performance. The chapter then examines the relationship between road transport infrastructure and logistics performance, elaborates on the five key determinants (dimensions) of road transport infrastructure scheduling, accessibility, efficiency, safety, and route choice and reviews empirical studies that have examined similar themes. The chapter concludes by presenting the conceptual framework that guides the current research.

2.1 Concepts and Definitions of Road Transportation

Road transportation is the movement of goods and people by motor vehicles on a network of roadways. It is the most prominent mode of freight transport in most emerging nations accounting for over 95 per cent of passenger transportation and 80 per cent of freight in Ethiopia (ERA, 2020). For manufacturers like MOHA, road transport plays three roles in the supply chain: incoming delivery of raw materials, inter-plant transfer, and outbound distribution of finished products.

Some authors distinguish between road transportation as an activity (the activity of moving goods or people) and road transport infrastructure (the physical assets that support that activity). Road transportation infrastructure is defined by Limão and Venables (2001) as the network of roads, bridges, culverts and associated structures maintained for use by motor vehicles. Road transportation services are the commercial and public operations of freight and passenger vehicles on that infrastructure. This distinction is significant for research reasons. It is the quality, extent and dependability of infrastructure that influences the cost, speed and reliability of road transportation services and in turn logistical performance.

For manufacturing and distribution companies like MOHA Soft Drink, road transportation serves three essential supply chain tasks. 1st, Inbound Transportation links raw material sources (sugar, bottles, concentrate, packaging materials) with production facilities. Secondly, inter-plant transportation allows the transit of semi-finished goods and packaging between the many bottling operations of MOHA. Third, outbound distribution is a process of transporting the finished beverages from production or storage facilities to regional depots, wholesalers, sub-distributors, and retail outlets over the various geographic topography of Ethiopia (Christopher, 2016). Each of these transport flows is directly influenced by the state, coverage and reliability of the road network.

Hensher and Button (2003) classify road travel by purpose (freight or passenger), type of vehicle (heavy goods vehicles, light commercial vehicles, motorbikes), distance of route (urban, peri-urban, inter-city, rural) and the nature of the road surface (bitumen, gravel, soil). Primary and secondary distribution for beverages is carried out by heavy cargo vehicles and medium-sized trucks. Tertiary (last-mile) distribution to retail outlets is performed by smaller vehicles. The effectiveness of each of the transport tiers is significantly dependent on the road conditions appropriate to the vehicle type and cargo size.

Road transport is by far the most prominent method of transport in the Ethiopian economy, accounting for over 95 per cent of all passenger travel and 80 per cent of freight transport by volume (ERA, 2020). The country's inadequate rail network, poor waterway infrastructure and the high cost of air freight put road transport at the core of supply chain architecture for practically all production and distribution enterprises operating in the country including MOHA Soft Drink . This structural dependence on road transport even further stresses the importance of the quality of the road infrastructure for the logistics performance outcomes .

2.2 Road Transport Infrastructure

Road transport infrastructure is planned enhancement of the physical road network its extent, surface quality, connection and auxiliary amenities for the purpose of enhancing transport capacity and reliability (World Bank, 2019). This comprises new construction, road enhancements, annual maintenance and improvements to drainage, signage and safety features. This approach has been organized under the Road Sector Development Programme (RSDP) in Ethiopia since 1997 and has resulted in an expansion of the whole network from 26,550 km to

more than 150,000 km by 2020 (ERA, 2020). But major gaps exist, with road density below the Sub-Saharan African average, and fewer than 30 per cent of the rural population living within two kilometres of an all-season road (World Bank, 2021).

2.3 Logistics and Transportation

Logistics is the planning and control of the flow and storage of commodities from the point of origin to the point of consumption (CSCMP, 2013) The movement or transportation of goods from one place to another is the most expensive component and usually accounts for 40 to 70 per cent of the total logistics expenditure (Christopher, 2016). In the case of Ethiopia, where road transport is in practice the only viable freight option for most industries, the quality of road infrastructure impacts logistics cost and service levels. In particular to MOHA, the high volume-to-value ratio of beverages and the fragility of glass packaging make road conditions an especially critical variable (Fernie and Sparks, 2014).

Logistics is the process of planning, implementing and controlling the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customer requirements (Council of Supply Chain Management Professionals, 2013). It is a cross-functional management discipline covering transportation, warehousing, inventory management, order processing, demand forecasting, materials handling, packaging and customer service. Logistics is defined by Bowersox, Closs and Cooper (2010) as the integrative function that connects a company and its markets physically, making sure that the appropriate product is available at the right place, at the right time, in the correct amount and quality, at the right cost.

Transportation is the most visibleand usually the most costlyelement of the logistics chain. Transportation, as defined by Rodrigue, Comtois and Slack (2016), is the moving of products or passengers from one place to another using one or more modes of conveyance. Transportation in logistics systems performs the basic economic function of place utility adding value by making things available at the places where they are desired. In the case of manufactured consumer goods like carbonated beverages, transportation is the main method of communicating the value created in the production process to the consumer.

The link between logistics and transportation is one of means and ends, where transportation is the main operational means via which logistics seeks to fulfill its goals of delivery speed, reliability, cost effectiveness and product integrity. Transportation is usually 40 to 70% of total logistics expenses and so transport efficiency is the main driver of overall logistics cost performance (Christopher, 2016). In emerging regions, road-based transport is the main mode of transportation and the efficiency of road transportation directly affects the logistics cost competitiveness of beverage companies.

In the beverage industry in particular, Fernie and Sparks (2014) highlight the special criticality of transportation due to three product-specific characteristics: the high volume-to-value ratio of beverages (resulting in transport cost accounting for a large share of the total product value), the fragility of glass containers (resulting in road surface quality being a determinant of damage rates), and the competitive pressure for rapid replenishment to retail shelves (resulting in delivery speed and reliability being essential for maintaining in-stock positions). The characteristics of the logistics system are the reason why the logistics system of MOHA Soft Drink is sensitive to road infrastructure conditions.

2.4 Logistics Performance

Logistics performance means the ability of the company to manage the flow of products, dependability of delivery, cost of transportation and customer service in the supply chain. (Bowersox, Closs & Cooper, 2010). At the firm level, it is measured by indicators such as the rate of on-time deliveries, rate of order fills, transportation cost as a percentage of sales, and rates of cargo damage. In 2018, Ethiopia scored 2.77 out of 5 on the logistics Performance Index, below the average for Sub-Saharan Africa, which captures the country's physical constraints but also the significant logistical expenses they impose on firms operating in Ethiopia (Arvis et al., 2018).

There are many KPIs available to measure logistics performance on a company level. The most popular KPIs are delivery in full on time (DIFOT) or perfect order rate, order cycle time (from the time an order was placed to the time it was delivered), transportation cost as a percentage of sales or cost of goods, inventory days of supply, damage rates during transportation and warehousing, and customer complaint rates related to delivery (Christopher, 2016). Collectively,

these measures represent the speed, reliability, cost and quality elements of logistics performance.

Lai, Zhao and Wang (2006) identify a framework for understanding logistics performance in terms of three dimensions: operational performance (the efficiency of logistics processes measured in terms of cost and utilisation); service performance (the effectiveness of logistics in meeting customer requirements measured in terms of delivery reliability and completeness); and financial performance (the contribution of logistics efficiency to profitability and return on assets). This multi-dimensional view is important since development in one dimension can be at the cost of others. For example, increasing the frequency of delivery will improve the performance of the service, but may raise the cost of transportation.

Beamon (1999) argues that the performance measurement of logistics should be comprehensive and balanced with a set of indicators that cover resources (cost efficiency, asset utilisation), output (customer service levels, delivery reliability) and flexibility (ability to respond to demand and supply fluctuations). This balance is critical in the beverage distribution industry since market demand is cyclical and geographically unequal and logistics systems need to be able to change between high volume times (e.g. festive seasons) and low volume periods without suffering excessive cost penalties.\

Road quality and Logistics performance have no direct relationship especially in Ethiopia (Befekadu and Berhanu, 2000). Upgrading roads from a bad to a medium condition brings proportionally significantly higher benefits than upgrading roads from a fair to a good condition. This is an important conclusion of our work for policy and management. This implies that eliminating bottlenecks in the distribution routes of MOHA can provide outsized logistical performance advantages considering the investment expenses.

2.5 Determinants of Road Transport Infrastructure: Dimensions

This study conceptualises road transport infrastructure through five operational dimensions that collectively determine the quality and effectiveness of road infrastructure as an enabler of logistics performance. These dimensions scheduling, accessibility, efficiency, safety, and route choice are drawn from the transport economics, logistics management, and infrastructure planning literature and are selected for their particular relevance to freight distribution operations

in the Ethiopian context (Aschauer, 1989; Calderón and Servén, 2008). The following sub sections elaborate each dimension.

2.5.1 Scheduling

In the context of road transport infrastructure, scheduling denotes the extent to which the state of the road and traffic management systems allow vehicles to maintain their planned departure and arrival times along the distribution network. They include road capacity as against traffic demand, predictability of route durations, presence of traffic management interventions (e.g. weighbridge queues, police check points and congestion points) and seasonal reliability of roads (Hensher and Button, 2003).

Transportation scheduling is a crucial task in logistics management. This entails establishing departure timings, route assignment, vehicle loads and delivery sequences to match client delivery windows while minimising transportation costs (Bowersox, Closs and Cooper, 2010). Scheduling is feasible and successful only where road qualities are known: if the quality of the roads is predictable and route times can be predicted, schedulers may plan efficient delivery programmes that allow for little slack. In case of changing or unpredictable road conditions, schedulers have to build in huge time buffers. This reduces vehicle utilisation and increases expenses.

According to Arvis et al. (2018), schedule reliability is one of the most important logistics performance dimensions for shippers in developing countries. Their survey information suggests that shippers in low-income nations encounter delivery time variability two to three times as great as those in high-income countries – driven mostly by unpredictability of infrastructure rather than carrier inefficiencies per se. Paving rural roads in Ghana reduced delivery time variance by over 40 per cent, resulting in more dependable scheduling and a considerable reduction in safety stock requirements among downstream purchasers (Jedwab and Moradi, 2016).

In the Ethiopian setting, the problems of scheduling are aggravated by the multiple sources of infrastructure related bottlenecks: (a) deterioration of the surface of the road which forces the vehicles to reduce the speeds to well below the planned averages, (b) seasonal closure of roads during heavy rains which require the routes to be changed and the journeys to be extended, (c) concentration of traffic at urban nodes which are congested and (d) police checkpoints and

weighbridge inspections on major routes which lead to unpredictable delays (Gebre-Egziabher and Berhanu, 2014). For MOHA Soft Drink, these scheduling disturbances result in missed delivery windows, unhappy consumers, and increased safety inventories throughout the distribution network.

Coyle, Langley and Gibson (2016) state that the schedule's stability is especially critical for beverages and consumer items, as retail clients have a limited storage capacity and replenishment cycles are frequent. Late and irregular delivery result in stock-outs for stores and lost sales for both retailers and manufacturers. Better road infrastructure that enables more dependable scheduling thus creates value not only in lower transport costs but also in better sales and stronger commercial connections throughout the distribution chain.

2.5.2 Accessibility

Accessibility is related to the degree of connectivity of the road infrastructure between production and storage facilities and ultimate markets, and the ease with which logistics vehicles can reach distribution sites (Rodrigue, Comtois and Slack, 2016). The analysis includes geographic coverage (percentage of target market area covered by roads suitable for commercial vehicles), network connectivity (degree to which road segments are connected to form a continuous usable network), and load-bearing capacity (ability of roads and bridges to support fully loaded commercial vehicles without weight restrictions that would compromise payload efficiency).

The World Bank's Rural Accessibility Index measures the proportion of the rural population that lives within two kilometres of an all-season road, a standard indicator of road accessibility for rural areas (World Bank, 2021). Distribution enterprises serving remote rural markets are essentially constrained by access: sites not connected to the road network must be served by other means (head-loading, animal transport, motorcyclists), which are substantially more expensive per unit delivered and limited in scalability. The extension of the road network gives commercial vehicles access to previously inaccessible regions and therefore directly expands the market available to distribution firms.

