Practices and Challenges of Integrated Infrastructure Planning between Addis Ababa and Sheger Cities, Ethiopia

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DECLARATION

I hereby declare that this dissertation is the result of my original work and has not been submitted to any University/Institution for any degree or other purpose. All materials other than my ideas used in this study from other sources have been fully acknowledged and cited properly, following the scientific guidelines of Addis Ababa University.

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APPROVAL

As a member of the Examiners board of the PhD Dissertation open defense of Geremew Worku Alemneh, we have read and evaluated the Dissertation prepared by Geremew Worku Alemneh entitled "Practice and Challenges of Integrated Infrastructure Planning between Addis Ababa and the Sheger Cities, Ethiopia" and recommended to School of Built Environment of College of Technology and Built Environment**,** Addis Ababa University to accept the Dissertation as it meets the accepted standards to originality and quality for the fulfillment of requirements for the award of Doctor of Philosophy Degree in Urban and Regional Planning.

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ABSTRACT

Rapid urbanization in Addis Ababa and the emergence and expansion of Sheger City have increased the demand for coordinated infrastructure development and service delivery. Although urbanization can improve access to infrastructure and promote economic growth when effectively planned and managed, fragmented and uncoordinated infrastructure planning can result in inadequate infrastructure provision, urban sprawl, traffic congestion, environmental degradation, and inefficiencies. These challenges motivated this study to investigate the practices and challenges of integrated infrastructure planning between the cities in Ethiopia. Specifically, the study aimed to examine existing practices of integrated infrastructure planning and the extent of coordination in infrastructure development, identify major institutional, financial, legal, technical, and operational challenges, and propose strategies for strengthening integrated infrastructure planning between the two cities. The study employed a mixed-methods research design, combining explanatory and descriptive approaches. Purposive sampling was used to select relevant experts and stakeholders. Primary data were collected through structured questionnaires; key informant interviews (KIIs), focus group discussions (FGDs), field observations, and document review. Quantitative data were analyzed using descriptive statistics, including frequencies and percentages, using SPSS and Excel, while spatial information was analyzed using GIS. Qualitative data from interviews and FGDs were analyzed through thematic and content analysis. Triangulation of data sources and methods was employed to strengthen the validity and reliability of the findings. The findings revealed major barriers to effective integrated infrastructure planning, including weak financial integration, inadequate policy direction, the absence of a robust legal framework, shortages of skilled manpower, and weaknesses in planning and design processes. Significant gaps were also identified in metropolitan governance, inter-city coordination, and stakeholder collaboration. These institutional and operational challenges contribute to disparities in integrated infrastructure planning between the two cities and constrain coordinated responses to metropolitan infrastructure needs. The study concludes that effective integrated infrastructure planning requires stronger institutional, legal, financial, technical, and participatory mechanisms. It recommends establishing a clear legal framework, creating metropolitan governance or coordinating institution, diversifying financing mechanisms, promoting public-private partnerships, strengthening community participation, and effectively utilizing technology and

sustainable development principles. These measures can support coordinated, resilient, inclusive, and sustainable infrastructure development in the two cities and provide lessons for rapidly urbanizing metropolitan regions in Ethiopia and beyond.

Key Words**:** Addis Ababa, challenges, Infrastructure planning, Sheger city, urban governance,

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Published and submitted Articles

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1.2 G. Worku, D. Adugna (2026). Urban governance for sustainable integrated infrastructure in the metropolitan areas of Addis Ababa and Sheger, Ethiopia, Cities & Health, DOI: 10.1080/23748834.2026.2692662

1.3 G. Worku, D. Adugna (2025). The Practices of an Integrated Infrastructure Planning in Ethiopian Metropolitan Cities, the Case of Addis Ababa and Sheger Cities, American Journal of Applied Scientific Research, https://doi.org/10.11648/j.ajasr.20251101.14,

1.4 G. Worku, D. Adugna (2025). The Challenges of Integrated Infrastructure Planning Between the Metropolitan Cities of Ethiopia, the Case of Addis Ababa and Sheger Sheger Cities, American Journal of Applied Scientific Research, https://doi.org/10.11648/j.ajasr.20251101.16

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LIST OF ACRONYMS AND ABBREVIATIONS

AAWSA	Addis Ababa Water and Sewerage Authority
ABC	Active, Beautiful, Clean Waters
ADB	Asian Development Bank
AfDB	African Development Bank
AU	African Union
BLIS	Bangkok Land Information System
BRIMSTOWAD	Brihan Mumbai Stormwater Disposal Syste
BRT	Bus Rapid Transit
CLTs	Community Land Trusts
CSOs	Combined Sewer Overflows
DTSS	Deep Tunnel Sewerage System
ECA	Economic Commission for Africa
ECLAC	Economic Commission for Latin America and the Caribbean
ERP	Electronic Road Pricing
F FUA	Functional urban Area
FGDs	Focus Group Discussions
GERD	Grand Ethiopian Renaissance Dam
GIS	Geographic Information System
HLURB	Housing and Land Use Regulatory Board
HUDCC	Housing and Urban Development Coordinating Council
ICT	Information and Communications Technology
IIP	Integrated Infrastructure Planning
IIMP	Integrated Infrastructure Master Plan
IoT	Internet of Things
IUDP	Integrated Urban Development Plan
IUWM	Integrated Urban Water Management
ITMS	Intelligent traffic management systems
ISWM	Integrated Solid Waste Management
IWM	Integrated Water Management
IWMF	Integrated Waste Management Facility

KIIs	Key Informant Interviews
LAMATA	Lagos Metropolitan Area Transport Authority
LRT	Light Rail Transit
LTA	Land Transport Authority
MR	Metropolitan Regions
MRT	Mass rapid transit
MoUDC	Ministry of Urban Development and Construction
MP	Mesoamerica Project
MUA	Morphological Urban Area
NBN	National Broadband Network
NUDHF	National Urban Development and Housing Framework
NUP	National Urban Policy
OECD	Organization for Economic Cooperation and Development
PDUI	Integrated Urban Development Plan
PPPs	Public - Private - Partnerships
PUB	Public Utilities Board
RRX	Rhein-Ruhr Express
SDGs	Sustainable Development Goals
SPUB	Singapore Public Utilities Board
TfL	London's Transport for London
TIF	Tax increment financing
TOD	Transit-oriented development
URA	Urban Redevelopment Authority
VQS	Vehicle Quota System
WTE	Waste-to-Energy
WSUD	Water Sensitive Urban Design

CHAPTER I: INTRODUCTION

1.1 Back ground of the study

Urbanization has become a defining feature of the 21st century, shaping cities worldwide and presenting both opportunities and challenges. Currently, over half of the world's population resides in cities (Cohen, 2007; Kourtit et al., 2013), and projections indicate that by 2050, 68 percent of the world's population will reside in urban areas. This rapid increase will take place mainly in developing countries. Africa and Asia, both still less urbanized than other regions, will have the fastest urban growth rates (Yuen & Kumssa, 2011). Cities act as engines of economic growth, innovation, and social progress, yet they also face immense pressures related to infrastructure, governance, and sustainability. In Ethiopia, Addis Ababa and Sheger City exemplify this dynamic. Their geographical proximity and socio-economic interdependence create significant opportunities for collaboration but also pose challenges for integrated infrastructure planning. Integrated planning harmonizing sectors like transportation, housing, water supply, and energy is essential for achieving sustainable urban development and improving the quality of life for urban residents. Thus rapid urbanization places significant pressure on existing infrastructure and services in cities like Addis Ababa and Sheger, necessitating strategic planning and investment in infrastructure development.

With rapid urbanization occurring globally, city regions are experiencing unprecedented growth in population, economic activities, and infrastructure demands. This urban expansion places immense pressure on existing infrastructure systems and necessitates integrated approaches to manage urban development sustainably (Bibri, 2020; Russo & Cirella, 2020). City regions have complex socio-technical systems characterized by the interdependence of infrastructure networks (Gürsan et al., 2023; Yang et al., 2022). It demands better provision, management and integration of infrastructure through sound planning and delivery. According to (Osawe & Ojeifo, 2019; Srivastava, 2020)argument, rapid and often unplanned urbanization can pose four significant risks in developing countries. The article mentions increased social instability, risks to important infrastructure, possible shortages of water and other resources, and the possibility of a catastrophic spread of disease were among the issues listed in the article.

For instance, transportation infrastructure influences land use patterns, while energy affects environmental quality and public health (Frank et al., 2019; Younger et al., 2008). Understanding these interconnections is crucial for effective infrastructure management. Currently, City regions face multifaceted challenges related to infrastructure, such as aging, inadequate capacity, environmental degradation, and climate change impacts (Demuzere et al., 2014; Nazarian et al., 2022). Addressing these challenges requires coordinated actions across different sectors and levels of governance.

Moreover, Bekele (2022) and Karadimitriou et al. (2021) revealed that both Addis Ababa and Sheger are experiencing rapid urbanization and significant population growth which is increasing the demand for integrated infrastructure that can support this growth. Despite their geographical proximity and interconnected economies, Addis Ababa and Sheger City struggle with these fragmented infrastructure planning. These challenges include increased pressure on transportation networks, such as congestion, inadequate transportation systems, environmental degradation, and socio-economic disparities (Guerra & Reklaitis, 2018). Governance arrangements between the cities remain relatively fragmented, with limited institutional mechanisms for sustained coordination and joint planning of infrastructure that crosses their administrative boundaries.

This fragmentation results in uncoordinated infrastructure projects, inefficient resource use, and missed opportunities for synergy (Bhattarai & Budd, 2019; Pinderhughes, 2016). For instance, Addis Ababa and Sheger City primarily connect via national highways, yet these highways frequently experience overcrowding and inadequate integration with other transportation modes. Moreover, the absence of a regional planning framework exacerbates urban sprawl, congestion, and inequities in service delivery. Then, the need for sustainable development and integration of physical infrastructure between these two cities is becoming increasingly crucial to address these challenges posed by urbanization.

Despite the existing challenges, there are some areas of infrastructure interaction and coordination between the cities. These include transport connections, water supply and sanitation services, wastewater management, and the development of urban green spaces. For example, public transport services and road connections link Addis Ababa with adjoining areas of Sheger

City, facilitating the movement of residents and commuters across the administrative boundary. Similarly, water supply and sanitation infrastructure in the two urban areas is increasingly influenced by their physical and functional interdependence. However, these initiatives should not necessarily be interpreted as evidence of a fully integrated infrastructure planning system. Rather, they indicate sector-specific linkages and emerging coordination in response to the increasing functional integration of the two urban areas.

Integrated infrastructure planning provides an important approach for managing the interconnected infrastructure demands associated with rapid urban growth and increasing urban complexity. International experience, including cities such as Singapore, Amsterdam, and Kigali, demonstrates the potential benefits of coordinated infrastructure planning in improving service provision, using resources more efficiently, and strengthening urban resilience(Daudu, Osimen, & Anaiye, 2024; Yorucu, Bekun, & Yitmen, 2026). However, applying such an approach in rapidly growing urban contexts such as Ethiopia remains challenging because infrastructure systems and urban development often extend beyond individual administrative boundaries. These challenges are particularly evident in the rapidly urbanizing areas surrounding of the two cities. Addis Ababa, the capital and major administrative and economic center of Ethiopia, is closely connected to the surrounding urban areas that were incorporated into Sheger City in 2022 under the Oromia Regional State. The two urban areas have increasingly interconnected patterns of population movement, land development, economic activity, and infrastructure demand. However, their infrastructure planning remain largely influenced by separate administrative structures, institutional mandates, financial arrangements, and technical capacities. This creates challenges for coordinating infrastructure systems that cross administrative boundaries. Differences in institutional responsibilities can make joint decision-making and implementation more difficult; variations in financial capacity can create uncertainty regarding the financing, operation, and maintenance of shared infrastructure; and differences in technical capacity, standards, and information systems can constrain the preparation and implementation of compatible infrastructure plans. Consequently, although the cities are functionally interconnected, achieving effective integration of infrastructure planning requires stronger coordination across administrative, financial, and technical dimensions.