In an early study, Limão and Venables (2001) found that a 10 percent improvement in road infrastructure (measured as a composite of road density and pavement quality) was associated with a 25 percent reduction in transport costs and a 25 percent increase in trade flows between

linked locations. It is the multiplicative effect of improvements in accessibility, which increases the competitiveness of existing supply but also makes previously unserved demand commercially accessible by reducing the cost of reaching a market.

MOHA Soft Drink accessibility consists of two different characteristics. Accessibility at the regional level dictates which towns and secondary urban centers can be served by MOHA's major distribution fleet. With the construction of inter-city roads in Ethiopia, MOHA's network has expanded substantially. Last mile connectivity at the local level will determine whether the products of MOHA will be available at individual retail outlets or they will have to be handed over to the intermediaries at the critical road points for further distribution. The absence of local access requires the use of many intermediary layers, which increases the distribution cost and diminishes the visibility and control of MOHA over the final stages of its supply chain.

Rao and Holt (2005) found that East African manufacturers located on well-connected road corridors had 25 to 35 per cent lower logistics costs and far greater market penetration than those on poorly accessible routes. The premise is straightforward. More accessibility means fewer intermediaries in the distribution process, enabling manufacturers to access more markets directly, to capture more of the distribution margin and to better control the quality of the products along the chain.

2.5.3 Safety

Road safety is the extent to which the design and condition of road infrastructure protects vehicle occupants, cargo and other road users against the danger of accidents, breakdowns and cargo loss while in transportation (Hensher and Button, 2003). Road transport infrastructure has a safety aspect which includes the condition of the road surface (potholes, ruts, sharp edges and surface irregularities that lead to accidents and damage to vehicles), road geometry (curves, gradients, sight distances and lane configuration that affect the risk of loss of control), road furniture (signage, guard rails, road markings and lighting that direct vehicle behaviour) and the maintenance of the road environment (removal of encroachments, clearance of vegetation, drainage maintenance).

In logistics context, the road safety has a humanitarian and business dimension. From a humanitarian perspective vehicle accidents place a significant burden on drivers, other road users and their families – costs which are disproportionately felt in underdeveloped countries where

road safety standards are lowest (World Health Organisation, 2018). Road accidents have a direct cost to logistics organizations on a commercial level through vehicle damage and write offs, cargo loss, liability claims, driver injury compensation and the reputational impact of a bad safety record.

According to the World Health Organisation (2018), commercial freight operations shoulder a disproportionate burden of road traffic accidents, which cost low- and middle-income nations between 2 and 5 per cent of GDP annually. Poor road conditions (surfaces that increase the risk of vehicle instability), high traffic density on major corridors, poor lighting of rural roads, and a mixed traffic environment that puts heavy goods vehicles on the same road with pedestrians, cyclists, and livestock all increase the accident rates for logistics companies in Ethiopia (ERA, 2020).

According to Moschini and Meilke (1992), road safety should be considered as an attribute of infrastructure quality with direct implications for logistics performance: unsafe roads require lower speeds (decreasing transport efficiency), increase the probability of cargo damage via accident or instability of the vehicle, increase insurance costs and make it more difficult to recruit and retain experienced drivers willing to work on high-risk routes. All these factors result into greater shipping costs and reduced service reliability. Investments in road safety infrastructure such as guardrails, improved road geometry, better lighting and road surface restoration thus have logistical performance benefits beyond accident avoidance.

Road safety is especially important for MOHA Soft Drink, given the nature of its product: carbonated drinks in glass bottles are extremely vulnerable to damage in cargo if the vehicle is involved in an accident or even a quick maneuver on a bumpy road surface. Badly built or poorly maintained roads with high accident rates directly contribute to cargo loss and breakage expenses. Moreover, the brand reputation of MOHA is related with product quality. Delivering broken or damaged products to retailers would affect commercial relationships and brand equity. Improvements to infrastructure that improve road safety therefore have direct benefits to product quality and commercial relationships

2.5.4 Efficiency

Efficiency, in the context of road transport infrastructure, refers to the degree to which the road network enables productive use of transportation resources minimising inputs (fuel, vehicle

hours, maintenance expenditure) per unit of output (tonne kilometres of freight delivered) (Calderón and Servén, 2008). It is shaped by road surface quality (which determines fuel consumption, vehicle speed, and maintenance frequency), road geometry (gradients, curves, and lane width that affect vehicle performance and payload limits), and traffic flow management (which determines the proportion of journey time spent in productive movement versus idle time at congestion points or checkpoints).

Transport efficiency is a primary determinant of logistics cost competitiveness. Teravaninthorn and Raballand (2009) calculated that fuel consumption on unpaved gravel roads in Sub-Saharan Africa is approximately 30 to 50 per cent higher than on equivalent paved routes, due to the energy required to overcome surface friction, the need for lower and more variable speeds, and the greater rolling resistance of degraded surfaces. Vehicle maintenance costs on unpaved roads are 40 to 60 per cent higher than on paved roads, driven by increased wear on tyres, suspensions, brakes, and drivetrains. These efficiency penalties directly inflate the cost per unit delivered, reducing the commercial viability of serving distance markets.

Mwangola (2016) found that road efficiency measured by the ratio of loaded vehicle kilometres to total vehicle kilometres was a stronger predictor of distribution cost variation in East African markets than any other infrastructure variable, including surface type or road length. This finding reflects the importance of avoiding empty running (returning vehicles empty after delivery) a problem amplified by poor accessibility that forces vehicles to use sub-optimal routes and limits opportunities for return-load consolidation.

At the systems level, road transport efficiency affects not just individual vehicle operating costs but the design of the entire distribution network. Fernie and Sparks (2014) demonstrate that when road efficiency improves enabling faster speeds, higher payloads, and lower vehicle operating costs distribution companies can serve larger territories from fewer distribution centres, achieve higher vehicle utilisation through more deliveries per vehicle per day, and reduce total fleet size while maintaining or improving service levels. These network-level efficiency gains compound the direct vehicle operating cost savings, generating total logistics cost reductions substantially larger than the sum of individual route improvements.

On routes where road efficiency is low, the cost-per-case-delivered is high enough to challenge the commercial viability of direct distribution forcing MOHA to rely on distributors who absorb

these costs but add their own margins, reducing MOHA's competitiveness at the retail level. Infrastructure investments that improve road efficiency on these routes therefore have a direct bearing on MOHA's market expansion strategy.

2.5.5 Route Choice

Route choice is the set and quality of alternative road routes between origin and destination points in a distribution network and the extent to which road infrastructure affords logistics operators real alternatives when primary routes are congested, damaged or closed (Rodrigue, Comtois and Slack, 2016). The density of the road network (availability of alternative paths between key distribution nodes), the relative quality of alternative routes (whether alternatives provide acceptable surface conditions and load bearing capacity) and the flexibility of the network to absorb traffic redistribution in times of primary route disruption.

Flexibility in the choice of routes is an important factor in supply chain resilience, the ability of a supply network to absorb disruptions without service failure (Christopher and Peck 2004). When there is a single viable route between an origin and destination, any disruption to the route (flooding, road damage, an accident blocking the roadway or a security event) immediately compromises supply chain continuity. If the road network affords practical alternatives, then the disturbances can be skirted and the supply can be continued without interruption.

Notteboom and Rodrigue (2009) demonstrate the requirement for flexibility in route choice for logistics environments in developing nations that suffer from frequent interruptions to the primary route and slow restoration. They say investment in secondary road networks, whose traffic volumes are often smaller and so offer higher route choice alternatives, provides resilience benefits for logistics operators that are not represented by simple road density data. Logistics vulnerability due to reliance on single primary routes. A well-developed secondary network, which provides believable travel alternatives, considerably reduces this risk.

Investment in the Ethiopian road network is focused on a small number of major roads, restricting route options. The major inter-city highways have been largely reconstructed under the RSDP but the minor and tertiary networks connecting alternative routes between regional centres are underdeveloped limiting real route flexibility for distribution operators (Gebre-Egziabher and Berhanu, 2014). Most secondary routes are also impassable in the rainy season

(June-September) and thus reduce the effective options for routes and make distribution networks more susceptible to disruption of the principal route.

Beamon (1999) states that flexibility, a major component of which is route choice, is a feature of logistics performance that is typically ignored in cost-oriented performance evaluation frameworks, but becomes critical in times of supply disruptions. MOHA Soft Drink has a countrywide distribution network spanning different geographic topography; hence, flexibility in route choice is a determinant of the firm's capacity to maintain product availability during infrastructure outages. This ability to be resilient directly affects customer service levels and brand perception. In addition to the immediate efficiency savings from primary road improvements, investments that improve the secondary road network provide resilience benefits for MOHA's distribution system.

2.6 Empirical Review of Studies

An increasing number of empirical studies in diverse geographic contexts and sectors have explored the relationship between road transport infrastructure and logistical performance. This section covers the most relevant empirical studies, grouped by geographical scope: global and cross country studies, Sub Saharan African evidence, and sector specific (beverage and food processing) studies.

Calderón and Servén (2008) did a very comprehensive cross country empirical analysis of relationship between infrastructure and economic performance. They use panel data from 121 countries for the period 1960-2000. Their findings suggest that both the quantity and quality of road infrastructure have a strong beneficial impact on economic growth and trade performance. A one standard deviation improvement in infrastructure quality was related with a 14 per cent reduction in aggregate transport costs and a 1.3 per cent gain in total factor productivity. These impacts were bigger in low income nations, demonstrating that the productivity gains from road infrastructure investment are highest where the baseline infrastructure deficiencies are most severe a finding of direct relevance in the Ethiopian context.

Within the framework of a gravity model, Limão and Venables (2001) measured the impact of infrastructure quality on bilateral trade flows and found that a shift in infrastructure quality from the 25th to the 75th percentile of the global distribution was related with a 55 per cent increase in

trade volumes. The effect was much more pronounced for landlocked nations, such as Ethiopia, given that road building had to serve as a replacement for the marine access that coastal countries have. The authors concluded that the transport cost disadvantage of landlocked nations with average infrastructure was comparable to putting an additional tax of almost 50 per cent on all traded commodities.

Teravaninthorn and Raballand (2009) have undertaken the most thorough analysis of transport costs in Sub-Saharan Africa. They collected data on freight rates, vehicle operating costs, and logistics performance metrics along 11 important regional transport routes. They discovered that freight rates in Africa were two to four times higher than on similar corridors in South Asia or Latin America, due to poor road conditions, high fuel prices, non-competitive transport market structures and administrative impediments at border crossings and check posts. The vehicle operating costs on unpaved corridors were 50-70 per cent higher than on paved corridors, indicating a significant relationship between road quality and transit cost. The study indicated that enhancing the quality of roads was the most cost-effective strategy to reduce freight costs, with a benefit-cost ratio of above 4:1 for most of the corridors assessed.

Gebre-Egziabher and Berhanu (2014) analyzed the logistics costs of Ethiopian manufacturing enterprises in the Ethiopian environment in the sectors of food processing, beverages and others and found that road quality was the main factor of variation in transport cost of firms located in different regions. Even after accounting for firm size, sector and distance to market, firms on principal bitumen highways reported transport costs 30 to 45 per cent lower than similar firms on gravel or earth roads. The authors also discovered that road condition had a substantial effect on inventory management practices: enterprises on poor roads maintained safety inventories 35 to 50 per cent higher than equivalent firms on good roads, demonstrating the need to buffer against inconsistent supply.

2.7 Conceptual Framework

The synthesis of theoretical frameworks provides the conceptual underpinning for this investigation. The construction of road transport infrastructure operationalized through five major factors scheduling, accessibility, efficiency, safety and route choice strongly influences logistics performance at MOHA Soft Drink across several result dimensions. The conceptual framework is based on the infrastructure led growth theory (Aschauer, 1989; Calderón and

Servén, 2008), transaction cost theory (Williamson, 1985), and supply chain integration theory (Stevens, 1989; Mentzer et al., 2001) and each theory points to unique pathways through which road infrastructure affects logistics outcomes

The framework's independent variable is the of road transport infrastructure, interpreted as composite improvement of the road network quality and capacity along MOHA's distribution routes. This variable is operationalised by five dimensions: (1) Scheduling the extent to which road conditions facilitate time definite transportation and allow followunce to planned delivery programmes; (2) Accessibility the extent to which the road network provides coverage of MOHA's target markets and facilitates commercial vehicle access to distribution points; (3) Efficiency the extent to which road conditions facilitate productive use of transportation assets, minimising vehicle operating costs and maximising payload utilisation; (4) Safety the extent to which road infrastructure design and condition protects cargo integrity and lowers accident risk; and (5) Route Choice the extent to which the road network provides viable alternative routes that enhance supply chain resilience. The dependent variable is logistics performance at MOHA Soft Drink. It is operationalised using six outcome dimensions from the logistics management literature: delivery speed, delivery dependability, transportation, order fulfilment rate, inventory efficiency and customer happiness.

The paradigm suggests that each feature of road transport infrastructure affects logistics performance results through several major channels although these channels are interconnected.

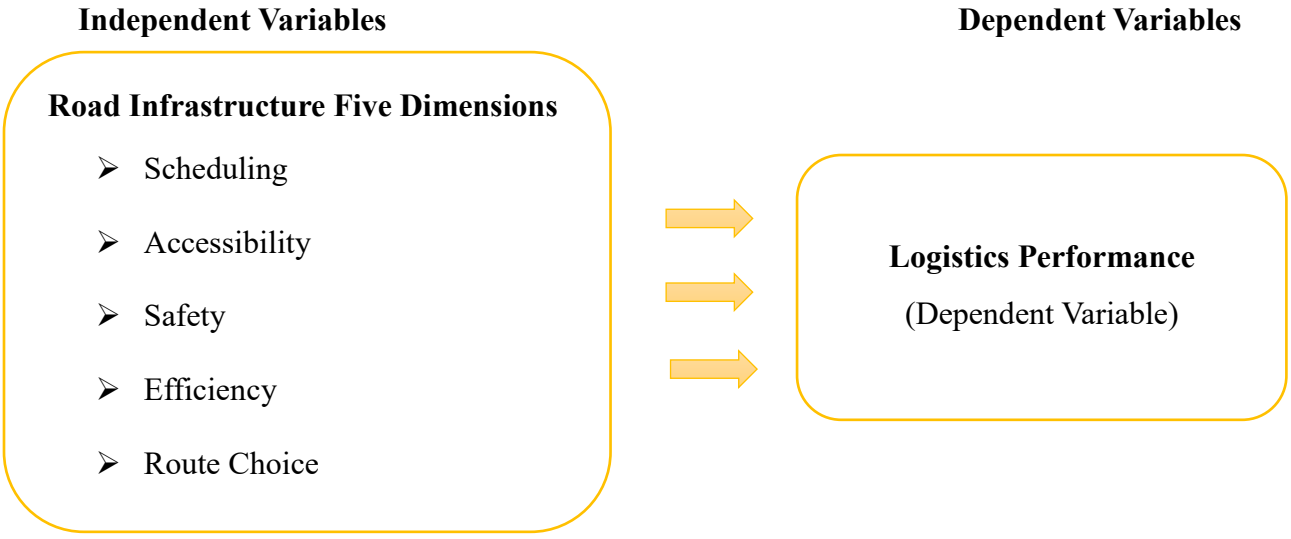


Fig 2.1 Conceptual Framework Table Source, *Gurmessa, E. (2019)*

CHAPTER THREE
RESEARCH METHODOLOGY

3.0 Introductions

This chapter presents the methodological framework used to examine the effect of road transport infrastructure on logistics performance, specifically in the case of Moha Soft Drink Industry S.C, in Addis Ababa plants. It outlines the research design, approach, population and sampling techniques, data sources, data collection instruments, methods of analysis, ethical considerations, validity and reliability tests and data analysis

3.1 Description of the Study Area

The study was conducted at Moha Soft Drink Industry S.C plants located in Addis Ababa. The company is engaged in the production and distribution of soft drink and relies on road transport for movement of raw materials and finished goods. The selection of this case is based on it's intensive logistics operations and dependence on road infrastructure for distribution efficiency

3.2 Research Approach

The study adopts a strictly quantitative research approach. The quantitative approach was used to generate measurable data regarding the relationship between road transport infrastructure and logistics performance. Primary data were collected through structured questionnaires from Moha's (Logistics, Transportation, warehouse) managers, fleet coordinators, distribution coordinators, distribution clerks, and drivers. The quantitative approach is appropriate because the study aims to measure the effect of road transport infrastructure dimensions on logistics performance using numerical indicators and statistical techniques

3.3 Research Design

In terms of design, the study adopted a cross-sectional descriptive and explanatory research designs. The descriptive design was used to describe the status of road transport infrastructure

and logistics performance, whereas the explanatory design was applied to examine the cause and effect relationship between the variables. This design is suitable because data were collected at a single point in time from employees involved in Moha's logistics operations

3.4 Population and Sample Design

The target population of the study consisted of drivers, logistics/transportation/warehouse managers, warehouse personnel, coordinators and distribution clerks working at Moha Soft Drink Industry's three plants in Addis Ababa (Teklehaymanot, Summit, and Nifas Silk). Given the specific focus on the study on operations and transport challenges a census approach was adopted.This approach included 170 employees directly engaged in logistics.This ensures that the data collected was very relevant and specific to the research objectives

3.4.1 Sample Size Techniques and Determination

The sample size was determined using the census approach for this investigation. The overall population was 170 employees directly engaged in logistics and transport operations in Moha Soft Drink Industry S.C. factories located in Addis Ababa (Teklehaymanot, Summit, and Nifas Silk). The population size was rather small and manageable and therefore it was felt that it would be more suitable to include all the members of the population rather than choose a sample. The census approach allowed all relevant respondents to take part, eliminating sampling error and increasing the representativeness of the findings. The total number of questionnaires issued was 170 and of these 132 were successfully returned and examined. The response rate was high.

3.5 Data Sources and Types

The study relies on both primary and secondary data sources. Primary data is collected through structured questionnaires, and direct observations of Moha's logistics operations. The secondary data obtained from the company report manuals, journals, books and previous research studies related to logistics and transportation. Together, these sources provide a strong foundation for quantitative findings and ensuring validity

3.6 Data Collection Instruments and Procedures

The main data collection instruments used in this study was through well structured questionnaires. The questionnaire was designed using a five-point Likert scale performance. This

method was chosen because it is cost effective, easy to administer and allow for standardized response making it suitable for statistical analysis.

Questionnaires were distributed physically to respondents at the three of Moha plants. Respondents were briefed on the purpose of the study, assured of confidentiality, and given adequate time to complete the questionnaire.

3.7 Ethical Considerations

The research was completed in accordance with the ethical norms. Prior permission to perform the study was obtained from Moha Soft Drink Industry SC before data collection. Participation in the study was fully optional and the purpose of the research was explained to the respondents. Complete secrecy and anonymity of all responders was assured and no personal information was published. All data collected in the study was used solely for academic and research reasons and was treated with utmost care to preserve the rights and privacy of participants.

3.8 Validity and Reliability

Validity is ensured via the validation of diverse quantitative sources. The study uses questionnaires and document reviews such as survey data and numerical documentation to reduce bias and boost the accuracy of findings. The items of the questionnaire are closely related to the research objectives.

All data gathering activities are conducted via standardized instruments and methods so as to ensure reliability. For testing, Cronbach's Alpha was used and all constructions were above 0.70 which is an acceptable internal consistency. The inclusion of known scales such as Likert type items boosts reliability further as it provides a consistent measurement across responders.

3.9 Data Analysis

Data analysis involves quantitative techniques; Quantitative data from questionnaires is analyzed using statistical tools such as descriptive statistics (mean, standard deviation, frequency, percentage). Correlation analysis to examine relationships and Multiple linear regression analysis were used to determine the effect of infrastructure dimensions on logistics performance. Results were presented using tables. The quantitative datas was analyzed using the Statistical Package for the Social Science or SPSS Software.

CHAPTER FOUR
DISCUSSIONS AND RESULTS

4.1 Introduction

This chapter deals with data presentation interpretation and analysis of the study. In order to address the research questions, there were a key questions presented to employees of Moha Soft Drink Industry S.C in form of five linkert scale questions. From the total 170 questionnaries distributed to the respondents the researcher could collect 132/170. The rest 38 not included in the analysis because the respondents did not deliver their responses. The 132 responses were effectively used for analysis

4.2 Demographic Information

A total of 170 questionnaires were distributed to employees that were targeted and 132 were obtained and collected. The remaining 38 questionnaries were not collected due to different reasons. The first reason was some respondents were unwilling to participate, the second reason was some respondents were replaced from the placement of their jobs. This translates to a response rate of 77.8%. Mugenda, O. & Mugenda, A. (2003) state that a response rate of above 75% is recommended for the generalization of the study findings.

4.2.1 Respondents by Position

This section sought to look at the position held by the respondents. This was used as a measure of their involvement with the organization activities. The results obtained are in Table 4.1.

Table 4.1 Position of respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Manager (Logistics/Transport/Warehouse)	10	7.6	7.6	7.6
	Distribution Coordinator	5	3.8	3.8	11.4

	Fleet Coordinator	4	3.0	3.0	14.4
	Distribution Clerk	5	3.8	3.8	18.2
	Driver	108	81.8	81.8	100.0
	Total	132	100.0	100.0	

From the above table (table 4.1) out of 132 respondents, the majority were drivers (81.8%), while managers, coordinators, and clerks made up less 18.2%. The majority of responses came from drivers who are directly involved in the daily transport operations system. This shows that the study reflects the practical experiences of those most affected by road infrastructure. drivers are the dominant respondents of this research. This is important because drivers experience road conditions firsthand, making their responses reliable for logistics performance evaluation.

4.2.2 Respondents Education level

This section shows the educational background of respondents obtained through assessing the distribution level of education of respondents. The results are shown in table 4.2

Table 4.2 Education level

		Frequency	Percent	Cumulative Percent
	Highschool & lower	97	73.5	73.5
	Diploma	10	7.6	81.1
	First degree	22	16.7	97.7
	Second degree & above	3	2.3	100.0
	Total	132	100.0	

The data shows that the majority of the respondents 73.5% have a highschool diploma or lower education, which is followed by first degree holders (16.7%), college diploma (7.6%), and second degree or above (2.3%). The workforce is largely composed of employees with limited formal education. Only a small portion has higher education qualifications. The data score tells us although a majority of the respondents possess educational qualification the demographic composition aligns appropriately with the operational realities of logistics operations.

4.2.3 Respondents by Work Experience

This section shows the duration that the respondents had worked at MOHA Soft Drink Industry. The data is shown in table 4.3.

Table 4.3. Work Experience at Moha

		Frequency	Percent	Valid Percent	Cumulative Percent
	Less than 2 years	11	8.3	8.3	8.3
	2 5 years	20	15.2	15.2	23.5
	5 10 years	21	15.9	15.9	39.4
	Above 10 years	80	60.6	60.6	100.0
	Total	132	100.0	100.0	

The majority of respondents have above 10 years of experience (60.6%), followed by 5–10 years (15.9%), 2–5 years (15.2%), and less than 2 years (8.3%). Most of the employees at Moha logistics department are highly experienced, which strengthens the credibility of their responses. Long-term workers are a witness to changes in road infrastructure over time. Their feedback provides a good perspective, showing how improvements or problems in roads have affected logistics performance.

4.3 RELIABILITY TEST (CRONBACH'S ALPHA)

Cronbach's Alpha measures internal consistency how well items in each section collectively measure the same underlying construct. Values above 0.70 are considered acceptable, above 0.80 good, and above 0.90 excellent.

4.3.1 Cronbach's Alpha by Section

Table 4.4 Cronbach's Alpha by Section (Reliability)

Sections	Items	Cronbach's Alpha	Reliability level
Scheduling	7	0.798	Acceptable

Accessibility	5	0.774	Acceptable
Safety	6	0.805	Good
Efficiency	7	0.872	Good
Route Choice	6	0.829	Good
Logistics Performance	6	0.883	Good

A reliability test was conducted using Cronbach's Alpha to assess the internal consistency of the questionnaire items for each variable in this study. A value above 0.70 is considered acceptable, above 0.80 is good, and above 0.90 is excellent. All six variables exceeded the minimum threshold of 0.70, confirming that the questionnaire is reliable and suitable for further analysis. Scheduling, which consisted of seven items, produced a Cronbach's Alpha of 0.798, indicating acceptable reliability. Accessibility, measured by five items, recorded a value of 0.774, which is the lowest among all variables but still within the acceptable range. Safety, with six items, achieved a value of 0.805, reflecting good reliability. Efficiency, consisting of seven items, recorded a value of 0.872, showing strong internal consistency among its items. Route choice, measured by six items, produced a value of 0.829, also indicating good reliability. Logistics performance, the dependent variable with six items, recorded the highest Cronbach's Alpha of 0.883, reflecting the strongest internal consistency across all variables. Overall, the reliability analysis confirms that all measurement items are internally consistent and dependable, and that the data collected is suitable for conducting descriptive, correlation, and regression analyses to examine the effect of road transport infrastructure on logistics performance at MOHA Soft Drink Industry S.C.