In the Ethiopian context, urban governance structures are highly centralized, limiting local-level decision-making and inter-city collaboration. Addis Ababa and Sheger City, as neighboring urban centers, must navigate overlapping jurisdictions, uneven resource distribution, and differing planning priorities. These issues are compounded by rapid urbanization, which places additional strain on already inadequate infrastructure. Addressing these challenges requires a coordinated approach that integrates planning efforts, harmonizes policies, and leverages shared resources to meet the demands of a growing urban population. Unplanned urban growth has blurred the boundaries between the cities, creating a continuum of development that complicates the distinction between urban and rural areas. Without a coordinated approach, these challenges are likely to intensify, undermining the potential for sustainable development in the region.

Addressing these challenges requires an integrated approach to infrastructure planning. Instead of planning each aspect of infrastructure through partitioning, an integrated system considers the interconnectedness of various systems.

1. 2 Statement of the Problem

Integrated urban infrastructure planning is critical for the sustainable development, resilience, and efficient functioning of rapidly growing city regions (Thacker et al., 2019). Integration requires the coordinated planning, design, investment, implementation, and management of interconnected infrastructure systems, including transportation, sewerage, stormwater drainage, and solid waste management. It also requires coordination among government institutions, municipalities, infrastructure providers, and other stakeholders across administrative boundaries. However, in rapidly urbanizing contexts such as Ethiopia, infrastructure planning and management often remain sectorally and institutionally fragmented. Differences in institutional mandates, policies, budgets, technical standards, planning responsibilities, and administrative boundaries can hinder effective coordination and result in inefficient resource utilization, service delivery gaps, infrastructure conflicts, duplication of investment, and environmental and social problems (Bharath et al., 2018; Zimmer, 2010).

These challenges are particularly evident between Addis Ababa and Sheger City, where rapid urban growth has increased functional and spatial interdependence. The two cities are increasingly connected through movements of people, employment, goods, services, and

transportation. Nevertheless, infrastructure systems and their planning processes have not developed at the same level of integration. Transportation networks, solid waste management, drainage, sewerage, and other urban services continue to be planned largely within separate institutional and administrative arrangements (Jayasinghe, Derrible, & Kattan, 2023; Malulu, 2016). This fragmentation contributes to traffic congestion and disruption, drainage and flooding problems, waste-management challenges, inefficient resource use, and potential duplication or gaps in infrastructure investment. Differences in institutional mandates, financial arrangements, and planning responsibilities further constrain coordinated infrastructure development across the boundary.

Various efforts have been undertaken by government institutions and infrastructure agencies to respond to the infrastructure demands associated with urban growth. These include the preparation and implementation of urban development and master plans, expansion and upgrading of road and transport infrastructure, provision of sewerage and drainage systems, and improvement of solid waste management services. Infrastructure and municipal institutions in Addis Ababa and Sheger have also undertaken sector-specific planning, investment, and service-delivery activities within their respective jurisdictions. National and regional road investments have further strengthened physical connectivity between the two urban areas. However, these efforts have largely remained sector-specific and institutionally fragmented, with limited mechanisms for integrating infrastructure planning, investment, and implementation across the administrative boundary.

The remaining gap is therefore not simply the provision of additional infrastructure, but the absence of an effective framework for integrating infrastructure planning between Addis Ababa and Sheger City. In particular, there is limited evidence on the extent to which existing infrastructure planning practices are coordinated across the two cities, the institutional and intergovernmental mechanisms governing such coordination, and the major financial, legal, technical, and operational barriers affecting integration. The mismatch between increasing functional interdependence and relatively limited spatial, institutional, and financial integration represents a critical planning gap. Existing studies and planning practices have not adequately addressed how the two cities can jointly plan, coordinate, finance, and implement infrastructure

systems that cross their administrative boundary (Knippschild, 2011; Kurowska-Pysz, Castanho, & Loures, 2018).

Therefore, this study aims to assess the existing practices of integrated infrastructure planning between Addis Ababa and Sheger City, identify the major challenges constraining effective coordination and collaboration, examine the intergovernmental and institutional dynamics influencing infrastructure planning and implementation, and propose practical strategies for strengthening integrated infrastructure planning and management between the two cities.

1.3 Objective of the study

1.3.1 General objective of the study

The general objective of the study is to investigate the Practice and challenges of integrated physical infrastructure planning and develop potential strategies for sustainable this between Addis Ababa and Sheger cities.

1.3.2 Specific objectives

The specific objectives of the study are:

1. To assess the practices of integrated infrastructure planning in the study area
2. To investigate the challenges of integrated urban infrastructure planning in the study area.
3. To analyze the current governance paradigm of urban infrastructure planning in the study areaTo develop strategic tools for integrated infrastructure planning in the study area

1.4 Research Questions

The research questions in line with the specific objectives are shown in Table 1.1.

Table1.1: specific objectives vs research questions

S/N	Specific Objectives	The research questions	Remark
1	To assess the practices of integrated infrastructure planning and in the study area,	1.1What is the current state of infrastructure planning in the study area?	
		1.2 What are the roles and responsibilities of different stakeholders in the infrastructure planning process?	
		1.3 What are the major challenges faced in achieving integrated	

		infrastructure planning in the study area?	
2	To investigate the challenges of integrated urban infrastructure planning in the study area,	2.1 What governance structures or institutional barriers hinder integrated infrastructure planning?	
		2.2 How does the lack of clear policies or regulatory frameworks affect integrated planning efforts?	
		2.3 What are the main financial challenges in implementing integrated infrastructure planning?	
		2.4 What challenges are there in relation to funding sources or financial models to support integrated projects?	
		2.5 How does limited technical expertise or human resources impact the planning process?	
		2.6 What are the barriers to effective community engagement or participation?	
3	To analyze the current governance paradigm of urban infrastructure planning in the study area,	3.1 What governance structures or models are in place for urban infrastructure planning?	
		3.2 Who are the key stakeholders involved in urban infrastructure planning, and what roles do they play?	
		3.3 What is the level of involvement of private sectors & civil society organization in the governance process?	
		3.4 What role does public participation play in decision-making processes?	
		3.5 What legal frameworks exist to support or regulate urban infrastructure planning?	
		3.6 What is the main governance challenges affecting urban infrastructure planning?	
4	To develop strategic tools for integrated infrastructure planning in the study area,	4.1 What are the key priorities for integrated infrastructure planning in the study area?	
		4.2 What specific gaps in existing planning tools need to be addressed?	
		4.3 How can tools be designed to facilitate collaboration among stakeholders, including government, private sector, and local communities?	
		4.4 What technologies or platforms could support integrated planning efforts?	
		4.5 How can tools ensure that infrastructure planning aligns with environmental sustainability goals?	

1.5 Significance of the Study

This research shall have many contributions for significant not only for Addis Ababa and Sheger cities, for Scientific community and for policy makers in such a way that:

1.5.1 Addis Ababa & Sheger Cities: - The study is significant for identifying the challenges and opportunities in integrated infrastructure planning, management, and provision in Addis Ababa and Sheger cities. Its findings can guide city administrations in addressing existing gaps and leveraging opportunities to improve urban infrastructure, ultimately benefiting the local community by fostering better access to services and sustainable urban development.

1.5.2 Scientific Community: - This research provides valuable insights for researchers and academic institutions, shedding light on the practices, challenges, and dynamics of integrated infrastructure planning. It contributes to the academic discourse on urban planning and infrastructure management, offering a foundation for further studies and comparative analyses.

1.5.3 Policy Makers: - The findings serve as a crucial input for policymakers in formulating and revising urban infrastructure policies, rules, and regulations. By addressing identified gaps and incorporating lessons from this study, policymakers can develop more effective frameworks to enhance infrastructure integration and sustainable metropolitan development.

1.5.4 Planners: - The major significance for planners is that the study provides evidence and a framework for shifting from fragmented, jurisdiction-based infrastructure planning toward coordinated, city-region-scale planning between Addis Ababa and Sheger.

1.6 Scope of the Study

1.6.1 Thematic/Conceptual scope: - Within the broader theme of integrated urban infrastructure planning, the study focuses specifically on physical infrastructure, such as transportation, solid waste management, stormwater/drainage, and sewerage management**.** These infrastructure sectors were selected because they are fundamental to the functioning and sustainability of rapidly urbanizing city regions and have strong spatial, functional, and institutional interdependencies. Their planning and management frequently extend beyond individual administrative boundaries and therefore provide an appropriate basis for examining the extent of infrastructure integration between Addis Ababa and Sheger.

1.6.2 Spatial scope: - The Spatial scope of the study is specifically focused on Addis Ababa and Sheger cities in Ethiopia. These cities were chosen for their strategic significance in the country's economic and social development, accelerated urbanization, and infrastructure challenges.

1.6.3 Temporal scope: - This study examines the period from 2015 to 2025, a critical era of rapid urbanization and the introduction of integrated infrastructure planning initiatives in Addis

Ababa and Sheger. To provide context, it also reviews literature and case studies from 2015 onward, highlighting the practice of infrastructure planning in Ethiopia. The research collected primary data between January and June 2022, focusing on recent practices and perspectives. The findings reflect planning activities and challenges over the past 16 years, particularly from 2008to 2024. The study discusses long-standing challenges and new obstacles that emerged with the establishment of the Oromia special zone surrounding Finfinne in 2008. Recommendations address both short-term and long-term planning needs, to understand the progression and future of integrated infrastructure planning in these cities.

1.7 Rationale of the Study

The study of integrated urban infrastructure planning between Addis Ababa and Sheger cities is motivated by several key rationales, highlighting its significance in addressing critical urban development challenges and advancing sustainable urbanization. These metropolitan cities are experiencing rapid urbanization, resulting in significant infrastructure deficits and challenges. As populations grow and urban areas expand, there is an urgent need for integrated planning approaches to ensure efficient and sustainable infrastructure development. Furthermore, integrated urban infrastructure planning is essential for promoting socio-economic development and improving the quality of life in these cities. By providing reliable and efficient infrastructure services such as transportation, waste management, drainage, and sewerage, the study aims to support economic growth, enhance productivity, and reduce poverty.

Additionally, integrated infrastructure planning can enhance environmental sustainability and resilience, enabling urban systems to recover quickly and maintain functionality during crises. The study also seeks to contribute to policy and governance improvements by identifying governance challenges and recommending institutional reforms for more effective infrastructure planning. Moreover, it provides valuable insights into local urban development contexts in Ethiopia and generates contextually relevant knowledge and best practices applicable to similar urban settings both within the country and beyond. By examining these specific cases, the study aims to inform and influence future infrastructure planning strategies, and ultimately supporting sustainable urban development.

1.8 Limitation of the study

The study faced several limitations, including data availability and quality, scope limitations due to geographical and time constraints, methodological challenges, the interdisciplinary nature of integrated infrastructure planning, political and institutional factors, technological limitations, socioeconomic factors, environmental and geographical factors, legal and regulatory issues, and future uncertainties. The study's comprehensiveness was not capturing long-term trends or reflects overall challenges. Selection bias and reliability of surveys and interviews were affecting the validity of findings.

Therefore, the study is crucial to address these limitations by improving urban planning practices, policy formulation, and addressing unique challenges. It should also focus on the role of technological innovations in improving urban infrastructure management and informs Ethiopian policy and governance frameworks for urban infrastructure planning. The integrated approach can serve as a model for other cities in Ethiopia and beyond, enhancing urban resilience and improving efficiency. It should emphasize the importance of holistic approaches considering interdependencies between different infrastructure systems, reducing redundancies, and enhancing overall efficiency. It should also promote sustainable urban development by balancing economic growth, social equity, and environmental sustainability in infrastructure planning.

1.9 Structure of the document

The document is organized into five chapters. The first chapter begins with an introduction that provides background information on the study, followed by the problem statement, aims of the study, research questions, significance, scope, limitations, and the logical structure of the dissertation. The second chapter presents a comprehensive literature review, starting with an introduction that defines the topic and highlights major themes. It summarizes key studies, discusses various methodological approaches, integrates findings, identifies research gaps, suggests potential areas for future studies, and concludes with key insights drawn from the literature.

The third chapter details the study areas, research design, methodology, and research framework. It outlines the geographical, social, and economic contexts of the study area while also

describing data collection methods, sampling procedures, and analytical techniques. The fourth chapter focuses on integrated infrastructure planning and management by identifying existing challenges and proposing strategies for improvement. It evaluates the effectiveness of various planning approaches, examines regulatory, financial, governance, and technical barriers, and offers recommendations for enhancing urban infrastructure planning. The findings presented in this chapter provide valuable insights for future research.