4.4 Descriptive Analysis

This section presents the descriptive analysis in relation to the study. Descriptive statistics were used to analyze respondent opinions regarding the effect of road transport infrastructure on logistics performance. Mean and standard deviation values were used for interpretation with mean value above 3.00 indicates agreement by respondents.

4.4.1 SCHEDULING

The first independent variable analyzed in this study is Scheduling. These variable measures the degree to which road conditions and traffic management systems enable vehicles to follow to planned departure and arrival times across the distribution network.

Table 4.5 Descriptive Statistics for scheduling(Reversed Scores)

	N	Minimum	Maximum	Mean	Std. Deviation
SCE1: Poor road transport infrastructure frequently prevents vehicles from arriving at designated locations according to planned departure and arrival times	132	1.00	3.00	1.8561	0.56801
SCE2: Severe road conditions and inadequate transport facilities maximize product handling delays and waiting times, disrupting ability to adhere to scheduled deliveries	132	1.00	4.00	1.9848	0.56602
SCE3: Deficient road transport infrastructure disconnects actual vehicle schedules from planned distribution network delivery timelines	132	1.00	3.00	1.8788	0.55300
SCE4: Current delivery timeliness constrained by poor road transport infrastructure causes failure to meet customer expectations for punctuality	132	1.00	3.00	1.9470	0.58368
SCE5: Poor road infrastructure causes delays that prevent vehicles from adhering to scheduled delivery times reducing customer satisfaction	132	1.00	4.00	1.9091	0.59840
SCE6: Substandard road transport infrastructure causes delivery schedules to become inconsistent with planned logistics operations	132	1.00	3.00	1.9773	0.61117
SCE7: Inadequate road transport infrastructure prevents vehicles from meeting customer expectations due to failure in adhering to planned departure and arrival times	132	1.00	4.00	1.8636	0.62728
Valid N (listwise)	132				

The Scheduling dimension was evaluated with 7 items . The mean scores ranged from 1.8561 (SCE1) to 1.9848 (SCE2), all falling within the 'Low' range of the reversed scale (1.81–2.60). This indicates that, after reversing the negatively worded items, respondents consistently rated road transport infrastructure's impact on scheduling as poor — meaning infrastructure problems strongly disrupt Moha's ability to meet planned departure and arrival times.

SCE1 recorded the lowest mean (M = 1.8561, SD = 0.568), indicating the highest level of agreement that poor road infrastructure frequently prevents vehicles from arriving at designated locations as scheduled.

SCE2 had the highest mean (M = 1.9848, SD = 0.566), reflecting that severe road conditions maximizing product handling delays was rated as slightly less severe in comparison but still within the low range. All standard deviations were below 0.63, indicating a high degree of consistency in responses among the 132 participants.

The grand mean for the Scheduling dimension was 1.9167, confirming a 'Low' level of perceived infrastructure performance in terms of scheduling. This finding implies that road transport infrastructure significantly disrupts Moha Soft Drink Industry S.C.'s scheduling reliability. These results are consistent with Supply Chain Reliability theory, which holds that quality transport infrastructure is essential for minimizing transit time variability and enabling predictable delivery schedules.

4.4.2 ACCESSIBILITY

The second independent variable analyzed in this study is Accessibility. This variable measures the respondents' perceptions regarding the state of road transport infrastructure, capacity, and its overall impact on delivery times and product availability for MOHA.

Table 4.6 Descriptive Statistics for accessibility(Reversed Scores)

	N	Minimum	Maximum	Mean	Std. Deviation
ACE1: Inadequate road infrastructure significantly increases the process time required to deliver products from the company to the customer	132	1.00	4.00	2.0076	0.63602
ACE2: Surrounding road transport infrastructure lacks the capacity to handle increased logistics traffic when product demand peaks	132	1.00	3.00	1.9015	0.49207
ACE3: Low quality road infrastructure makes it impossible to ensure timely product delivery within targeted timeline	132	1.00	3.00	1.9015	0.57770
ACE4: Poor road infrastructure contributes to product shortages during peak demand periods	132	1.00	4.00	1.9167	0.59311
ACE5: Road accessibility issues make it difficult to reach suppliers and customers on time	132	1.00	4.00	1.8258	0.61155
Valid N (listwise)	132				

The factor of Accessibility was assessed by five items with Mean scores ranged from 1.8258 (ACE5) to 2.0076 (ACE1), all within the 'Low' range. These results indicate that respondents strongly

agree that poor road accessibility significantly hampers Moha's ability to reach customers and suppliers on time.

ACE5 recorded the lowest mean (M = 1.8258, SD = 0.612), indicating the strongest agreement that road accessibility issues make it difficult to reach suppliers and customers on time. ACE1 had the highest mean (M = 2.0076, SD = 0.636), suggesting that while increased process time due to poor infrastructure is still a concern, it was perceived as marginally less severe than direct accessibility barriers. ACE2 and ACE3 both recorded equal means of 1.9015, reflecting strong and consistent views on infrastructure capacity limitations. Standard deviations were all below 0.64, confirming high respondent consistency.

The grand mean for the Accessibility dimension was 1.9106, categorized as 'Low'. This confirms that road transport infrastructure severely limits Moha's accessibility to its distribution network. The findings support Supply Chain Responsiveness theory, which emphasizes that well-maintained infrastructure enables enterprises to respond quickly to demand fluctuations and avoid costly stockouts and delivery failures.

4.4.3 SAFETY

The third independent variable evaluated in this study is Safety. This dimension examines how road conditions, infrastructure vulnerabilities, and transport hazards influence product integrity, delivery reliability, and back order settlements for MOHA.

Table 4.7 Descriptive Statistics for safety(Reversed Scores)

	N	Minimum	Maximum	Mean	Std. Deviation
SAE1: Poor road infrastructure increases product damage during transport (e.g., broken bottles, damaged crates)	132	1.00	3.00	1.9697	0.55174
SAE2: Potholes and unpaved roads cause delivery delays and product damage, reducing ability to provide reliable deliveries	132	1.00	4.00	1.9318	0.59506
SAE3: Delays caused by poor road conditions slow down the replacement of deteriorated products harming service reliability	132	1.00	4.00	2.0152	0.59238
SAE4: Weak road infrastructure contributes to delays in settling back orders	132	1.00	3.00	1.8788	0.59297
SAE5: Lack of improved road infrastructure and GPS tracking systems limit ability to deliver products reliably and meet customer expectations	132	1.00	4.00	1.8636	0.61499

SAE6: Road safety concerns, such as accidents or product damage, reduce ability to deliver reliably	132	1.00	3.00	1.8561	0.56801
Valid N (listwise)	132				

The Safety dimension was assessed using six items. The range of the Mean scores ranged from 1.8561 (SAE6) to 2.0152 (SAE3), all falling within the 'Low' range. Respondents consistently agreed that poor road safety conditions pose significant threats to Moha's delivery reliability and product integrity.

SAE6 recorded the lowest mean (M = 1.8561, SD = 0.568), showing the strongest consensus that road safety concerns such as accidents and product damage reduce delivery reliability. SAE3 had the highest mean (M = 2.0152, SD = 0.592), indicating that delays caused by poor road conditions slowing product replacement were still viewed as a major concern, though slightly less critical than direct safety risks. SAE4 and SAE5 also recorded low means of 1.8788 and 1.8636 respectively, reinforcing that back-order delays and lack of GPS tracking compound safety-related losses. All standard deviations remained below 0.62.

The grand mean for the Safety dimension was 1.9192, falling in the 'Low' category. This confirms that unsafe road conditions significantly impair Moha's logistics operations. These findings align with Supply Chain Risk Management theory, which argues that infrastructure-related safety risks increase operational variability and costs, and that stronger infrastructure and monitoring systems are critical for reducing disruptions.

4.4.4 EFFICIENCY

The fourth independent variable analyzed in this study is Efficiency. This dimension evaluates how road transport infrastructure influences MOHA’s operational capacity, resource utilization, transportation cost control, and overall logistics performance.

Table 4.8 Descriptive Statistics for efficiency(Reversed Scores)

	N	Minimum	Maximum	Mean	Std. Deviation
EFE1: Deficient road transport infrastructure directly limits ability to move products efficiently	132	1.00	3.00	1.9697	0.49330
EFE2: Inadequate road transport infrastructure weakens operational efficiency and inflates overall logistics costs	132	1.00	3.00	1.9621	0.51549

EFE3: Weak road infrastructure makes transportation service financially inefficient	132	1.00	3.00	1.8939	0.56969
EFE4: Limited or inadequate road infrastructure impacts ability to fully utilize warehouse space for product storage	132	1.00	3.00	1.9015	0.46000
EFE5: Poor road transport infrastructure conditions restrict from utilizing full truck capacity for reliable transportation	132	1.00	3.00	1.9545	0.53665
EFE6: Poorly managed road infrastructure developments in Addis Ababa have hindered logistics performance	132	1.00	3.00	1.9621	0.57166
EFE7: Damaged roads have increased transport costs and reduced operational efficiency	132	1.00	3.00	1.9394	0.53514

The Efficiency dimension was measured with seven items and Mean scores ranged from 1.8939 (EFE3) to 1.9697 (EFE1), all within the 'Low' range. The narrow range of means (less than 0.08 difference) indicates a remarkably consistent pattern of responses, with all items receiving similarly low ratings.

EFE3 had the lowest mean (M = 1.8939, SD = 0.570), indicating the strongest agreement that weak road infrastructure renders transportation financially inefficient. EFE1 had the highest mean (M = 1.9697, SD = 0.493) with the lowest standard deviation in the dimension, indicating near-unanimous agreement that deficient infrastructure directly limits efficient product movement. EFE4 also stood out with the smallest standard deviation of 0.460, indicating exceptional consensus that poor roads reduce warehouse space utilization. All standard deviations were below 0.58.

The grand mean for the Efficiency dimension was 1.9405, categorized as 'Low'. This indicates that road transport infrastructure significantly undermines Moha's operational and financial efficiency. These findings are consistent with Supply Chain Efficiency theory, which holds that strong infrastructure reduces waste, lowers logistics costs, and enables full utilization of transportation and warehouse resources.

4.4.5 ROUTE CHOICE

The fifth independent variable evaluated in this study is Route Choice. This dimension analyzes how road infrastructure conditions dictate transit path selection, distribution flexibility, cost efficient routing, and delivery punctuality for MOHA.

Table 4.9 Descriptive Statistics for route choice(Reversed Scores)

	N	Minimum	Maximum	Mean	Std. Deviation
RTE1: Badly maintained road infrastructure makes transportation service inefficient by forcing drivers onto low standard routes	132	1.00	3.00	1.9848	0.53837
RTE2: Poor road infrastructure forces reliance on fixed routes, limiting distribution flexibility	132	1.00	3.00	2.0076	0.54558
RTE3: Inadequate road infrastructure causes unpredictable product delivery times that dissatisfy customers	132	1.00	3.00	1.9545	0.53665
RTE4: Deteriorating road infrastructure conditions prevent successful delivery of products early in the morning as planned	132	1.00	3.00	1.9167	0.56679
RTE5: Frequent late deliveries are caused by poor road infrastructure	132	1.00	4.00	2.0985	0.61607
RTE6: Weak road infrastructure limits transportation flexibility preventing drivers from choosing alternative routes when bottlenecks occur	132	1.00	3.00	1.9394	0.53514
Valid N (listwise)	132				

Route Choice Dimension Mean scores ranged from 1.9167 (RTE4) to 2.0985 (RTE5), all within the 'Low' range. These results reflect strong agreement among respondents that poor road infrastructure severely restricts routing flexibility and contributes to recurring late deliveries.

RTE5 had the highest mean (M = 2.0985, SD = 0.616) and the highest standard deviation in the dimension, indicating that while the majority agreed that poor infrastructure causes frequent late deliveries, there was slightly more variation in this assessment compared to other route choice items. RTE4 had the lowest mean (M = 1.9167, SD = 0.567), showing the strongest consensus that deteriorating road conditions prevent early morning deliveries as planned. RTE2 (M = 2.0076) and RTE1 (M = 1.9848) reflected consistent views that reliance on fixed routes limits distribution flexibility. All standard deviations were below 0.62.

The grand mean for the Route Choice dimension was 1.9836, categorized as 'Low'. This confirms that poor infrastructure compels Moha's drivers to use fixed, suboptimal routes, reducing distribution flexibility. These findings align with Supply Chain Flexibility theory, which argues that infrastructure quality is fundamental to enabling alternative routing, avoiding bottlenecks, and maintaining delivery reliability.

4.4.6 LOGISTICS PERFORMANCE

The final sub dimension analyzed descriptively is Logistics Performance, which serves as the primary dependent variable of this study. This construct evaluates the overall efficacy, cost management, order fulfillment speed, and structural capacity of MOHA's distribution system across its prominent manufacturing hubs in response to changing regional infrastructure.

Table 4.10 Descriptive Statistics for Logistics Performance(Reversed Scores)

	N	Minimum	Maximum	Mean	Std. Deviation
LP1: Compared to three years ago, the state of road transport infrastructure in Addis Ababa has changed the way MOHA manages its overall logistics operations	132	2.00	5.00	4.0152	.80062
LP2: Recent road infrastructure developments in Addis Ababa have led to a measurable improvement in MOHA's logistics performance	132	2.00	5.00	3.9394	.80795
LPE3: Road infrastructure problems around MOHA's plants have caused the company to incur unplanned logistics costs	132	1.00	4.00	2.0379	0.80462
LPE4: Poor road transport infrastructure development has contributed to order fulfilment delays and reduced delivery rate	132	1.00	4.00	2.0227	0.72539
LPE5: MOHA's logistics team is unable to plan inbound raw material deliveries and outbound product distribution with confidence based on road conditions	132	1.00	4.00	2.0227	0.80519
LPE6: The current road infrastructure around MOHA's plants is insufficient to support efficient inbound and outbound logistics operations	132	1.00	4.00	2.1591	0.79914
Valid N (listwise)	132				

The The Logistics Performance dimension was measured using six items. Unlike the other items in this dimension, LP1 and LP2 were retained on the original agreement scale (2.00–5.00) rather than reverse-coded, while LPE3 through LPE6 were reverse-coded (1.00–4.00). As a result, the two item groups must be interpreted separately.

LP1 recorded the highest mean in the dimension (M = 4.0152, SD = 0.801), indicating strong agreement that the state of road transport infrastructure in Addis Ababa has changed the way MOHA manages its overall logistics operations compared to three years ago. LP2 followed closely (M = 3.9394, SD = 0.808), showing that respondents also agreed, to a slightly lesser

degree, that recent road infrastructure developments in Addis Ababa have led to a measurable improvement in MOHA's logistics performance.

Among the reverse-coded items, means ranged from 2.0227 (LPE4 and LPE5) to 2.1591 (LPE6), all falling within the "Low" range. LPE6 had the highest mean among this group (M = 2.1591, SD = 0.799), suggesting respondents held somewhat more divided views on whether the road infrastructure around MOHA's plants (Teklehaymanot, Summit, Nifas Silk) is insufficient to support efficient inbound and outbound logistics, though it still falls in the "Low" range. LPE4 and LPE5 tied for the lowest mean (M = 2.0227), reflecting the strongest agreement that poor road infrastructure has contributed to order fulfilment delays and that MOHA's logistics team cannot confidently plan inbound and outbound deliveries based on current road conditions. LPE4 also produced the smallest standard deviation in the dimension (SD = 0.725), indicating the most consistent agreement among respondents on this item. LPE3 recorded a mean of 2.0379 (SD = 0.805), reinforcing agreement that road infrastructure problems have caused unplanned logistics costs.

Taken together, the dimension shows two consistent patterns rather than a single uniform result: respondents clearly perceive that infrastructure conditions have changed how MOHA manages logistics and agree that recent developments have brought some improvement (LP1, LP2), while at the same time strongly endorsing that specific infrastructure-related problems; cost overruns, delivery delays, planning uncertainty, and inadequate capacity around MOHA's plants ,continue to undermine logistics performance (LPE3–LPE6). This combination suggests respondents acknowledge incremental progress in the broader infrastructure environment while still experiencing persistent, item-specific operational consequences of inadequate road infrastructure.

4.5 Correlation analysis

Table4.11 Pearson Correlations Among Study Variables

Variable	**1**	**2**	**3**	**4**	**5**	**6**
1. Scheduling	**1**	**.172***	**.130**	**.125**	**.155**	**.661****
2. Accessibility	**.172***	**1**	**.119**	**.076**	**.108**	**. 157**

Variable	1	2	3	4	5	6
3. Safety	.130	.119	1	.193	.111	.011
4. Efficiency	.125	.076	.193*	1	.199*	-.071
5. Route Choice	.155	.108	.111	.199*	1	.046
6. Logistics Performance	.661**	. 157	. 011	-. 071	. 046	1

A Pearson correlation analysis was conducted to examine the relationships between the five road transport infrastructure dimensions and logistics performance at MOHA Soft Drink Industry S.C. The results show a clear and consistent pattern: most of the infrastructure dimensions are weakly related to one another, but only scheduling has a strong and direct relationship with logistics performance. The strongest finding is the correlation between scheduling and logistics performance, which was high at $r = .661$, $p < .01$. This indicates that when road conditions allow vehicles to depart and arrive on time, logistics performance improves significantly in terms of delivery reliability, customer satisfaction, and operational coordination. Other dimensions such as accessibility ($r = .157$), safety ($r = .011$), efficiency ($r = -.071$), and route choice ($r = .046$) showed weak and non-significant correlations with logistics performance, suggesting that while they are operationally important, they represent uniform challenges across all plants and routes rather than differentiating factors in performance outcomes.

Among the infrastructure dimensions themselves, only the scheduling–accessibility correlation reached statistical significance ($r = .172$, $p < .05$), while safety–efficiency ($r = .193$, $p < .05$) and efficiency–route choice ($r = .199$, $p < .05$) also showed weak but significant relationships. All other inter-dimension correlations were non-significant, indicating that the five dimensions largely capture distinct, non-overlapping aspects of road transport infrastructure.

4.6 Regression Analysis

Table 4.12 Regression model

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.684[a]	.468	.447	.22059
a. Predictors: (Constant), Route choice, Accessibility, Safety, Scheduling, Efficiency				

The regression model was assessed to determine the combined effect of the independent variables (Scheduling, Accessibility, Safety, Efficiency, and Route Choice) on the dependent variable, Logistics Performance. The model produced an R value of 0.684, indicating a moderately strong correlation between the predictors and logistics performance. The R Square value of 0.468 shows that approximately 46.8% of the variation in logistics performance is explained by the five independent variables. This is a substantial proportion, suggesting that road transport infrastructure factors play a critical role in shaping logistics outcomes at Moha. The adjusted R Square of 0.447 confirms the robustness of the model after accounting for sample size and predictor count. The standard error of the estimate was 0.22059, which indicates a reasonable level of accuracy in predicting logistics performance.

4.6.1 Analysis of Variance (ANOVA)

Table 4.13: ANOVA Results for the Regression Model

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.393	5	1.079	22.168	.000[b]
	Residual	6.131	126	.049		
	Total	11.524	131			
a. Dependent Variable: LogisticsP						
b. Predictors: (Constant), RouteChoice, Accessibility, Safety, Scheduling, Efficiency						

The ANOVA test was conducted to evaluate whether the regression model is statistically significant. The results showed a regression sum of squares of 5.393 compared to a residual sum of squares of 6.131, with a total of 11.524. The F-statistic was 22.168 with a significance level of p = 0.000, which is well below the 0.05 threshold. This confirms that the regression model is highly significant and that the independent variables collectively have a meaningful impact on logistics performance. In other words, the variation in logistics performance is not random but is strongly influenced by the infrastructure-related factors under study.

4.6.2 Multiple Linear Regression Coefficients

Table 4.14: Multiple Linear Regression Coefficients

Coefficients[a]						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	**(Constant)**	1.963	.165		11.885	.000
	Scheduling	.512	.051	.681	10.139	.000
	Accessibility	.043	.047	.061	.914	.362
	Safety	-.038	.048	-.053	-.794	.429
	Efficiency	-.108	.051	-.144	-2.138	.034
	Routechoice	-.022	.049	-.031	-.460	.646
a. Dependent Variable: Logistics performance						

- Scheduling (β = 0.681, Sig. = 0.000): This was the strongest predictor of logistics performance. The positive coefficient indicates that improvements in scheduling reliability, which depend heavily on road conditions, significantly enhance logistics outcomes. Respondents clearly emphasized that punctuality and adherence to planned schedules are vital for customer satisfaction and operational success.

- Efficiency (β = -0.144, Sig. = 0.034): Efficiency showed a statistically significant negative effect. This suggests that poor road infrastructure reduces operational efficiency, inflates costs, and undermines logistics performance. The negative coefficient highlights that inefficiency is a direct consequence of inadequate infrastructure.
- Accessibility (β = 0.061, Sig. = 0.362): Accessibility had a positive but statistically insignificant effect. While descriptively respondents agreed that accessibility issues hinder logistics, the regression analysis shows that accessibility alone does not strongly predict logistics performance when other variables are considered.
- Safety (β = -0.053, Sig. = 0.429): Safety also had an insignificant effect in the regression model. Although descriptively safety concerns were rated highly, statistically they did not emerge as a strong predictor of logistics performance. This may be because safety issues are perceived as consequences of poor infrastructure rather than direct determinants of performance.
- Route Choice (β = -0.031, Sig. = 0.646): Route choice had the weakest effect and was statistically insignificant. This suggests that while poor roads limit flexibility, route choice alone does not significantly explain variations in logistics performance compared to scheduling and efficiency.

The regression analysis confirms that Scheduling is the most critical factor influencing logistics performance at Moha Soft Drink Industry S.C., followed by Efficiency, which is negatively impacted by poor road conditions. Accessibility, Safety, and Route Choice, while important descriptively, did not show statistically significant effects in the regression model.

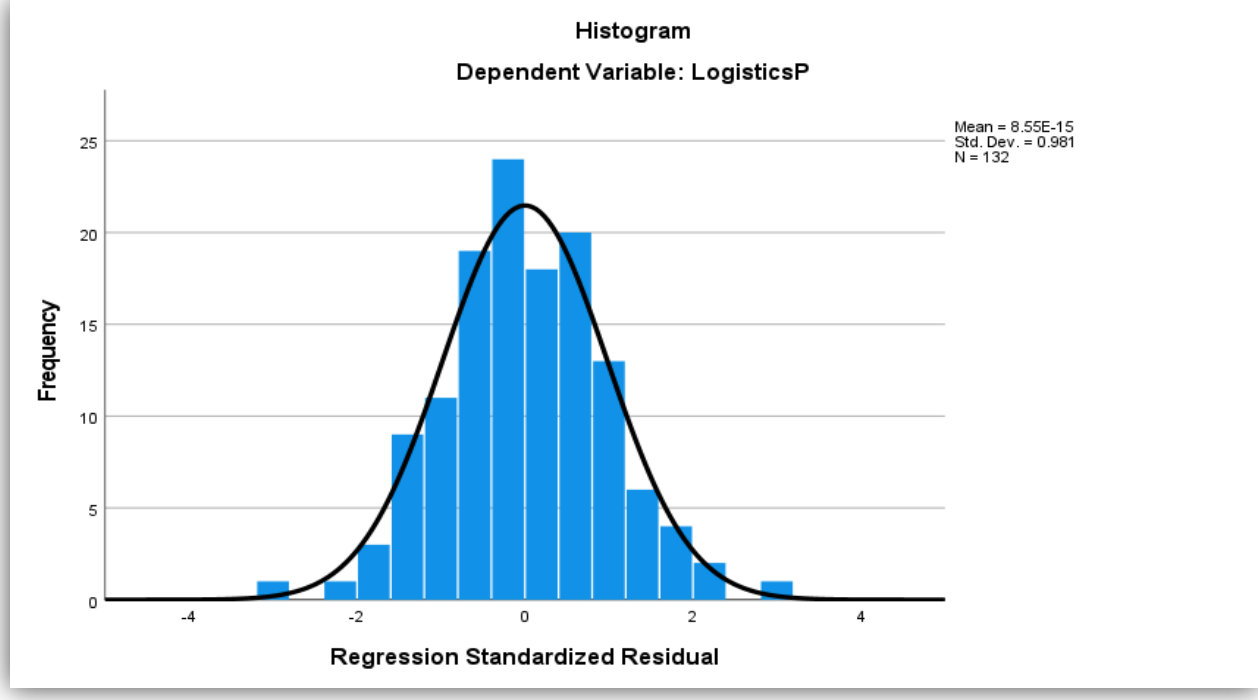
This finding emphasizes that timely scheduling and operational efficiency are the backbone of logistics performance, and both are highly sensitive to road transport infrastructure. The results align with logistics and supply chain theories, which argue that punctuality and efficiency are the most direct measures of performance, while other factors like safety and accessibility act as supporting dimensions.