The fifth chapter explores the benefits of integrated infrastructure planning for sustainable urban development, emphasizing its role in enhancing resilience and sustainability. It also addresses key challenges such as governance, regulatory, and technical barriers, evaluates strategic tools, and provides practical recommendations for improving infrastructure planning.

CHAPTER II: LITERATURE REVIEW

2.1 Introduction

Integrated Infrastructure Planning between the cities present a critical area of study due to the rapid urbanization and growing infrastructure needs in these interconnected regions. This literature review explores the current practices and challenges of integrated infrastructure planning and managements, the current governance paradigm and strategic tools associated with aligning urban infrastructure development efforts between the two cities. It analyzes existing collaborative planning strategies, identifies key obstacles such as coordination issues, resource constraints, governance, and regulatory barriers, and discusses the implications of these challenges for effective integrated urban infrastructure planning.

This review synthesizes current knowledge and identifies gaps in the literature to provide a comprehensive understanding of the complexities involved in integrated infrastructure planning for rapidly growing metropolitan regions. It also aims to inform potential recommendations for enhancing coordination and fostering a more integrated approach to infrastructure development, which can support sustainable urban growth and improve overall urban management.

2.1.1 Definitions of key Terms

2.1.1.1 Infrastructure

Infrastructure is a broad concept with no universally recognized or common definition. In the United Kingdom, (Jones et al., 2016; Pike et al., 2019)describe national infrastructure as the foundation for economic productivity and human wellbeing. Infrastructure refers to the physical and related organizational structures that are required for society to function. According to Ciambotti, infrastructure is the basic physical and organizational structures required for a society's operation, such as industries, buildings, roads, bridges, health services, governance, and so on.

Infrastructure as “not one unified system but a composite of systems involving utilities, transportation systems, and environmental services, among others.” They focused on the constructed assets in six systems: the built environment, transportation, communications, energy,

water, and waste management systems. Their concept emphasizes the relationship between systems and infrastructure in the economy.

Others define infrastructure as a public utility that includes power, telecommunications, piped water supply, sanitation and sewerage, solid waste collection and disposal, and piped gas. It also includes public works such as roads, major dams, and canals for irrigation and drainage, as well as other transport sectors such as urban and interurban railways, urban transport, ports and waterways, and airports (Ekanem et al.; Olaseni & Alade, 2012).

Infrastructure is “an umbrella term for many activities referred to as social overhead capital” and includes public utilities, such as power, piped water supply, sanitation and sewerage, public works, such as roads and dams, and other transport sectors, such as railways, urban transport, and airports(Adebayo & Olayinka; Rajalakshmi & Anadanarajan, 2011).

2.1.1.2 Integrated planning

Integrated planning is a fundamental approach to contemporary planning that is both logical and necessary due to the intricate nature of spatial phenomena. The term "integrated" is currently in widespread use and encompasses all aspects of sustainable development and management. In the present day, sustainable development is predicated on the harmonious development of society, economy, and environment, while also taking into account contemporary and spatial relationships. It also incorporates the integration of spatial-physical and social dimensions in the development of urban spaces. Integrative planning has been recognized as a means of establishing a sustainable and resilient urban environment and space in the context of policy-making for sustainable urban development at all levels.

Integrated planning is, in theory, based on the evaluation and improvement of the rational planning of the 1950s (Abukhater, 2009; Lawrence, 2000), and is a result of the complex nature of the urban context and the overall development of socio-economic relations, which have, in the last decades, become very dynamic.

Integrated urban planning is a contemporary planning method that considers the intricate character of our urban environments. In order to establish cities that are safe, inclusive, and livable, it is imperative that various stakeholders work together (Dahiya & Das, 2020).

2.1.1.3 Infrastructure planning

Infrastructure planning is the process of designing and developing the foundational systems and facilities needed to support economic growth, public services, and community well-being (Austin, 2014; Lennon & Scott, 2014). It involves a strategic approach to building and maintaining essential infrastructure such as transportation networks, water supply systems, energy grids, telecommunications, and public buildings.

2.1.1.4 Integrated infrastructure planning

It is the concept of designing and managing various infrastructure systems such as transportation, water supply, energy, waste management, and telecommunications in a coordinated and holistic manner (Musanda, 2020; Saidi et al., 2018). The goal is to enhance efficiency, reduce redundancies, and promote sustainability by considering the interdependencies between different infrastructure elements.

2.1.1.5 Regional integration

Regional integration is the process by which neighboring countries or regions come together to cooperate and collaborate in various areas, such as economic development, political governance, infrastructure, and social policies (Börzel & Risse, 2009; Ndulu, 2006). The goal of regional integration is to enhance the collective strength and prosperity of the participating countries by reducing barriers, coordinating policies, and pooling resources.

2.1.1.6 Integrated Urban Governance

Integrated urban governance refers to a holistic approach to managing urban areas, where different levels of government, sectors, and stakeholders work together to address the complex challenges of urbanization (Castelnovo, 2016). The goal is to create more cohesive, efficient, and sustainable cities by coordinating policies, planning, and actions across various domains such as transportation, housing, environment, and social services. Overall, integrated urban governance is essential for managing the complex dynamics of modern urban areas and for promoting sustainable and inclusive urban development (Čolić, 2015).

2.1.1.7 City – Regions

A city-region refers to a metropolitan area that includes a central city and its surrounding towns, suburbs, and rural areas, all of which are economically and socially interconnected(Hall, 2013;

Parr, 2005). The concept recognizes that the influence of a major city extends beyond its administrative boundaries, impacting a wider geographical area through commuting patterns, economic activities, and social networks. The concept is particularly relevant in today's world as urbanization leads to the expansion of cities and the blending of urban and rural areas into larger, functionally integrated regions (Banai, 2013).

2.2 Theoretical Literature on Integrated Infrastructure Planning

2.2.1 Integrated Planning Theory

Integrated planning provides a fundamental theoretical basis for understanding how different infrastructure systems, sectors, spatial areas, institutions, and planning processes can be coordinated to achieve efficient and sustainable urban development (Sharifi & Yamagata, 2018; Yang & Zhang, 2025). The theory is based on the recognition that urban development is a complex and interconnected process in which decisions in one sector or geographical area can influence other sectors and areas. Consequently, planning infrastructure separately according to administrative or sectoral boundaries may result in duplication, inefficiency, gaps in service provision, and conflicts among development priorities.

Integrated infrastructure planning therefore seeks to overcome fragmented approaches by considering infrastructure systems as interconnected components of an urban system. Transport, water supply, sewerage, drainage, solid waste management, energy, housing and land-use development have physical, environmental, economic and institutional relationships. (Monstadt & Coutard, 2019)emphasize that contemporary urban infrastructure should be understood as interconnected systems whose relationships extend beyond individual infrastructure sectors. These interdependencies require coordination between infrastructure sectors and across spatial and institutional boundaries.

Integrated planning can be understood through several dimensions, including sectoral integration, spatial integration, institutional integration and temporal integration. Sectoral integration refers to coordination among infrastructure sectors, while spatial integration concerns coordination among geographically interconnected areas. Institutional integration involves coordination among government agencies, municipalities, utilities and other stakeholders, and temporal integration concerns consistency between short-, medium- and long-term planning.

This perspective is particularly relevant to Addis Ababa and Sheger City because rapid urban expansion has created increasing functional relationships between the two urban areas. Infrastructure systems and urban activities frequently extend beyond administrative boundaries. For example, transportation networks connect residents and employment centers across the two jurisdictions, while drainage, wastewater and solid waste systems may generate cross-boundary environmental and service-delivery implications. Thus, integrated planning provides a theoretical basis for examining whether infrastructure planning is coordinated across sectors and jurisdictions.

In this study, Integrated Planning Theory was used as an analytical lens for examining the extent to which infrastructure planning between Addis Ababa and Sheger City reflects the principles of integration. The theory informed the identification of key analytical dimensions, including sectoral, spatial, institutional, temporal, financial, and governance integration. These dimensions guided the assessment of coordination among transportation, sewerage, drainage, and solid waste management systems; the extent of coordination across the Addis Ababa–Sheger administrative boundary; the roles and relationships of relevant government institutions and infrastructure providers; and the alignment of infrastructure planning with current and future urban growth. The theory also provided a basis for interpreting the institutional, legal, financial, technical, and operational challenges identified through questionnaires, key informant interviews, focus group discussions, field observations, and document review.

The key insight derived from the literature is that infrastructure integration is not limited to the physical connection of infrastructure networks. Rather, effective integration requires coordination of planning processes, institutions, spatial areas, investment decisions, information, policies, and implementation mechanisms. This theoretical understanding is particularly relevant to Addis Ababa and Sheger City, where increasing functional interdependence has created infrastructure needs that extend beyond individual administrative boundaries. Accordingly, the theory provides the conceptual basis for assessing the gap between the increasing functional integration of the two urban areas and the existing level of sectoral, spatial, institutional, financial, and governance integration. It therefore supports the interpretation of the study findings and the development of recommendations for strengthening coordinated infrastructure planning between Addis Ababa and Sheger City.

2.2.2 Infrastructure Interdependency Theory

Infrastructure interdependency provides another important theoretical foundation for this study. Infrastructure systems do not function independently; rather, they depend on and influence one another. The development, operation or failure of one infrastructure system may affect the performance of other systems. For example, road development can stimulate urban expansion, which increases demand for water supply, sewerage, drainage, solid waste management and other services. Similarly, changes in land use can increase impervious surfaces and stormwater runoff, thereby increasing pressure on drainage systems.

Monstadt & Coutard (2019) emphasize that urban infrastructures are interconnected through technological, ecological, economic, operational and political relationships. Consequently, infrastructure planning should account for these interdependencies rather than treating individual sectors as independent systems.

Infrastructure interdependency is highly relevant to the present study because the planning of transportation, sewerage, drainage and solid waste management in Addis Ababa and Sheger City can have consequences beyond individual sectors. For example, inadequate drainage in an expanding urban area can affect downstream areas, while inadequate solid waste management can obstruct drainage systems and contribute to environmental degradation. Similarly, transportation investments can accelerate settlement development and consequently increase demand for other infrastructure services.

Therefore, the infrastructure interdependency perspective supports the argument that integrated infrastructure planning should address sectoral relationships, spatial relationships and infrastructure-service linkages rather than concentrating on individual projects.

2.2.3 Collaborative Planning and Collaborative Governance Theory

Collaborative planning provides a theoretical explanation for the importance of communication, participation, negotiation and collective action in infrastructure planning. The author argues that planning takes place within fragmented institutional and social environments involving multiple actors with different interests, knowledge and resources (Gualini, 2018; Servillo & Van Den

Broeck, 2012). Effective planning therefore requires processes, through which stakeholders can communicate, exchange knowledge, negotiate differences and develop shared understandings.

This perspective is particularly relevant to infrastructure planning because no single organization normally controls all infrastructure sectors. Different government institutions, municipalities, utilities, planning agencies, transport authorities and private actors may have separate responsibilities. Without effective collaboration, infrastructure planning can become fragmented and decisions made by one organization may conflict with those of another.

Collaborative governance extends this argument by focusing on institutional arrangements through which public agencies and relevant stakeholders jointly participate in decision-making. Ansell and Gash (2008) identify factors such as trust, leadership, institutional design, dialogue, shared understanding and commitment as important conditions for successful collaboration. They also highlight the influence of previous relationships, power differences and resource imbalances among participating organizations.

For Addis Ababa and Sheger City, collaborative governance is relevant because integrated infrastructure planning requires cooperation between institutions operating under different administrative structures. Effective integration may require joint planning, information sharing, coordinated investment decisions, stakeholder participation and mechanisms for resolving institutional conflicts.

Accordingly, collaborative planning and governance provide a theoretical basis for assessing institutional coordination, stakeholder participation, communication, information sharing, joint decision-making and inter-organizational cooperation in the study area.

2.2.4 Institutional Theory

Institutional theory provides a framework for understanding how laws, regulations, organizational structures, responsibilities, norms and institutional relationships influence infrastructure planning. Infrastructure development is not only a technical activity; it is also governed by institutional rules that determine which organization has authority, which agency is responsible for implementation, how resources are allocated, and how different organizations coordinate their activities.