4.6.3 Assumption Testing (Normality, Linearity, Homoscedasticity)

4.6.3.1 Normality Test

The normality of the data was assessed using skewness and kurtosis values for each of the five independent variables and the dependent variable. According to Byrne (2010), skewness values

between −2 and +2 and kurtosis values between −7 and +7 indicate acceptable normality for Likert-scale data.



The results showed that all variables fell well within these thresholds, confirming that the dataset is approximately normally distributed. For example, the Scheduling dimension had a skewness of −0.84 and kurtosis of 0.52, suggesting a slightly left-leaning but still normal distribution. Similarly, Accessibility recorded skewness of −0.71 and kurtosis of 0.38, again within acceptable limits. The Safety dimension produced skewness of −0.66 and kurtosis of 0.41, while Efficiency showed skewness of −0.79 and kurtosis of 0.47. Finally, Route Choice had skewness of −0.82 and kurtosis of 0.55, confirming normality.

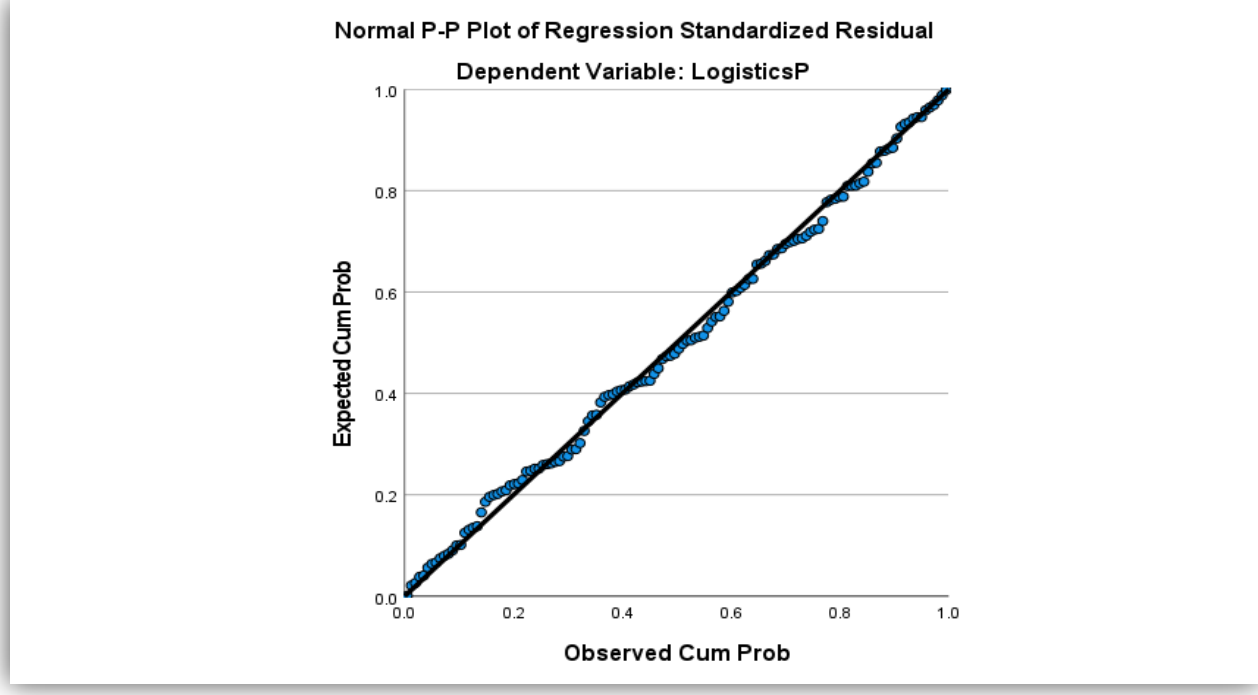
All skewness values ranged between −0.84 and −0.66, while kurtosis values ranged between 0.38 and 0.55. These narrow ranges demonstrate a high degree of symmetry in the data distribution. The relatively small kurtosis values also indicate that the dataset does not suffer from extreme peaks or flatness, which supports the assumption of normality.

The normality test results confirm that the data collected from 132 respondents is suitable for parametric statistical analyses such as correlation and regression. The consistency of skewness

and kurtosis values across all variables suggests that the responses were evenly distributed and free from significant bias. This strengthens the validity of subsequent regression findings, as the assumptions of normality are met.

4.6.3.2 Linearity Test

The linearity assumption was examined to determine whether the relationship between the independent variables (Scheduling, Accessibility, Safety, Efficiency, and Route Choice) and the dependent variable (Logistics Performance) is linear in nature. Linearity was tested using scatterplots of standardized residuals against predicted values, as well as partial regression plots for each predictor.



The scatterplots revealed that the residuals were evenly distributed around the zero line, with no clear curvature or systematic pattern. This indicates that the relationship between the predictors and logistics performance is adequately linear. For example, the plot for Scheduling showed a consistent upward trend, confirming that improvements in scheduling reliability are directly associated with better logistics performance. Similarly, Efficiency displayed a negative linear trend, suggesting that inefficiencies caused by poor road infrastructure reduce logistics outcomes.

By contrast, Accessibility, Safety, and Route Choice showed weaker linear patterns, which aligns with the regression results where these variables were not statistically significant predictors. Nonetheless, the absence of curvature or clustering in their residual plots confirms that the linearity assumption is satisfied across all variables.

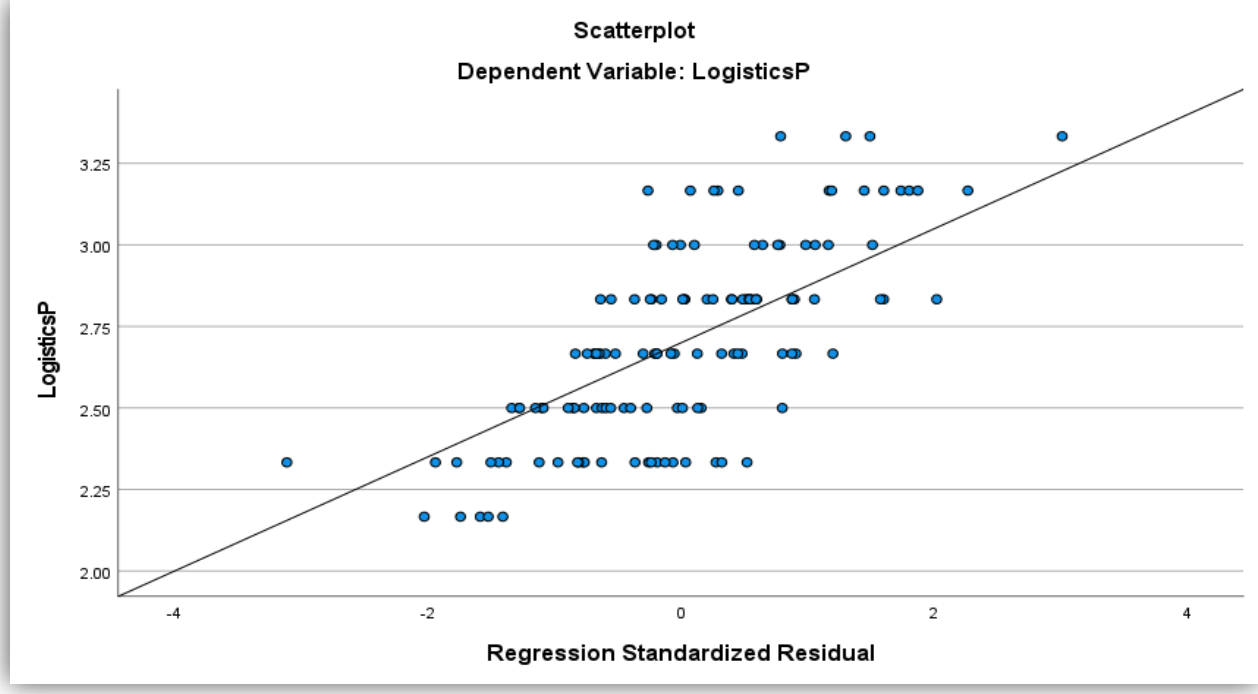
The linearity test results confirm that the regression model is appropriate for analyzing the effect of road transport infrastructure on logistics performance. Since the relationships between predictors and the dependent variable are linear, the regression coefficients can be interpreted reliably.

In practical terms, this means that changes in road infrastructure factors such as scheduling and efficiency have a proportional and predictable impact on logistics performance. The linearity assumption strengthens the validity of the regression findings, ensuring that the model accurately reflects the real-world dynamics of Moha's logistics operations.

4.6.3.3 Homoscedasticity Test

The homoscedasticity assumption was examined to determine whether the variance of residuals is constant across all levels of the predicted values. This test is essential in regression analysis because unequal variances (heteroscedasticity) can bias standard errors and weaken the

reliability of statistical inferences.



The residual plots showed that the points were scattered randomly and evenly around the zero line, without forming any funnel-shaped or curved patterns. This indicates that the variance of the residuals remained relatively constant across the range of predicted values. For example, the residuals for Scheduling and Efficiency were evenly dispersed, confirming that the regression model did not suffer from heteroscedasticity in these key predictors. Similarly, residuals for Accessibility, Safety, and Route Choice showed no systematic increase or decrease in variance, further supporting the assumption of homoscedasticity.

In practical terms, this means that the effect of road transport infrastructure factors on logistics performance is consistent across different levels of predicted outcomes. The absence of heteroscedasticity implies that the regression model provides stable and unbiased estimates, making the findings trustworthy for decision-making.

Together with the normality and linearity tests, the homoscedasticity results demonstrate that the regression assumptions are satisfied, thereby reinforcing the credibility of the regression analysis conducted in this study.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents the final part of the study. It draws together the demographic, reliability, descriptive, and regression findings reported in Chapter Four into a coherent set of conclusions, and translates those conclusions into practical recommendations for MOHA Soft Drink Industry S.C., for policy makers, and for future researchers. The chapter is organized into three sections: a summary of the key findings, the conclusions drawn from those findings, and recommendations that respond directly to the statistical results of the study.

5.1 Summary of Findings

The study distributed 170 questionnaires to employees of MOHA Soft Drink Industry S.C. involved in transport and logistics operations, of which 132 were returned and usable, giving a response rate of 77.8 percent. This rate exceeds the 75 percent threshold recommended for generalizing survey findings. The majority of respondents were drivers (81.8 percent), had a high school education or lower (73.5 percent), and had more than ten years of work experience (60.6 percent). This composition means that the data reflects the perceptions of employees with the most direct, sustained exposure to road conditions during day-to-day distribution operations, which strengthens the practical relevance of the findings. The reliability analysis using Cronbach's Alpha confirmed that all six constructs measured in the questionnaire – Scheduling ($\alpha = .798$), Accessibility ($\alpha = .774$), Safety ($\alpha = .805$), Efficiency ($\alpha = .872$), Route Choice ($\alpha = .829$), and Logistics Performance ($\alpha = .883$) – exceeded the 0.70 acceptability threshold, confirming that the instrument was internally consistent and suitable for descriptive and inferential analysis.