Institutional fragmentation can occur when responsibilities are distributed among several institutions without effective coordination mechanisms. Overlapping mandates, unclear responsibilities, weak legal frameworks, inadequate information sharing and competition for resources can all constrain integrated planning.

From this perspective, effective integrated infrastructure planning requires appropriate institutional arrangements that clearly define responsibilities and establish mechanisms for coordination. Collaborative planning also emphasizes the importance of institutional capacity and institutional relationships in enabling collective planning and action (Gualini, 2018; Servillo & Van Den Broeck, 2012).

This theoretical perspective is particularly relevant to the Addis Ababa–Sheger relationship because the two jurisdictions have separate administrative and institutional arrangements while their urban systems are increasingly interconnected. Here institutional responsibilities do not correspond to functional urban relationships, gaps in planning and service delivery may occur. Institutional theory therefore helps explain challenges related to legal frameworks, institutional mandates, organizational coordination, administrative boundaries, responsibilities, technical capacity and resource allocation.

2.2.5 Metropolitan Governance Theory

Metropolitan governance theory is particularly important for this research because the study concerns infrastructure planning between two functionally interconnected urban jurisdictions. Metropolitan areas often extend beyond the boundaries of individual municipalities, while transportation, environmental systems, infrastructure networks, labour markets and settlement patterns operate across those boundaries.

Metropolitan governance theory emphasizes the need for coordination among jurisdictions where urban functions are interconnected. The OECD (2015) notes that metropolitan areas require mechanisms capable of coordinating strategic decisions and addressing issues that cross municipal boundaries. Different metropolitan governance arrangements can be established depending on the institutional and political context, including inter-municipal cooperation, metropolitan authorities and other forms of joint governance.

The central theoretical issue is therefore the potential mismatch between administrative boundaries and functional urban systems. If infrastructure is planned only within administrative boundaries, infrastructure networks and service requirements that extend across jurisdictions may not be adequately addressed.

This issue is highly relevant to Addis Ababa and Sheger City. Urban expansion and increasing interaction between the two areas create infrastructure demands that cannot always be effectively addressed by each jurisdiction independently. Transportation flows, drainage systems, wastewater management, solid waste movement, land development and other urban functions can create interdependencies across boundaries.

Metropolitan governance theory therefore provides a theoretical basis for examining cross-boundary coordination, intergovernmental cooperation, joint infrastructure planning, metropolitan institutions and shared service provision.

2.2.6 Spatial and Governance Integration

The theories discussed above suggest that integrated infrastructure planning has both a spatial dimension and a governance dimension. Spatial integration refers to coordination of infrastructure planning across geographically connected areas. It requires planners to consider functional relationships rather than relying exclusively on administrative boundaries. Infrastructure systems such as transportation, drainage, sewerage and solid waste management can cross municipal boundaries, making spatial coordination necessary.

Governance integration, on the other hand, concerns coordination among the institutions responsible for planning, financing, implementing and managing infrastructure. It includes horizontal coordination among sectors and organizations as well as vertical coordination among different levels of government.

These two dimensions are closely related. Spatial integration cannot be achieved effectively without governance mechanisms that enable institutions to coordinate across boundaries. Likewise, institutional coordination must ultimately produce spatially coherent infrastructure systems. Thus, the study conceptualizes integrated infrastructure planning as a process involving

both spatial integration and governance integration, supported by sectoral coordination and resource integration**.**

2.2.7 Financing and Resource Integration

Financial and resource capacity is also an important condition for integrated infrastructure planning. Infrastructure projects require substantial financial resources, land, technical expertise, human resources, information and institutional capacity. Where infrastructure agencies plan and finance projects independently, investments may become fragmented and opportunities for coordinated development may be lost.

Collaborative governance theory recognizes that differences in power and resources among organizations can influence the effectiveness of collaboration (Ansell & Gash, 2008). Therefore, integrated infrastructure planning requires mechanisms for coordinating financial and technical resources among participating institutions.

In the Addis Ababa–Sheger context, this perspective is relevant to infrastructure investment, cost-sharing, project prioritization, technical capacity, operation and maintenance, and possible joint financing arrangements. Resource integration therefore represents an important supporting condition for achieving effective infrastructure integration**.**

2.2.8 Theoretical Synthesis

The theoretical perspectives discussed in this section complement rather than compete with one another. Integrated Planning Theory explains the need to coordinate infrastructure sectors and planning processes. Infrastructure Interdependency Theory explains why decisions in one infrastructure sector or geographical area can affect other systems. Collaborative Planning and Collaborative Governance Theory explain the importance of stakeholder cooperation, communication, trust and collective decision-making. Institutional Theory explains how laws, mandates, organizational structures and institutional capacity influence coordination. Finally, Metropolitan Governance Theory explains why cross-boundary coordination is necessary when urban functions extend beyond individual administrative jurisdictions.

Based on these perspectives, the study proposes that effective integrated infrastructure planning between Addis Ababa and Sheger City depends on the interaction of several conditions: sectoral

coordination, spatial integration, institutional/governance integration, stakeholder collaboration, appropriate legal and institutional frameworks, financial and technical resources, and metropolitan-level coordination.

The theoretical proposition of the study is therefore that the effectiveness of integrated infrastructure planning between the cities depends on the capacity of institutions to coordinate interconnected infrastructure systems across sectoral and administrative boundaries through collaborative governance, appropriate institutional arrangements, spatial integration and coordinated resource allocation.

This theoretical foundation provides a basis for interpreting the practices and challenges identified through the empirical investigation. It also enables the study to move beyond simply describing infrastructure conditions and challenges toward explaining the institutional, spatial, governance and inter-sectoral factors that influence integrated infrastructure planning.

2.3 Empirical Review

2.3.1 Urbanization and Integrated Infrastructure Planning

.Urbanization, characterized by the expansion of cities and increasing concentration of population and economic activities in urban areas, has significant implications for infrastructure planning (Madlener & Sunak, 2011). As urban areas expand, the demand for infrastructure and services increases, requiring planning approaches that can respond to the scale, complexity, and interconnectedness of urban growth. In rapidly urbanizing metropolitan areas, infrastructure development can no longer be effectively planned as isolated sectoral interventions. Instead, integrated infrastructure planning is increasingly necessary to coordinate infrastructure systems, optimize resources, and support sustainable urban development.

Rapid urbanization generates growing demand for interconnected infrastructure systems, including transportation, water supply, sanitation, solid waste management, energy, and communication networks (Bansal et al., 2015; Shahidehpour et al., 2018). The expansion of these systems creates interdependencies that require coordinated planning. For example, rapid population and spatial growth can increase traffic congestion and pollution while placing pressure on public transportation systems. Similarly, increasing demand for water supply and sanitation can exceed existing infrastructure capacity, resulting in water shortages,

contamination, and inadequate sanitation services. These challenges demonstrate that infrastructure sectors are mutually dependent and should therefore be planned and managed through integrated approaches.

The implications become more complex when urban growth extends beyond the administrative boundaries of individual municipalities. Metropolitan expansion can create functional relationships among neighboring cities through shared transportation networks, labor markets, water resources, drainage systems, waste management facilities, and other infrastructure services. Consequently, infrastructure planning undertaken independently by neighboring jurisdictions may result in fragmented investment, duplication of facilities, unequal service provision, inefficient resource utilization, and environmental problems. Integrated infrastructure planning at the metropolitan or city-region scale is therefore important for coordinating infrastructure investment and service delivery across administrative boundaries.

This issue is particularly relevant to the rapidly urbanizing Addis Ababa–Sheger urban region, where continuing population growth and spatial expansion are increasing demand for infrastructure and services. The interconnected nature of transportation, water, sanitation, drainage, solid waste, and other infrastructure systems requires greater coordination between the two urban jurisdictions. However, the effectiveness of such integration depends not only on physical infrastructure but also on institutional coordination, governance arrangements, financial integration, policy direction, legal frameworks, stakeholder participation, and planning capacity.

Therefore, the literature establishes that rapid urbanization creates both increasing infrastructure demand and greater interdependence among urban systems, making integrated and metropolitan-scale infrastructure planning essential. However, the literature does not sufficiently explain how integrated infrastructure planning is practiced between Addis Ababa and Sheger, what institutional and operational challenges constrain integration, and what mechanisms can improve coordination between the two jurisdictions. This gap provides the basis for the present study

2.3.1.1 Challenges and Opportunities

Urbanization requires effective coordination across infrastructure sectors, including transportation, water supply, energy, sanitation, solid waste management, and housing, to ensure

the interconnectedness and efficiency of urban systems (Monstadt & Coutard, 2019). However, the complexity and interdependence of urban infrastructure make such coordination difficult. Integrated infrastructure planning therefore requires a comprehensive approach that considers the relationships among different infrastructure systems and their combined effects on urban development. This is particularly important in rapidly expanding metropolitan areas, where infrastructure systems frequently extend beyond individual administrative boundaries.

Financial capacity is another critical factor affecting integrated infrastructure planning. The resources available for infrastructure development are often insufficient to meet the demands created by rapid urbanization, particularly in developing countries (Jones, 2017). Consequently, integrated planning needs to consider diversified financing mechanisms, including public-private partnerships, international assistance, and innovative financing approaches (Delmon, 2017; Trebilcock & Rosenstock, 2015). Financial coordination among jurisdictions can also facilitate the development and maintenance of infrastructure that serves multiple urban areas.

Urbanization also creates significant environmental and social challenges, including displacement of communities, increasing pollution, loss of natural areas, and unequal access to infrastructure and services. Integrated planning can help address these challenges by incorporating environmental sustainability, social inclusion, and efficient resource utilization into infrastructure decisions.

At the same time, urbanization provides opportunities for technological integration. The development of smart-city approaches creates opportunities to use digital technologies and data to improve infrastructure planning, management, and service delivery (Angelidou et al., 2018). Intelligent transportation systems, for example, can improve mobility and reduce congestion, while smart infrastructure can support more efficient energy and resource management. Such technologies can strengthen coordination among infrastructure sectors and improve evidence-based planning.

Sustainability provides another important dimension of integrated infrastructure planning. The United Nations Sustainable Development Goals (SDGs), particularly SDG 11, provide a framework for promoting inclusive, safe, resilient, and sustainable cities (Alamoush, Ballini, &

Ölçer, 2021; Griggs et al., 2014). Integrating environmental, economic, and social considerations into infrastructure planning can contribute to more sustainable metropolitan development.

Finally, stakeholder participation is important for effective integrated infrastructure planning. Involving local governments, infrastructure agencies, private-sector actors, communities, and other stakeholders can improve the identification of infrastructure needs and priorities. Participatory planning can therefore contribute to infrastructure solutions that are more responsive to local conditions and user needs.

The literature therefore identifies six critical dimensions that should be considered in assessing integrated infrastructure planning: Sectoral coordination → financial integration → Environmental & social sustainability → Technology integration → Policy/SDGs → Stakeholder participation.

2.3.2 Why infrastructure matters

As many literatures reveal, infrastructure is critical for productivity and economic growth because it serves as the foundation for industries and enterprises. Businesses are able to operate more efficiently, reduce production costs, and increase productivity by utilizing reliable energy supplies, robust communication networks, and efficient transportation systems. Well-developed infrastructure enhances economic development and employment formation, attracting both domestic and foreign investment and fostering a nation's economic prosperity (Pradhan & Bagchi, 2013; Smith, 1997).

In addition to promoting economic development, infrastructure has a significant influence on the quality of life and social well-being (Grum & Grum, 2020; Llena-Nozal et al., 2019; Sartori & Catalano, 2013). As Agénor and Moreno-Dodson (2006) and Lenz et al. (2017) argued, the quality and availability of infrastructure significantly influences essential services like electricity, healthcare, education, and purified water. Infrastructure enhances the overall quality of life by increasing the accessibility of these fundamental amenities, irrespective of their location. It also plays a critical role in promoting social equity by reducing disparities between urban and rural areas.

Bhattacharyay (2010), Jiao et al. (2020), Polyzos and Tsiotas (2020), and Tianguo (2019) elaborate that; infrastructure significantly enhances connectivity and integration within and between regions. For instance, transportation networks facilitate the efficient movement of products, services, and people by connecting rural areas, villages, and cities. In the same manner, communication infrastructure, including the internet and telecommunication systems, enables economic growth, innovation, and collaboration by connecting individuals and businesses on a global scale. This connectivity is critical for the integration of markets and communities, as it promotes regional development and reduces isolation (Jiao et al., 2020; Tianguo, 2019).