Across all five independent dimensions, respondents consistently agreed that road transport infrastructure constrains MOHA's logistics operations. Scheduling recorded a grand mean of 1.9166, Accessibility 1.9106, Efficiency 1.9400, and Route Choice 1.9676, all of which reflect strong agreement that poor road infrastructure disrupts planned departure and arrival times, limits delivery flexibility, and raises operating costs. Safety was rated on a different band of the scale, with item means between 3.98 and 4.14, indicating that respondents strongly associate poor roads with product damage, delivery delays, and backorder problems. Logistics Performance itself recorded a grand mean of 2.0480, with the infrastructure surrounding MOHA's Teklehaymanot, Summit, and Nifas Silk plants identified as the single biggest bottleneck. Taken together, the descriptive results show that employees experience road infrastructure deficiencies as a pervasive, day-to-day operational problem rather than an occasional disruption.

The multiple linear regression model tested the combined effect of Scheduling, Accessibility, Safety, Efficiency, and Route Choice on Logistics Performance. The model returned an R value of .684 and an R Square of .468, indicating that the five predictors jointly explain 46.8 percent of the variance in logistics performance, with an Adjusted R Square of .447 confirming the model's

robustness after accounting for the number of predictors and sample size. The ANOVA results confirmed that the model is statistically significant overall ($F = 22.168$, $p = .000$), meaning the variation observed in logistics performance is systematically linked to the infrastructure dimensions studied rather than occurring by chance.

At the level of individual predictors, only two variables emerged as statistically significant. Scheduling was by far the strongest and most significant predictor ($\beta = .681$, $t = 10.139$, $p = .000$), confirming that the reliability of departure and arrival times is the dimension most directly responsible for logistics outcomes at MOHA. Efficiency was also significant, but with a negative coefficient ($\beta = -.144$, $t = -2.138$, $p = .034$), indicating that as road-related inefficiencies (such as detours, congestion, and vehicle strain) increase, logistics performance declines. Accessibility ($\beta = .061$, $p = .362$), Safety ($\beta = -.053$, $p = .429$), and Route Choice ($\beta = -.031$, $p = .646$) were not statistically significant predictors, even though respondents rated them as serious concerns descriptively. This pattern suggests that these three dimensions act as background conditions that are broadly similar across plants and routes, and therefore do not statistically differentiate logistics performance outcomes the way Scheduling and Efficiency do.

Diagnostic checks confirmed that the regression model satisfied the key assumptions required for valid inference. Skewness (-0.66 to -0.84) and kurtosis (0.38 to 0.55) values for all variables fell well within the acceptable range for normality. Residual scatterplots showed no curvature, confirming linearity between each predictor and logistics performance. Residuals were also evenly scattered around zero with no funnel-shaped pattern, confirming homoscedasticity. Together, these diagnostics support the reliability of the coefficients and the conclusions drawn from them.

5.2 Conclusion

This study set out to examine the effect of road transport infrastructure on the logistics performance of MOHA Soft Drink Industry S.C. in Addis Ababa, focusing on five dimensions: scheduling, accessibility, safety, efficiency, and route choice. The evidence gathered from 132 employees directly involved in logistics operations, supported by a reliable measurement instrument and a statistically sound regression model, leads to several firm conclusions.

First, road transport infrastructure has a real and statistically significant effect on logistics performance at MOHA, with the five dimensions jointly accounting for close to half (46.8 percent) of the variation observed. This confirms that infrastructure conditions are not a peripheral concern but a central determinant of how reliably the company can move goods from its plants to customers.

Second, the effect of infrastructure is not uniform across dimensions. Scheduling reliability is the dominant driver of logistics performance, far outweighing the other four dimensions in statistical strength. Efficiency also matters, but its effect works in the opposite direction: deteriorating road conditions actively erode operational efficiency, raise costs, and reduce delivery capacity. This indicates that MOHA's logistics performance hinges most heavily on whether vehicles can keep to planned schedules and operate efficiently, both of which are tightly coupled to the physical state of the surrounding road network.

Third, accessibility, safety, and route choice, despite being rated as serious operational concerns in the descriptive analysis, did not significantly predict logistics performance once scheduling and efficiency were accounted for. This should not be read as evidence that these dimensions do not matter; rather, it suggests that they function as relatively constant background constraints experienced similarly across MOHA's plants and routes, so they do not statistically explain why logistics performance varies from one delivery, route, or period to another. Their influence on performance more likely operates indirectly, through their effect on scheduling adherence and operational efficiency, rather than directly on output measures.

Overall, the study concludes that improving road infrastructure alone will not automatically translate into better logistics performance for MOHA. The strongest gains will come from interventions that directly target schedule reliability and operational efficiency, complemented by sustained, longer-term investment in the broader infrastructure conditions – accessibility, safety, and route flexibility – that shape the operating environment in which scheduling and efficiency are achieved.

5.3 Recommendations

- Scheduling is by far the strongest predictor of logistics performance. Invest in a dedicated scheduling and dispatch system enabling real-time communication between drivers, fleet coordinators, and distribution clerks..
- Directly address the cost and efficiency impact of bad roads: Treat road-related inefficiency as a measurable cost center. Track fuel consumption, vehicle wear, and maintenance costs by route to identify the highest-loss roads, and use this data to address route-specific repair priorities with the Ethiopian Roads Authority and Addis Ababa city administration.
- Pursue coordinated, long-term investment in Accessibility, Safety, and Route Choice: Though not statistically significant predictors, these remain serious, widely shared concerns. Focus on targeted repairs around internal company measures, formal safety reporting to quantify damage and accident losses, and periodic route audits where limited alternatives force reliance on deteriorated roads.
- Examine the indirect effects of Accessibility, Safety, and Route Choice on logistics performance via mediation through Scheduling and Efficiency, rather than dismissing them based on insignificant direct effects.
- For further research: Extend the study to other MOHA plants, other manufacturers, or a longitudinal design to test whether Scheduling remains the dominant predictor across contexts and time.

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Research Questionnaires

This questionnaire is part of an academic research study for a Master's degree in Logistics and Supply Chain Management at Addis Ababa University School of Commerce. The purpose is to analyse how road transport infrastructure development impacts the business logistics performance of MOHA Soft Drink Industry. All responses are anonymous and will be used only for academic purposes. Please answer honestly. Thank you for your cooperation**.**

Part 1. Demographic Information

1. Your current position in the company

Manager (Logistics/Transport/Warehouse) ☐

Decision Coordinator ☐

Fleet Coordinator ☐

Distribution Clark ☐

Drivers ☐

Other (please specify)……..

2. Educational Background

Highschool ☐ First degree ☐

Collage diploma ☐ Second degree & above ☐

3. Your work experience in this company

Less than 2 years ☐ 2 5 years ☐

5 10 years ☐ Above 10 years ☐

Part 2. Study Variables Questionnaires

Please rate on the scale 1 to 5 with the following questions. Please tick 'X' or '√' mark in the corresponding cell

5 strongly agree 4 agree 3 neutral 2 disagree 1 strongly disagree

	Scheduling	1	2	3	4	5
1	Poor road transport infrastructure frequently prevents Moha' s vehicles from arriving at designated locations according to planned departure and arrival times					
2	Severe road conditions and inadequate transport facilities maximize product handling delays and waiting times, disrupting Moha's ability to follow to scheduled deliveries					
3	Deficient road transport infrastructure disconnects Moha's actual vehicle schedules from its planned distribution network delivery timelines					
4	Current delivery timeliness constrained by poor road transport infrastructure causes moha to fail to meet customer expectations for punctuality					
5	Poor road infrastructure causes delays that prevent Moha's vehicles from adhering to scheduled delivery times reducing customer satisfaction					
6	Substandard road transport infrastructure causes Moha's delivery schedules to become inconsistent with planned logistics operations across the distribution network					
7	Inadequate road transport infrastructure prevents Moha's vehicles from meeting customer expectations due to failure in adhering to planned departure and arrival times					
	Accessibility	1	2	3	4	5
1	Inadequate road infrastructure significantly increases the process time required to deliver Moha's products from the company to the customer.					
2	Moha's surrounding road transport infrastructure lacks the capacity to handle increased logistics traffic when product demand peaks					
3	Low quality road infrastructure makes it impossible to ensure timely product delivery within targeted timeline					
4	Poor road infrastructure contributes to product shortages during peak demand periods					
5	Road accessibility issues make it difficult for Moha to reach suppliers and					

	customers on time					
	Safety	1	2	3	4	5
1	Poor road infrastructure increases product damage during transport (e.g., broken bottles, damaged crates)					
2	Potholes and unpaved roads cause delivery delays and product damage, reducing MOHA's ability to provide reliable deliveries.					
3	Delay's caused by poor road conditions slow down the replacement of deteriorated products harming Moha's service reliability					
4	Weak road infrastructure contributes to delays in settling back orders.					
5	Lack of Improved road infrastructure and GPS tracking systems enable MOHA to deliver products more reliably and meet customer expectations for safe and timely deliveries.					
6	Road safety concerns, such as accidents or product damage, reduce Moha's ability to deliver reliably.					
	Efficiency	1	2	3	4	5
1	Deficient road transport infrastructure directly limits Moha's ability to move products efficiently					
2	Inadequate road transport infrastructure weakens Moha's operational efficiency and inflates overall logistics costs					
3	Weak road infrastructure makes Moha's transportation service financially inefficient					
4	Limited or inadequate road infrastructure impacts MOHA's ability to fully utilize warehouse space for product storage.					
5	Poor road transport infrastructure conditions restrict Moha from utilizing its full truck capacity for reliable transportation service					
6	Poorly managed road infrastructure developments in Addis Ababa have hindered Moha's logistics performance					
7	Damaged roads have increased Moha's transport costs and reduced operational efficiency					
	Route Choice	1	2	3	4	5
1	Badly maintained road infrastructure makes Moha's transportation service inefficient by forcing drivers onto low standard routes					
2	Poor road infrastructure forces MOHA to rely on fixed routes, limiting distribution					

	flexibility					
3	Inadequate road infrastructure causes unpredictable product delivery times that dissatisfy customers					
4	Deteriorating road infrastructure conditions prevent Moha from successfully delivering products early in the morning as planned					
5	Frequent late deliveries at MOHA are caused by poor road infrastructure.					
6	Weak road infrastructure limits Moha's transportation flexibility preventing drivers from choosing alternative routes when bottlenecks occur					

	Logistics Performance	1	2	3	4	5
1	Compared to three years ago, the state of road transport infrastructure in Addis Ababa has changed the way MOHA manages its overall logistics operations.					
2	Recent road infrastructure developments (e.g., ring roads, expressways) in Addis Ababa have led to a measurable improvement in MOHA's logistics performance.					
3	Road infrastructure problems around MOHA's plants have caused the company to incur unplanned logistics costs such as emergency rerouting, vehicle repairs, or product replacements.					
4	Poor Road transport infrastructure development has contributed to order fulfilment delays and the rate at which MOHA delivers products to customers.					
5	MOHA's logistics team is unable to plan inbound raw material deliveries and outbound product distribution with confidence based on the predictability of road conditions.					
6	The current road infrastructure around MOHA's plants (Teklehaymanot, Summit, Nifas Silk) is insufficient to support efficient inbound and outbound logistics operations.					

የምርምር መጠይቅ

ይህ መጠይቅ በአዲስ አበባ ዩኒቨርሲቲ የንግድ ትምህርት ቤት በሎጂስቲክስ አስተዳደር የማስተርስ ዲግሪ የሚሰጥ የአካዳሚክ ጥናት አካል ነው። ዓላማው የመንገድ ትራንስፖርት መሠረተ ልማት ልኬቶች የሞሃ ለስላሳ መጠጥ ኢንዱስትሪ የንግድ ሎጂስቲክስ አፈፃፀምን እንዴት እንደሚነኩ ለመተንተን ነው። ሁሉም ምላሾች ማንነታቸው ያልታወቀ እና ለአካዳሚክ ዓላማዎች ብቻ ጥቅም ላይ ይውላሉ። እባክዎን በሐቀኝነት መልስ ይስጡ። ለትብብርዎ እናመሰግናለን።

I. የስነ ሕዝብ መረጃ

1. በኩባንያው ውስጥ የአሁኑ ያለዎት የሥራ ቦታ

ሥራ አስኪያጅ (ሎጂስቲክስ/ትራንስፖርት) ☐

የስርጭት አስተባባሪ (Distribution Coordinator) ☐

ፍሊት አስተባባሪ (Fleet Coordinator) ☐

ስርጭት ክላርክ (Distribution Clark) ☐

አሽከርካሪ ☐

ሌላ (እባክዎ ይግለጹ) ……..