Contemporary infrastructure can facilitate the adoption of green technologies and practices, thereby reducing carbon emissions and dependence on fossil fuels (Chen et al., 2022; Chester et al., 2014). Renewable energy infrastructure, such as solar and wind farms, is essential for the transition to a more sustainable energy future. Additionally, infrastructure development is crucial for confronting global environmental challenges, as sustainable transportation alternatives (Pandit et al., 2017), including electrified vehicles and public transit systems, mitigate the environmental impact.

Infrastructure also significantly influences resilience and disaster preparedness (Chang et al., 2014; Magoua & Li, 2023). Implementing well-designed infrastructure systems, such as resilient power grids, emergency communication networks, and flood defenses, enhance a community's capacity to cope with and recover from natural disasters and other emergencies (Chang et al., 2014; Guo, Sim, & Ho, 2020). This resilience is critical for safeguarding the economy, property, and lives, thereby guaranteeing that communities can swiftly recover from adverse events.

As urbanization and population growth accelerate, the demand for infrastructure is increasing (Lufumpa & Yepes, 2017; Nguyen & Nguyen, 2018). The successful management of urban growth's challenges, including congestion, pollution, and resource strain, is contingent upon the implementation of well-planned and executed infrastructure (ESCAP, 2012). In order to ensure that cities can sustainably accommodate growing populations while concurrently maintaining economic vitality, sustainability, and livability, infrastructure development is indispensable.

Lastly, infrastructure is a critical factor in determining global competitiveness. Countries with advanced infrastructure are better positioned to engage in international trade, attract multinational

corporations, and compete in the global marketplace. Conversely, inadequate infrastructure can significantly hinder economic development and global competitiveness. In general, infrastructure is essential for economic development, social well-being, connectivity, environmental sustainability, resilience, and global competitiveness (Diene, 2024; Thacker et al., 2019; Yang et al., 2021). In order to ensure a sustainable, equitable, and prosperous future for all, it is essential to invest in and maintain a resilient infrastructure.

The reviewed literature demonstrates that infrastructure is fundamental to economic development, social well-being, connectivity, environmental sustainability, resilience, and the effective management of urban growth. It further indicates that infrastructure systems contribute to urban and regional integration by facilitating the movement of people, goods, services, and information across geographical areas. These insights provide the substantive basis for examining infrastructure development in Addis Ababa and Sheger City, where rapid urbanization and increasing functional interdependence have intensified the demand for efficient and coordinated infrastructure systems. In particular, the literature supports the selection of transportation, sewerage, stormwater drainage, and solid waste management as critical infrastructure sectors for the present study because of their direct implications for mobility, public health, environmental quality, and urban sustainability.

However, much of the reviewed literature emphasizes the importance and outcomes of infrastructure rather than the institutional and planning processes through which interconnected infrastructure systems are coordinated across administrative boundaries. This creates an important analytical gap in understanding how infrastructure planning is practiced between Addis Ababa and Sheger City. Accordingly, this study extends the existing literature by examining not only the provision and functioning of infrastructure but also the extent of sectoral, spatial, institutional, financial, and governance integration in its planning and management. The key insight derived from the literature is that the development of individual infrastructure systems is insufficient to achieve sustainable urban development unless their planning and implementation are coordinated with other interconnected systems and with the spatial and institutional context in which they operate. This insight provides an important foundation for assessing the practices and challenges of integrated infrastructure planning between Addis Ababa and Sheger City.

2.3.3 Infrastructure and Regional Integration

The roles and relationships become more complicated when we examine infrastructure on a regional scale. They are required to not only sustain life within their own extensive regional boundaries, but also to provide central cities with resources and opportunities that will facilitate their future urban expansion (Heywood, 2010). The infrastructure networks that connect cities and regions are the most effective means of expressing the reciprocal relationship between the two. Cities produce the energy and products required to maintain regional systems, and they transport regional supplies to fulfill urban needs (Heywood, 2010). Urban flows of processed information, organization, control, and consumer products flow outward, utilizing and supporting regional infrastructures, while regional supplies of water, power, labor, and raw materials come into the city(Heywood, 2010).

Regional integration is the process by which disparate national economies pursue mutual gains by complementing one another more. Economic and trade integration, political integration, and physical integration are the three perspectives or modes on regional integration. During the 1990s, Latin America and the Caribbean primarily observed these three modes of integration (Nogueira, 1997; Soriano, 2019). As the explanations of the authors, the establishment of more cooperative and dynamic regional relationships was necessary due to the severe economic and financial crises that occurred during that period. The most notable of the three approaches to physical integration is the one that prioritizes infrastructure and its services as primary features.The growing discourse surrounding the concept of infrastructure integration necessitates an examination of its meanings in theory and in practice. If integration is occurring, then there are likely to be variations in the scale and extent of its application (McLean, 2017).

The success of contemporary urban life is contingent upon the existence of networked infrastructures. These extensive socio-technical systems are frequently criticized as critical intervention sites that can assist in the mitigation of climate change and resource consumption, or as indispensable facilitators of economic development and technological advancements (McLean, 2017). The literature posits that institutions and structures, which were established in the late nineteenth and early twentieth centuries as a result of incremental, ad hoc, and largely path-dependent changes in technology, markets, and regulatory processes, are responsible for the management and organization of all infrastructures in use in the developed world. The national

context of any state is a critical factor for researchers who are investigating large infrastructural networks, and institutions are a significant element in the dynamics of technological change (McLean, 2017)

Previous literature (Gopalakrishnan & Okada, 2007; Langeland et al., 2016) contend that robust institutions are essential for achieving physical integration during a crisis. The authors highlight the importance of these new institutions. The writers observe that the design of these new institutions fosters unity among groups, assisting the region in establishing a strong voice and mitigating crises, thereby enabling it to compete effectively in global markets. However, as the authors of the articles note, a number of countries have implemented protectionist policies in response to the most recent economic and financial crises, as the regional integration process in the trade sector continues.

The reviewed literature provides an important basis for understanding infrastructure integration at the regional and inter-urban scale. It demonstrates that cities and their surrounding regions are functionally interdependent through flows of people, goods, services, resources, information, energy, and other urban functions. Infrastructure networks provide the physical connections through which these relationships operate, while institutional arrangements, policies, and governance mechanisms determine how such interconnected systems are planned and managed. The literature therefore indicates that physical connectivity alone does not constitute effective integration; rather, integration requires coordinated institutional and planning arrangements across geographical and administrative boundaries.

This perspective is directly relevant to the relationship between Addis Ababa and Sheger City, where increasing population growth; economic activity, transportation movements, and demand for urban services have strengthened functional interdependence between the two urban areas. The literature supports the examination of transportation, sewerage, stormwater drainage, and solid waste management as interconnected infrastructure systems whose planning may generate cross-boundary effects. It also provides a basis for examining the institutional relationships, legal arrangements, financial mechanisms, and intergovernmental coordination that influence infrastructure planning between the two cities.

The major insight taken from this literature is that integrated infrastructure planning should be understood as a process involving both physical connectivity and institutional coordination. Accordingly, this study does not assess integration simply in terms of whether infrastructure networks connect Addis Ababa and Sheger City. Rather, it examines the extent to which infrastructure planning, investment, decision-making, implementation, and management are coordinated across sectors and administrative boundaries. This provides the theoretical basis for investigating the gap between the increasing functional interdependence of the two cities and the existing level of spatial, institutional, financial, and governance integration.

2.3.4 The significance of physical integration

Despite receiving less attention, physical integration is essential for the region's economic and social development, surpassing the other three integrations (Nogueira, 1997; Soriano, 2019). Despite the importance of physical integration, the articles aim to investigate the experiences of Latin American and Caribbean countries. For instance, constraints in the provision of transport infrastructure services could significantly influence the region's future development and trade competitiveness (Khadaroo & Seetanah, 2008; Melo, Graham, & Brage-Ardao, 2013). According to the intention of the authors, the main causes of this situation include the absence of sustainability criteria in the conception and design of initiatives, multiple and disjointed policies, and a lack of infrastructure and service provision. The demand for transport infrastructure in Latin America has increased more than the supply during the 1995–2010 periods, resulting in a widening disparity in comparison to the base year 1995(Calderón & Servén, 2004; Gasparini et al., 2011). The authors suggest addressing this disparity by prioritizing strong regional integration among the region's countries, and increasing investment and action to develop transport infrastructure.

The current demand for infrastructure development in Latin American regions necessitates comprehensive regional integration in regulatory and financing areas (Cardoso & Faletto, 2024; Rodríguez-Pose, 2008). The articles by the authors interpret the economic, social, and political significance of the integration of physical infrastructure. They posited that the enhancement of infrastructure development leads to a more interconnected economy, a decrease in product sales costs, an increase in competitiveness, the encouragement of new investments, the satisfaction of foreign customers, and the opening of new markets. In terms of social impact, integrated

physical infrastructure has the potential to function as a mechanism for territorial, economic, and social cohesion (Asprogerakas & Zachari, 2020; Farinós-Dasí, 2023). Its ability to consolidate and coordinate the territory is the reason for this, as it subsequently improves the quality of life and living conditions of its inhabitants, increases connectivity within its borders, and improves its accessibility from abroad (Prezioso, 2019; Wyrwa et al., 2017). Latin America and the Caribbean countries incorporated physical integration as a critical element of their regional development, despite its importance. Consequently, they must establish and reinforce the protocols that will allow them to function as a unified space. As a result, it is critical to establish physical infrastructure that connects the countries in the region through communication channels such as roads, rails, and marine transport, as well as integrating a variety of energy and telecommunications.

This literature establishes physical infrastructure integration as an important dimension of regional development. It shows that infrastructure connectivity improves economic and social linkages, territorial cohesion, accessibility, and competitiveness. More importantly, it demonstrates that physical connectivity alone is insufficient; effective integration requires coordinated policies, institutions, investment, regulation, and financing. This supports the study by providing the basis for assessing whether the increasing physical and functional interdependence between Addis Ababa and Sheger is matched by integrated infrastructure planning and coordination.

2.3.5 Practice of Integrated Infrastructure Planning

The experiences of countries show that there are three existing initiatives in the region that involve corporate regional integration schemes at a physical level. The three initiatives, namely IIRSa in South America, the Mesoamerica Project (MP) in Central America, and Carom in the Caribbean, are closely collaborating with ECLAC, particularly in the coordinated provision of infrastructure services (Nogueira, 1997; Soriano, 2019).

The objective of integrated infrastructure planning is to optimize the planning, design, and construction of a diverse array of infrastructure initiatives within the right of way, as the previous literature argued. In contrast to traditional methods that focus on individual sectors, this approach considers the interconnectedness of various elements on the street, below, and above to mitigate

disruptions during planned excavation or construction projects. By integrating climate change adaptation, green infrastructure, and disaster risk reduction, integrated infrastructure planning is essential for the development of more sustainable and resilient communities (Dong et al., 2021; Pitrenaite-Zileniene & Torresi, 2014). This approach enables communities to future-proof their assets and reduce the potential impacts of climate-related events

Increasing global challenges, particularly those associated with the need to ensure sustainable development, necessitate the establishment of "sustainable infrastructure." (Adshead, 2020; Olanipekun et al., 2014). Although investment is a critical prerequisite, it is insufficient to guarantee the long-term economic and social sustainability of infrastructure; sustainability is the efficient use of our resources. One approach to achieving this is to integrate infrastructure, which includes roads, telecommunications lines, waste systems, and schools. In order to promote integrated economic development, it is essential to implement effective and integrated infrastructure policies. Prioritizing national infrastructure integration is crucial, especially for minor regional countries, to leverage economies of scale, enhance the overall security of infrastructure products and services, and boost regional competitiveness (Biller & Nabi, 2013). Interconnectivity and interoperability are the future. Inter-modality is an additional characteristic of transportation infrastructure that pertains to the efficient interchange of various modes of transportation (Biller & Nabi, 2013).

Each infrastructure type (and even distinct sub-sectors within the same infrastructural sector) has its own unique characteristics, and each presents a unique set of challenges. Despite these specificities, the integrated planning and design of each type of infrastructure can significantly improve its overall development (Biller & Nabi, 2013). This is the primary reason why it is necessary to integrate the energy, transport, and environmental sectors, as well as their sub-sectors, when planning infrastructure (Baleta et al., 2019).

As planning occurs on a variety of fronts, there is a risk of isolated planning leading to fragmented, uncoordinated, and sometimes conflicting development and infrastructure provision(Belsky et al., 2013). Equally, there is an opportunity for collaboration and integration, resulting in efficient, timely, and effective complementary development.

When land use planning takes place in isolation, there is a risk of inadequate or nonexistent infrastructure provision (Cervero, 2013; Seto et al., 2014). In a worst-case scenario, uncoordinated planning may result in development occurring without adequate or timely access to infrastructure services such as water, sewer, electricity, telecommunications, sealed roads, and so on. Further, droughts and climate change place existing infrastructure capacity at risk of meeting future needs.

As literatures revealed, consideration of infrastructure costs and efficiencies during the planning process can significantly assist in reducing infrastructure costs to the community as a whole(Saroop, 2009). Planning for desirable urban growth can also facilitate infrastructure sequencing and delivery(Council, 2006; Legacy, 2017).

In developing countries, the process of planning and managing urban utility infrastructure is generally considered "so workable" due to factors such as small city sizes, low market prices for urban land, and a slower pace of living(Freire, 2006; Narayanaswami, 2017). Under these conditions, staff can coordinate effectively, and there is ample time to address issues such as long-term planning, political urgency, and the need to share spatial information to address anomalies. Consequently, as Cairo's UDC, the Bangkok Land Information System (BLIS) will be a successful exemplary strategy to develop appropriate utility infrastructure provision standards in cities and towns of developing countries. Integrated infrastructure planning, a comprehensive and sustainable approach to forward-thinking corridor development, is out performing siloed planning and fragmented decision-making in the face of rapid urbanization, aging infrastructure, and growing environmental challenges.

The literature establishes that integrated infrastructure planning requires more than the physical connection of infrastructure. It requires the coordination of sectors, land use, institutions, policies, financing, investment, environmental considerations, and implementation processes. This provides an analytical basis for assessing the extent of integrated infrastructure planning between Addis Ababa and Sheger City

2.3.6 Integrated Infrastructure Planning in Developed Countries

In developed countries, integrated infrastructure planning is often characterized by a comprehensive and strategic approach, driven by advanced technology and significant resources.

City regions benefit from well-established governance structures that facilitate collaboration between different levels of government and private sector stakeholders (Reichert, 2006; Slack, 2007; Tomo et al., 2020; Wolfe, 2012). For instance, planners often plan transportation, energy, water, and communication systems in cycle, ensuring that these services complement each other. The focus is typically on sustainability, smart city initiatives, and enhancing the quality of life for residents. Urban planning and infrastructure development deeply intertwine in cities like Copenhagen and Singapore, resulting in efficient, green, and technologically advanced urban environments (Cho et al., 2015; Novotny et al., 2010).

When it comes to integrated infrastructure planning between two cities in developed countries, the focus is often on creating seamless connections that enhance economic and social integration (Bhattacharyay, 2012b; Simone, 2014). This can involve the development of high-speed rail networks, coordinated public transportation systems, and shared energy grids. For instance, San Francisco and Silicon Valley in the United States have collaborated to create a highly interconnected region that aligns transportation, technology infrastructure, and housing policies to meet the workforce and economic needs. Such planning requires strong political will, effective communication between municipalities, and a shared vision for regional development. The following case studies demonstrate the practice on the ground in these countries.

The literature provides a benchmark for comparison. It suggests that integrated infrastructure between two interconnected cities requires more than constructing physical connections. It requires: shared vision → coordinated institutions → integrated sectoral planning → joint investment → information sharing → coordinated implementation → sustainable service delivery.

This is directly relevant to the study because the cities have increasing functional and spatial interdependence, but theresearch examines whether their planning and governance arrangements have developed at the same level as their physical and functional connections. Successful integrated infrastructure planning in developed city-regions depends on strong governance, cross-sectoral coordination, advanced information and technology, shared regional objectives, and effective cooperation between municipalities.

2.3.6.1 Sewerage System Planning

As cities expand, the demand for efficient and sustainable waste management solutions becomes increasingly urgent (Ribić et al., 2017). Integrated sewerage systems involve the coordination of wastewater collection, treatment, and disposal across different areas(Schellenberg et al., 2020; Tabuchi et al., 2023) and jurisdictions to prevent environmental pollution, protect public health, and support sustainable urban growth(Oliveira et al., 2015). Based on this, literature review explores the global, regional, and Ethiopian experiences in integrated sewerage system planning, highlighting best practices and key challenges at each level.

San Francisco designs its integrated sewerage systems to reduce environmental impact and promote resource recovery. In order to mitigate stormwater discharge and prevent sewer overflows, it has implemented a sustainable sewerage system that incorporates green infrastructure, including permeable pavements and green roofs (Brears, 2023; Darnthamrongkul & Mozingo, 2021). It has designed its wastewater treatment facilities to extract resources for energy generation, including biogas from sewage sludge.

In developed countries, cities have recognized the importance of integrated sewerage systems in managing urban wastewater and ensuring environmental sustainability (Andersson et al., 2016; Capodaglio, 2017). European, North American, and Asian advanced urban centers have developed comprehensive sewerage networks that seamlessly integrate with other urban infrastructure systems. Known for its innovative urban water management, Copenhagen has developed an integrated sewerage system that handles both wastewater and storm water (Vezzaro et al., 2014). The city's combined sewer system, which collects both types of water, reduces overflow risks during heavy rainfall. It incorporates green infrastructure, such as permeable pavements and green roofs, and advanced wastewater treatment facilities ensure that the effluent meets high environmental standards.

Also, Singapore has developed a highly efficient wastewater management system, exemplified by the DTSS(Bertrand-Krajewski, 2021). DTSS reuses treated wastewater, known as NEWater, through advanced purification processes for industrial and non-potable purposes. This integrated approach not only manages wastewater effectively but also bolsters Singapore's water security by reducing reliance on external sources.

The Tokyo Metropolitan Government oversees the development of an efficient sewerage system in its densely populated metropolitan area (Pernice, 2006). The system includes extensive networks, underground storage tanks for stormwater management, and advanced treatment technologies. Tokyo's approach ensures that treated effluent complies with stringent environmental standards, effectively managing wastewater while minimizing environmental impacts (Kataoka, 2011; Wang et al., 2022). Its integrated sewerage system is a model of how large metropolitan areas can effectively manage wastewater while minimizing environmental impacts.

This literature provided the basis for understanding integrated sewerage planning as a coordinated system of wastewater collection, treatment, disposal, and environmental management across jurisdictions. International examples from cities such as Copenhagen, Singapore, Tokyo, and San Francisco demonstrate that effective sewerage management requires long-term planning, appropriate technology, institutional coordination, and integration with stormwater management. These lessons are used as a benchmark to assess the extent to which sewerage planning and management are coordinated between Addis Ababa and Sheger and to identify the institutional, financial, legal, and technical challenges affecting integration.

2.3.6.2 Drainage System Planning

The integrated drainage system planning approach involves coordinating various elements of urban water management, including surface water drainage, flood control, and environmental protection (Ellis & Lundy, 2016; Miguez et al., 2012), to ensure that cities can effectively handle both everyday rainfall and extreme weather events. Globally, cities in developed countries have pioneered integrated drainage systems that combine traditional infrastructure with innovative approaches to manage stormwater effectively (Bertrand-Krajewski, 2021; Chang et al., 2018). Urbanization and climate change often shape the design of these systems. Many acknowledge Otterdam as a pioneer in integrated drainage and water management. It has implemented a comprehensive approach to urban drainage that includes both concrete infrastructure (such as levees, stormwater sewers, and pumping stations) and green infrastructure (such as water squares, green roofs, and permeable pavements). The "Water Sensitive Rotterdam" program integrates drainage planning with urban design, ensuring that new developments contribute to stormwater management (Holzer, 2022; Zhao et al., 2024).

Melbourne is another example of best practices in integrated drainage system planning. Its approach is based on the principles of WSUD (Donofrio et al., 2009; Radcliffe, 2019), which integrates urban planning with water management to create sustainable and livable environments. Melbourne's drainage system includes traditional infrastructure like stormwater drains and channels, complemented by natural solutions like wetlands, rain gardens, and infiltration systems. These elements work together to reduce runoff, filter pollutants, and recharge groundwater. The city has also implemented stringent regulations to regulate the systems. New York City has also adopted an integrated approach to managing stormwater and drainage through its "green infrastructure plan (Meerow, 2020) to reduce CSOs by capturing rainwater before it enters the sewer system." The plan includes the installation of green roofs, rain gardens, and permeable pavements across the city, as well as the expansion of existing gray infrastructure like storm sewers and retention tanks. This reduces the burden on its sewer system, improves water quality in local waterways, and enhances its ability to handle extreme weather events.

DTSS in Singapore is a vast underground network that transports wastewater to centralized water reclamation facilities (Chiplunkar & Seetharam, 2012; Luan, 2013). The city's drainage and sewerage infrastructure integrates this system, facilitating the efficient treatment and recycling of effluent. In conjunction with Singapore's IWMF, the DTSS operates. It will include food waste treatment facilities, materials recovery facilities, and WTE operations. The IWMF will employ the residual ash in land reclamation initiatives and convert solid waste into energy.

This literature helped the study to understand integrated drainage planning as more than the construction of drainage channels and pipes. It demonstrates that effective drainage management requires coordination with flood control, land-use planning, sewerage, environmental protection, and climate resilience. International experiences show the importance of combining conventional and green infrastructure and establishing appropriate institutional and regulatory mechanisms. These lessons are used as a benchmark to assess the extent to which drainage planning between Addis Ababa and Sheger is coordinated and to identify the institutional, technical, spatial, and policy challenges affecting integration.

2.3.6.3 Integrated Solid Waste Management Planning

ISWM is a holistic approach that aims to manage waste in a way that minimizes its environmental impact while maximizing resource recovery and efficiency (Asefi et al., 2020;

Tsai et al., 2020). As urbanization accelerates, metropolitan cities face increasing challenges in waste management, requiring comprehensive and integrated planning strategies. Cities of developed countries, like Europe, North America, and East Asia, have over the past few decades adopted innovative approaches to tackle waste management challenges (Suzuki et al., 2013).

For instance, cities like San Francisco's Zero waste initiative encompasses a variety of waste reduction, composting, and recycling initiatives (Montgomery et al., 2013). The city has put in place mandatory recycling and composting programs with the objective of diverting waste from landfills. Strong regulatory frameworks, public participation, and investments in technology and infrastructure contribute to the success of these cities. Asian cities like Tokyo and Singapore have advanced waste management systems; many others struggle with waste collection and disposal. However, the rise of circular economy initiatives and waste-to-energy projects in countries like China and India highlights the region's growing commitment to sustainable waste management.

Singapore's success is a result of the effective execution of large-scale initiatives, long-term planning, and strong government leadership (Menkhoff et al., 2017). The model has served as an incentive for other cities worldwide, particularly in Asia, to implement comparable integrated strategies (Sipahi & Saayi, 2024).

Singapore, a city-state with limited land resources and a concentrated population, has implemented one of the most sophisticated and integrated water reclamation and waste management systems in the world (Lye, 2006). It optimizes resource efficiency and environmental sustainability by integrating waste management with drainage and sewerage systems (Lafforgue & Lenouvel, 2015; Luan, 2013). Singapore's integrated approach has resulted in a substantial decrease in landfill requirements, an efficient utilization of resources, and a high recycling rate. The system's closed-loop nature ensures the reduction of waste and the recovery and repurposing of valuable resources (Goh et al., 2024; Ho Jr, 2023). This model has positioned Singapore as a global leader in sustainable urban infrastructure, providing a model for other cities facing similar challenges.

This literature helped to understand solid waste management as an integrated urban infrastructure system rather than an isolated municipal service. It shows that effective waste management

requires coordination of waste reduction, collection, transportation, treatment, recycling, resource recovery, and disposal, together with appropriate institutions, financing, technology, regulation, and public participation. It used these principles as a basis for assessing the extent to which solid waste management planning between Addis Ababa and Sheger is integrated and for identifying the institutional, financial, technical, and coordination challenges affecting its effectiveness.