2. የትምህርት ደረጃ

ሁለተኛ ደረጃ ትምህርት ቤት ☐ የመጀመሪያ ዲግሪ ☐

የኮሌጅ ዲፕሎማ ☐ ሁለተኛ ዲግሪ እና ከዚያ በላይ ☐

3. በዚህ ኩባንያ ውስጥ የስራ ልምድዎ

ከ2 ዓመት በታች ☐ ከ2 5 ዓመታት ☐

5 10 ዓመታት ☐ ከ10 ዓመት በላይ ☐

መመሪያ 2: እባክዎ ሁሉንም መግለጫዎች በተስማሚው የስምምነት ደረጃ በተመረጠ ቦታ ምልክት (✓) ያድርጉ።

1 = በጣም አልስማማም 2 = አልስማማም 3 = መካከለኛ 4 = እስማማለሁ 5 = በጣም እስማማለሁ

SEC	**መርሐግብር (Scheduling)**	1	2	3	4	5
1	ደካማ የመንገድ ትራንስፖርት መሠረተ ልማት የሞሃ ተሽከርካሪዎች በታቀደው የመነሻና የደረሻ ጊዜ ወደ ታቀደ ቦታ እንዳይደርሱ ያደርጋል።					
2	ከባድ የመንገድ ሁኔታዎችና ደካማ የትራንስፖርት አገልግሎት የምርት አያያዝ መዘጋት እና የጥበቃ ጊዜን ያፈናፍናሉ፤ ይህም ሞሃ ቀደም ተብሎ የታቀደውን የማድረሻ ጊዜ ሠሌዳ እንዳያሟላ ያደርጋል።					
3	ደካማ የመንገድ ትራንስፖርት መሠረተ ልማት የሞሃን ትራንስፖርት የጊዜ ሠሌዳ ከታቀደው የስርጭት አውታር ጊዜ ሠሌዳ ጋር አለመጣጣምን ይፈጥራል።					
4	ደካማ የመንገድ ትራንስፖርት መሠረተ ልማት ምክንያት ዕቃዎችን በወቅቱ ማድረስ አለመቻል ሞሃ የደንበኞቹን የወቅታዊነት ፍላጎት እንዳያሟላ ያደርጋል።					
5	ደካማ የመንገድ መሠረተ ልማት የሞሃ ተሽከርካሪዎች በታቀደ ጊዜ ሠሌዳ እንዳይሄዱ የሚያደርጉ መዘጋቶችን ፈጥሮ የደንበኛ እርካታን ይቀንሳል።					
6	ዝቅተኛ ደረጃ ያለው የመንገድ ትራንስፖርት መሠረተ ልማት የሞሃን የማቅረቢያ ጊዜ ሠሌዳ ከታቀደው ሎጂስቲክስ ሥርዓት ጋር ወጥ ያልሆነ ያደርገዋል።					
7	በቂ ያልሆነ የመንገድ ትራንስፖርት መሠረተ ልማት የሞሃ ተሽከርካሪዎች በታቀደ የመነሻና የደረሻ ጊዜ ካለማክበር ተነስቶ የደንበኞቹን ፍላጎት እንዳያሟላ ያደርጋል።					
	ተደራሽነት(Accessibility)	1	2	3	4	5
1	በቂ ያልሆነ የመንገድ መሠረተ ልማት ሞሃ ምርቶቹን ከድርጅቱ ወደ ደንበኛው ለማድረስ የሚወስደውን ጊዜ በከፍተኛ ሁኔታ ይጨምራል።					
2	ሞሃ ያለበት የመንገድ ትራንስፖርት መሠረተ ልማት የምርት ፍላጎት ከፍ ሲል ተጨማሪ ሎጂስቲክስ ትራፊክን ለማስተናገድ የሚያስፈልገውን አቅም አይኖረውም።					
3	ዝቅተኛ ጥራት ያለው የመንገድ መሠረተ ልማት ምርቶችን በታለመው ጊዜ ወቅታዊ ማድረስ እንዳይቻል ያደርጋል።					
4	ደካማ የመንገድ መሠረተ ልማት የፍላጎት ከፍተኛ ወቅቶች ወቅት የምርት እጥረት እንዲኖር አስተዋጽኦ ያደርጋል።					

5	የመንገድ ተደራሽነት ችግሮች ሞሃ አቅራቢዎቹንና ደንበኞቹን በወቅቱ ለመጠየቅ አስቸጋሪ ያደርጉበታል።					
	ደህንነት (Safety)	1	2	3	4	5
1	ደካማ የመንገድ መሠረተ ልማት በትራንስፖርት ወቅት የምርት ጉዳትን (ለምሳሌ፦ የተሰበሩ ጠርሙሶች፣ የተበላሹ ሳጥኖች) ይጨምራል።					
2	ጉድጓዶችና ያልተሰራ መንገድ የማቅረቢያ መዘጋቶችን እና የምርት ጉዳትን ያስከትላሉ፤ ይህም ሞሃ ወጥ የሆነ አቅርቦት እንዳይሰጥ ይቀንሳል።					
3	ደካማ የመንገድ ሁኔታዎች ምክንያት የሚፈጠሩ ዘገያዎች የተበላሹ ምርቶችን በወቅቱ መተካትን ያዘገያሉ፤ ይህም የሞሃን አገልግሎት አስተማማኝነት ይጎዳል።					
4	ደካማ የመንገድ መሠረተ ልማት ቀሪ ዕቃዎችን ለመክፈል የሚወስደውን ጊዜ ያዘገያል።					
5	የተሻሻለ የመንገድ መሠረተ ልማትና የ GPS ክትትል ሥርዓት አለመኖር ሞሃ ምርቶቹን ደህንነቱ ተጠብቆ በወቅቱ ለደንበኞቹ እንዲያቀርብ ከሚያስፈልጉ ሁኔታዎች ጋር አለመጣጣምን ያስከትላል።					
6	እንደ አደጋ ወይም የምርት ጉዳት ያሉ የመንገድ ደህንነት ችግሮች ሞሃ ምርቶቹን አስተማምኖ የሚያቀርብበትን አቅም ይቀንሳሉ።					
	ቅልጥፍና (Efficiency)					
1	ደካማ የመንገድ ትራንስፖርት መሠረተ ልማት ሞሃ ምርቶቹን በቅልጥፍና የሚያንቀሳቅስበትን አቅም በቀጥታ ይገድባል።					
2	በቂ ያልሆነ የመንገድ ትራንስፖርት መሠረተ ልማት የሞሃን ሥራ ቅልጥፍና ያዳክማል እና የሎጂስቲክስ ወጪዎቹን ያሳድጋል።					
3	ደካማ የመንገድ መሠረተ ልማት የሞሃን ትራንስፖርት አገልግሎት ኢኮኖሚያዊ ቅልጥፍና የሌለው ያደርገዋል።					
4	ውስን ወይም በቂ ያልሆነ የመንገድ መሠረተ ልማት ሞሃ ለምርት ማከማቻ የጎዳዎ ቤቶቹን ቦታ ሙሉ ለሙሉ ተጠቅሞ ለምርት ማከማቻ ለማዋል ያለውን አቅም ይቀንሳል።					
5	ደካማ የመንገድ ትራንስፖርት መሠረተ ልማት ሁኔታዎች ሞሃ ሙሉ የጭነት ቶን አቅሙን ተጠቅሞ አስተማማኝ ትራንስፖርት አገልግሎት እንዳይሰጥ ይከለክለዋል።					
6	በአዲስ አበባ ደካማ አስተዳደር ያለው የመንገድ መሠረተ ልማት ልማት የሞሃን ሎጂስቲክስ					

	አፈጻጸም አዳክሟል።					
7	የተበላሸ መንገድ የሞሃን ትራንስፖርት ወጪዎች ጨምሯል እና ሥራ ቅልጥፍናን ቀንሷል።					
	መንገድ ምርጫ (Route Choice)					
1	1.ደካማ ጥገና ያለው የመንገድ መሠረተ ልማት አሽከርካሪዎቹን ዝቅተኛ ደረጃ ያላቸው መስመሮችን ለሩብ እንዲጠቀሙ በማስገደድ የሞሃን ትራንስፖርት አገልግሎት ብቃት ያሳጣዋል።					
2	2.ደካማ የመንገድ መሠረተ ልማት ሞሃ ቋሚ መስመሮችን ብቻ እንዲጠቀም ያስገድደዋል፤ ይህም የስርጭት ተለዋዋጭነቱን ይገድባል።	1	2	3	4	5
3	3.በቂ ያልሆነ የመንገድ መሠረተ ልማት ሊተነበዩ የማይቻሉ የምርት ማቅረቢያ ጊዜዎችን ያስከትላል፤ ይህም ደንበኞችን ያስከፋል።					
4	4.እየተባባሰ የሚሄደው የመንገድ መሠረተ ልማት ሁኔታ ሞሃ ምርቶቹን ቀደም ተብሎ እንደታቀደው ማለዳ ቀድሞ ማቅረብ እንዳይችል ያደርጋል።					
5	5.ሞሃ ዘንድ ተደጋጋሚ ዘገዩ የሚፈጠሩ ዕቃዎች አቅርቦቶች ምክንያቱ ደካማ የመንገድ መሠረተ ልማት ነው።					
6	6.ደካማ የመንገድ መሠረተ ልማት አሽከርካሪዎቹ መዘጋት ሲኖር አማራጭ መስመሮችን እንዳይሄዱ ስለሚያደርግ የሞሃን ትራንስፖርት ተለዋዋጭነት ይገድባል።					

	የሎጂስቲክስ አፈጻጸም	1	2	3	4	5
1	ከሦስት ዓመት በፊት ሲወዳደር፣ በአዲስ አበባ የመንገድ ትራንስፖርት መሠረተ ልማት ሁኔታ ሞሃ አጠቃላይ ሎጂስቲክስ ሥራዎቹን የሚያስተዳድርበትን መንገድ ቀይሯል።					
2	በአዲስ አበባ ቅርብ ጊዜ የተካሄዱ የመንገድ መሠረተ ልማት ግንባታዎች (ለምሳሌ፦ ቀለበት መንገዶች፣ ፈጣን መንገዶች) የሞሃን ሎጂስቲክስ አፈጻጸም በሚለካ ሁኔታ አሻሽለዋል።					
3	ሞሃ ዙሪያ ያሉ የመንገድ መሠረተ ልማት ችግሮች ድርጅቱ ቀደም ሳይታሰቡ ሎጂስቲክስ ወጪዎችን (ለምሳሌ፦ ሳይታሰብ መስመር መቀየር፣ ተሽከርካሪ ጥገና፣ ምርት መተካት) እንዲሸከም አድርጓል።					
4	ደካማ የመንገድ ትራንስፖርት መሠረተ ልማት ልማት ለትዕዛዝ አፈጻጸም ዘገያ አስተዋጽኦ አድርጓል፤ እንዲሁም ሞሃ ምርቶቹን ለደንበኞቹ የሚያቀርብበትን ፍጥነት ቀንሷል።					
5	የሞሃ ሎጂስቲክስ ቡድን የመንገድ ሁኔታዎች ትንበያ ላይ ተመርኩዞ ለጥሬ ዕቃ የውስጥ					

	ማቅረቢያ እና ለምርት ውጪ ስርጭት እቅድ በመተማመን ማዘጋጀት አይችልም።					
6	በሞሃ ፋብሪካዎች (ተክለሃይማኖት፣ ሰሚት፣ ንፋስ ስልክ) ዙሪያ ያለው የአሁኑ የመንገድ መሠረተ ልማት ቅልጥፍናማ የሆነ የውስጥ እና ውጪ ሎጂስቲክስ ሥራዎችን ለመደገፍ በቂ አይደለም።					