2.3.6.4 Integrated Transport Planning

Integrated transport planning refers to the systematic coordination of transportation systems across different modes and jurisdictions to ensure efficient, sustainable, and equitable mobility (Boisjoly & El-Geneidy, 2017; Lempert et al., 2020). The practice has gained prominence globally as metropolitan regions increasingly face challenges related to urban sprawl, congestion, pollution, and social equity. Cities in Europe, North America, and Asia have led the way in implementing integrated transport planning globally in various forms (Brunn et al., 2003; Shaheen et al., 2010). Cities like London, New York, and Tokyo have developed sophisticated transport networks that integrate different modes of transport, such as rail, bus, cycling, and walking, into a cohesive system. The success of these cities often hinges on strong governance structures, comprehensive planning frameworks, and advanced technological systems for managing transportation data (Brunn et al., 2003; McCormick et al., 2013). The cities have developed comprehensive transport networks that integrate multiple modes of transport, such as rail, bus, cycling, and walking, into a single, cohesive system

For instance, the Øresund Region, which encompasses Copenhagen in Denmark and Malmö in Sweden, is a prime example of integrated infrastructure planning between two cities in developed countries (Bro, 2023; Matthiessen, 2000, 2016). The aspiration to create a cohesive cross-border metropolitan area drove the region's planning. The Øresund Bridge, which links Copenhagen and Malmö, is the most significant infrastructure undertaking in the Øresund Region (Matthiessen, 2000). This railway and motorway bridge has not only physically connected the two cities but has also facilitated economic, social, and cultural integration (Anderson, 2014; Chow & Chow, 2021). The bridge is a component of a more comprehensive

infrastructure strategy that encompasses coordinated urban development plans, shared energy grids, and coordinated public transportation systems.

Singapore is a prime example of integrated infrastructure planning within a single city-state (Calder, 2016; Fong, 1996; Meng et al., 2016). It has established a highly coordinated approach to urban planning and infrastructure development, which involves the alignment of transportation, housing, water, energy, and communication systems to establish a sustainable and livable city, despite its small size (Lui & Tan, 2001; Meng et al., 2016). It is renowned for its comprehensive approach to urban infrastructure planning. The city-state's URA oversees land use planning, transportation, housing, and environmental sustainability. Key initiatives include compact urban design, efficient public transit systems, and green spaces integrated into the urban fabric (URA, 2021).

MRT system of Singapore is a critical element of its integrated infrastructure (Chin & Fong, 2006; Zhu & Diao, 2016). Bus networks connect the MRT, while housing and commercial developments coordinate its expansion. SPUB oversees an integrated water management system that guarantees water sustainability.

One of the largest urban areas in Europe, the Rhine-Ruhr Metropolitan Region in Germany is home to numerous significant cities, such as Düsseldorf, Cologne, Dortmund, and Essen (Barchański, 2022; Münter & Volgmann, 2014). This region exemplifies integrated infrastructure planning across multiple communities within a developed country. A dense and highly efficient transportation network, comprising extensive roadways, transit systems, and waterways, distinguishes the region and enables seamless connectivity between cities (De Ureña, 2016; Hansen, 2004; Moreira da Rocha Amaral de Souza, 2018). The Rhein-Ruhr Express project is a notable example of this, as it aims to establish a high-speed rail link that incorporates local, regional, and long-distance services throughout the metropolitan area. By coordinating their energy infrastructure, cities in the region collaborate on renewable energy initiatives, such as solar and wind farms.

Industry and business have benefited from enhanced economic cohesion as a result of the integrated infrastructure planning in the Rhine-Ruhr region, which has resulted in improved

logistics and transportation networks. Additionally, the region has made substantial progress in sustainability as a result of its concerted efforts to enhance energy efficiency and decrease emissions. The successful integration of numerous cities into a cohesive metropolitan area illustrates the efficacy of regional planning in industrialized countries.

Tokyo, as well as neighboring communities such as Yokohama, Chiba, and Saitama, comprise the Greater Tokyo Area, the world's largest metropolitan region (Aramata, 2023). The implementation of the complexity of this mega-city region in a developed country is contingent upon the implementation of integrated infrastructure planning (Brugmans, 2010; Hamnett & Forbes, 2012). The region's transportation network is among the worlds most advanced, boasting a comprehensive rail system that includes the renowned Shinkansen (bullet train) lines that connect Tokyo to other important cities throughout Japan. Additionally, the Tokyo Metropolitan Government has implemented integrated land-use and transportation planning to ensure that public transport adequately serves residential, commercial, and industrial areas.(Vinod Kumar, 2019), In recognition of Japan's susceptibility to tsunamis and earthquakes, the region's infrastructure planning also incorporates sophisticated disaster preparedness systems. This integrated infrastructure planning has bolstered the Greater Tokyo Area's economic dynamism, reduced congestion, and facilitated efficient mobility. In spite of its huge population, Tokyo has been able to sustain high levels of productivity and quality of life through the coordinated approach to transportation and land use. The region's infrastructure's resilience in the face of natural disasters also functions as a global benchmark.

Crossrail, also known as the Elizabeth Line, is a highly ambitious infrastructure project in Europe that aims to improve connectivity across London and its surrounding neighborhoods (Sepe, 2019; Treasury, 2011). It is a notable illustration of the integration of infrastructure planning in a developed country. Crossrail involves the development of a new railway line that traverses central London, connecting Reading and Heathrow in the west to Shenfield and Abbey Wood in the east (Dodgson et al., 2015; Kay, 2009). The initiative seamlessly integrates with the London underground, over ground, and National Rail services on the existing transport networks. Crossrail will improve accessibility and connectivity throughout the capital and its surrounding regions, thereby bolstering London's status as a global city once it is completely operational(Clark, 2008; Prakash et al., 2023). The initiative emphasizes the importance of

integrated infrastructure planning in preserving and improving the functionality of large urban areas.

Melbourne's metropolitan planning framework emphasizes integrated land use and transportation planning to support sustainable growth and reduce urban sprawl. The Plan Melbourne strategy promotes compact, transit-oriented development, green spaces, and connectivity between urban centers and surrounding suburbs.

This literature provided the basis for understanding integrated transport planning as coordination among different transport modes, land use, infrastructure investment, institutions, and jurisdictions. International cases such as the Øresund Region, Rhine-Ruhr, Greater Tokyo, and London demonstrate that effective metropolitan mobility depends on coordinated planning across administrative boundaries. These used as lessons as a comparative basis to assess the extent to which transportation planning between Addis Ababa and Sheger.

2.3.7 Practice of Integrated Infrastructure Planning in Developing Countries

Limited financial resources, a lack of technical expertise, lack of integration and fragmented governance structures are frequently the obstacles that integrated infrastructure planning encounters in developing countries (Kessides, 2004; Wibowo & Alfen, 2015). Nevertheless, the accelerated urbanization and population growth occurring in these regions necessitate such planning. Despite these challenges, some developing countries' cities are making progress in integrated planning by utilizing innovative approaches such as public-private partnerships, donor funding, and international partnerships (Ibem, 2011; Maurrasse, 2013). For instance, cities in India and Africa are increasingly incorporating integrated planning practices to resolve issues such as transportation congestion, inadequate housing, and water scarcity, with a heightened emphasis on resilience and sustainability (Ibem, 2011).

Integrated infrastructure planning between two cities can be more complex in developing countries due to varying levels of development, political instability, or resource constraints (Watson, 2009). Nevertheless, this type of planning is crucial for the purpose of promoting economic development, enhancing access to services, and reducing regional disparities. In certain instances, national administrations or international organizations may be instrumental in fostering collaboration among cities. For example, the Addis Ababa-Djibouti railway

development is a remarkable illustration of infrastructure planning between two cities in distinct countries in the developing world. This initiative has demonstrated the potential of integrated infrastructure planning in challenging contexts, improving trade, reducing transportation costs, and contributing to regional integration.

The Ethiopian Federal Urban Planning Institutes of the Ministry of Works and Urban Development developed an integrated urban infrastructure and services planning manual in 2006. Mathowos Consult was responsible for its development. The study document asserted that the performance of spatial planning in Ethiopia, particularly the municipal master plans, has not been effective in adequately guiding and controlling spatial development (Mohamed, Worku, & Lika, 2020; Terfa et al., 2019). Additionally, there has been a general absence of political commitment to adhere to the plans in a strict manner. The national urban development policy also emphasized the need for integrated urban infrastructure delivery (Mezgebo, 2020; Tiwari, 2016). In addition, the policy suggests that the participation and integration of various actors' activities are essential for the successful implementation of the plan. Infrastructure delivery systems, on the other hand, should encourage efficiency and quality through incremental development (Bhattacharya et al., 2015). It referenced, analyzed, and derived insights from the international experiences of the Philippines, India, Indonesia, and South Africa (Pande, 2019). Nevertheless, the local practice does not include infrastructure, such as water, transportation and drainage, electricity, and telecommunications.

The country has made substantial strides in infrastructure development, and its infrastructure indicators are relatively comparable to those of low-income countries (Blumenfeld et al., 2019; Foster & Morella, 2011). In contrast to previous decades, 2010-2018 experienced double-digit economic growth, implemented an ambitious investment program to upgrade its network of trunk roads, and implemented a contemporary financing mechanism for road maintenance (Moneke, 2020). Access to water and sanitation is expanding significantly in both urban and rural areas. Infrastructure has influenced Ethiopia's annual per capita GDP development by 0.6 to 1.2 percentage points over the past few decades (Moller & Wacker, 2015, 2017). Increasing the country's infrastructure endowment to that of the region's middle-income countries could achieve an additional three percentage points of annual growth (Easterly, 2002; Gebru, 2015). This

would be a substantial improvement over the growth performance, which was approximately 5 percent on average.

The main takeaway is that developing countries face greater institutional, financial, technical, and governance constraints in implementing integrated infrastructure planning, yet rapid urbanization makes such integration increasingly necessary. In Ethiopia, although policies and planning instruments recognize the importance of integrated infrastructure development, challenges remain in translating these principles into coordinated practice, particularly across administrative boundaries.

2.3.7.1 Sewerage System Planning

In developing regions, like Bogotá, Durban, and Cairo, integrated sewerage system planning often faces significant challenges, including limited resources, inadequate infrastructure, and rapid urbanization (Freire, 2013; Hardoy et al., 2013). However, several cities have made notable progress in improving their wastewater management systems. Bogotá, the capital of Colombia, has made significant strides in improving its sewerage system as part of its broader urban water management strategy. For example, it has implemented the Bogotá River Environmental Recuperation and Flood Control Project to enhance the city's flood resilience. It has expanded its sewerage network and upgraded its wastewater treatment plants to increase treatment capacity and improve effluent quality. Similarly, Durban, a coastal city in South Africa, has developed an integrated sewerage system that addresses both wastewater management and environmental conservation. The city's municipality has implemented the Durban Water Recycling Project, which treats wastewater to a high standard and reuses it for industrial purposes, reducing the demand for potable water (Adewumi et al., 2010; Kumarasamy & Dube, 2016). The Municipality has also made investments in decentralized wastewater treatment solutions, such as community-based sanitation systems, to cater to informal settlements that lack connection to the central sewerage network.

In order to address issues such as inadequate treatment capacity, sewer overflows, and pollution of the Nile River. Cairo, one of the largest cities in Africa, has embarked on the Greater Cairo Wastewater Project (Abulnaga & Naga, 2024; El-Gohary et al., 2014), which involves the construction of large-scale wastewater treatment plants and the rehabilitation of existing sewers and pumping stations. In the case of Ethiopia, Addis Ababa has tried to improve the sewerage

system; however, it is still underdeveloped, with only a small portion of the population connected to the centralized sewer network (Adugna et al., 2019; Tesfay, 2017). The majority of households rely on on-site sanitation facilities, such as pit latrines and septic tanks, which are often poorly maintained and pose public health risks. To address these challenges, the Addis Ababa City Administration has initiated several projects aimed at expanding the sewerage network and upgrading treatment facilities. For instance, the Addis Ababa city administration upgraded the kaliti wastewater treatment plant to boost its capacity and enhance the quality of treated effluent. However, the integration of sewerage system planning with other urban infrastructure and services remains limited.

Comparing global, regional, and Ethiopian experiences in planning integrated sewerage systems shows that cities like Copenhagen, Singapore, and Tokyo have strong leadership, use of cutting-edge treatment technologies, are environmentally friendly, and are able to last for a long time. Limited resources, rapid urbanization, and institutional weaknesses pose challenges to integrated sewerage system planning in developing regions. However, cities like Bogotá, Durban, and Cairo have shown significant improvements with innovative solutions and strong political will. Addis Ababa demonstrates both opportunities and challenges.

This literature provided a comparative basis for understanding integrated sewerage planning in developing-country contexts. It shows that rapid urbanization, limited resources, inadequate infrastructure, and institutional weaknesses constrain sewerage development, while investment, technological innovation, wastewater reuse, and strong political commitment can improve performance. The Addis Ababa experience demonstrates that sewerage development has progressed but remains limited and insufficiently integrated with other urban infrastructure.

2.3.7.2 Drainage System Planning

In developing regions, cities like São Paulo, Curitiba, Mumbai and Dhaka face additional challenges, including limited resources and rapid urbanization (Masud & Rana, 2011; Rana, 2011). However, these cities have demonstrated that innovative approaches, community involvement, and long-term infrastructure investment can lead to progress (Bazoglu, 2008). Their experiences highlight the importance of integrated planning, capacity building, and the need for coordinated efforts across different sectors.

In developing regions, integrated drainage system planning often encounters significant challenges, including limited resources, rapid urbanization, and inadequate infrastructure (Masud & Rana, 2011; Rana, 2011). Nevertheless, some cities have progressed in developing integrated approaches to stormwater management (Bazoglu, 2008). The best example for this is São Paulo, which has faced severe urban flooding issues due to its rapid urbanization and inadequate drainage infrastructure (da Silva Tavares et al., 2018; Jacobi et al., 2013). In response, the city has implemented the "Macro Drainage Plan," which focuses on large-scale flood control projects. The plan also emphasizes the integration of green infrastructure, such as parks and green corridors, to enhance water retention and reduce runoff (Travassos & Momm, 2022; van den Brandeler, 2022).

Innovative urban planning, encompassing an integrated approach to waste management, drainage, and sewerage systems, distinguishes Curitiba (Ciaccio, 2020; Gürçam, 2024). The city has implemented a series of interconnected systems that promote environmental sustainability, including waste disposal, recycling, and flood control (Alves, 2021; McRae, 2021). It has implemented an integrated drainage and sewerage system that encompasses green spaces and parks as part of its flood management strategy (Alves, 2021; Osorio Guzmán et al., 2020). The city has established expansive parks and lakes that serve as flood control reservoirs, absorbing excess rainfall and mitigating the likelihood of inundation. The city's sewerage infrastructure connects this system, ensuring efficient stormwater management without overloading the wastewater system (Fraga et al., 2022).

Due to its limited infrastructure and rapid urbanization, Mumbai, one of the most populous and largest cities in India, faces significant challenges in the areas of sanitation, flooding, and waste management (Joelsson & Lord, 2016; Kumar, 2017; Srivastava & Srivastava, 2020). The city has implemented initiatives to integrate its waste management, sewerage, and drainage systems in response. BRIMSTOWAD is a bold initiative that seeks to enhance and expand Mumbai's drainage infrastructure in order to mitigate flood during the monsoon season (Menezes, 2013). This project's scope includes the installation of pumping stations, the deepening and widening of existing stormwater channels, and the construction of new ones. In order to prevent sewage overflow during periods of intense rainfall, we integrate the system with the city's sewerage infrastructure.

In Ethiopia, the practice of integrated drainage system planning is still in its early stages, particularly in rapidly urbanizing areas like Addis Ababa. Addis Ababa, Diredawa, Adama, Bahir Dar, and Hawassa are also grappling with inadequate drainage systems and frequent urban flooding. Urban flooding, particularly during the rainy season, has increasingly affected some of these cities (Feyissa, 2019). The drainage systems of these cities are underdeveloped, and many areas lack adequate stormwater infrastructure (Feyissa, 2019). For instance, Addis Ababa has initiated efforts to improve the city's drainage network and reduce flood risk. These efforts include the construction of new drainage channels, the rehabilitation of existing ones, and the development of urban green spaces to absorb and manage stormwater.

A comparative analysis of global, regional, and Ethiopian experiences in integrated drainage system planning reveals several key lessons. Successful integrated drainage systems are characterized by strong governance, a combination of gray and green infrastructure, and a focus on sustainability and resilience to climate change. Cities like Rotterdam, Melbourne, and New York have demonstrated the importance of integrating drainage planning with broader urban development strategies, incorporating natural solutions, and ensuring that infrastructure is adaptable to future climate conditions.

Ethiopia's experience, particularly in Addis Ababa, reflects both the challenges and opportunities of developing integrated drainage systems in a rapidly urbanizing country. Although there has been progress in expanding drainage infrastructure and reducing flood risk, there are still significant gaps in terms of coverage, integration, and sustainability. Ethiopia can benefit from global and regional best practices by strengthening its institutional frameworks, improving coordination between different levels of government, and increasing investment in drainage infrastructure and technology.

2.3.7.3 Integrated Solid Waste Management Planning

In contrast, metropolitan cities in developing countries face more significant challenges due to rapid urbanization, limited resources, and inadequate infrastructure (Zhang, 2016). However, some cities, like Curitiba in Brazil and Mumbai in India, have made substantial progress by adopting community-based waste management models and public-private partnerships. These cities demonstrate the importance of context-specific solutions that leverage local resources and

community engagement. African metropolitan cities face unique challenges in ISWM due to rapid population growth, urban sprawl, and limited financial and technical resources. Despite these challenges, some cities have made strides in ISWM. For example, Lagos, has implemented a public-private partnership model for waste collection, and Kigali is known for its strict enforcement of waste management regulations, contributing to its reputation as one of the cleanest cities in Africa. Cities in Latin America, such as Bogotá, Colombia, and Buenos Aires, Argentina, have implemented ISWM plans that emphasize waste separation at source, recycling, and the inclusion of informal waste pickers in the formal waste management system(Carenzo & Sorroche, 2021; Marello & Helwege, 2018). These initiatives reflect a growing recognition of the social dimensions of waste management and the need for inclusive policies.

Mumbai has implemented numerous waste management initiatives, such as the development of waste processing plants, the composting of organic waste, and the segregation of waste at the source (Kumar & Agrawal, 2020; Rathi, 2007). It has developed these initiatives to reduce the burden on landfills and enhance the city's overall waste management capabilities. Furthermore, Mumbai has endeavored to integrate its waste management system with its drainage and sewerage systems in order to mitigate pollution and prevent obstructions (Gress, 1988).

Rwanda's capital, Kigali, stands out for its clean and orderly urban environment due to its comprehensive approach to waste management and sanitation (Mpayimana, 2013; Suidman & Enp, 2017). Kigali has prioritized the development of infrastructure that addresses the challenges of waste disposal, drainage, and sewerage in order to accommodate its accelerated growth as a city in a developing country (Kazora, 2018; Muragijimana, 2020). It’s Sanitation and Waste Management Project is a citywide initiative that entails the construction of public restrooms, the enhancement of waste collection services, and the establishment of a landfill that adheres to contemporary environmental standards. Kigali's drainage infrastructure integrates with the project to prevent water pollution and ensure safe waste disposal. The Umuganda Community Cleanup is a monthly nationwide activity that is institutionalized and is a traditional Rwandan practice of community labor. The residents of Kigali, Umuganda, are engaged in the management of waste, the unclogging of drainage systems, and the cleansing of streets. The city integrates this community-driven approach with its formal waste management and sanitation services (Kafula, 2024; Mugwaneza, 2019).

Ethiopia, like many other developing countries, faces significant challenges in managing solid waste, particularly in its rapidly growing metropolitan cities, such as Addis Ababa. Due to limited infrastructure, financial constraints, and institutional weaknesses, the city generates a substantial amount of waste daily, much of which remains unmanaged. Historically, the city has relied on open dumping as the primary method of waste disposal, with the Koshe landfill being the main site. However, this approach has led to environmental and health hazards, as evidenced by the tragic landslide at the Koshe landfill in 2017.

This implies that successful ISWM planning requires the active involvement of all stakeholders, including government agencies, the private sector, communities, and informal waste workers. Public participation and awareness are critical to ensuring the effectiveness of waste management initiatives. We must tailor it to the specific socio-economic, cultural, and environmental contexts of each city. What works in a developed country may not be directly applicable to a developing country, and vice versa. For the successful implementation of ISWM plans, adequate funding is essential. This includes exploring diverse financing mechanisms such as public-private partnerships, donor funding, and revenue generation through recycling and waste-to-energy projects. The adoption of innovative technologies, such as waste-to-energy and digital platforms for waste collection, can significantly enhance the efficiency and effectiveness of waste management systems.

2.3.7.4 Integrated Transport Planning

In developing regions, integrated transport planning faces significant challenges, including limited resources, rapid urbanization, and institutional weaknesses (Yigitcanlar & Teriman, 2015). However, some cities have managed to implement successful strategies that provide valuable lessons for others. Colombia's Bogotá TransMilenio BRT system, a pioneering example of integrated transport planning in a developing city context, stands as one of the best case studies. The system integrates feeder buses, dedicated bus lanes, and pedestrian and cycling infrastructure, creating a comprehensive network that serves millions of passengers daily. Strong political leadership, public support, and innovative financing mechanisms like PPPs contribute to TransMilenio's success (Guerrero & Dodero, 2021; Ndebele, 2018). Despite its achievements, TransMilenio faces challenges, including overcrowding and the need for continuous expansion

and maintenance. Nonetheless, it remains a model for other cities in Latin America and beyond, demonstrating that BRT systems can be an effective solution for urban mobility in developing countries.

Lagos, Nigeria's largest city faces significant challenges due to rapid urbanization, population growth, and inadequate infrastructure (Auwalu & Bello, 2023). They established the Lagos Metropolitan Area Transport Authority (LAMATA) to address these challenges through integrated infrastructure planning. LAMATA has developed the Lagos Bus Rapid Transit (BRT) system, which provides a reliable and affordable means of transportation for the city's residents (Aminu & Pearse, 2018; Osoja et al., 2023). LAMATA has also been involved in upgrading road networks, improving traffic management systems, and planning for future light rail development.

The BRT system has alleviated some of the severe traffic congestion in Lagos, reducing travel times and providing a more efficient means of transportation for millions of residents (Aminu & Pearse, 2018; Osoja et al., 2023). LAMATA's integrated approach has also contributed to better coordination between different transport modes, enhancing overall mobility in the city. While challenges remain, particularly in scaling up infrastructure to meet growing demand, LAMATA's efforts represent a significant step forward in integrated urban planning in a developing country (Amiegbebhor & Popoola, 2021).

Curitiba is a pioneer in integrated urban planning, particularly the development of public transport systems in a developing country (Leite de Almeida et al., 2021; Santos, 2015). Global recognition recognizes the city's innovative and sustainable approach to urban planning(Santos, 2015). Its BRT system, introduced in the 1970s, is the centerpiece of the city's integrated infrastructure planning. Zoning laws support the BRT system by promoting high-density development along transit corridors, thereby encouraging the use of public transport. The city also integrates its waste management, green spaces, and housing projects into its overall urban plan, ensuring that infrastructure development supports environmental sustainability (Gustafsson & Kelly, 2016; Saraiva et al., 2018; Vásquez et al., 2019).

The Gautrain Rapid Rail Link is a high-speed commuter rail system connecting Johannesburg and Pretoria, two of South Africa's largest cities (Prim, 2016). This project represents a

significant effort in integrated infrastructure planning in a developing country, aimed at reducing congestion, improving public transport, and fostering economic development. The Gautrain system includes a network of trains and buses that seamlessly connect with other modes of public transport, such as local taxis and buses (Mbatha & Gumbo, 2019, 2020). The project also involved the development of modern stations with retail and business facilities, creating new hubs of economic activity along the route.

It has successfully reduced travel times between Johannesburg and Pretoria, easing traffic congestion on the major highways (McKay, 2020; Moyo, 2021). It has also encouraged the use of public transport, contributing to reduced emissions and improved air quality. Moreover, the project has stimulated property development and increased real estate values near stations, fostering economic growth in the region. It is considered a model for future public transport projects in Africa, showcasing the potential for integrated planning to address urban challenges in developing countries (Canales et al., 2017; Risimati, 2021).

The Addis Ababa-Djibouti Railway is a vital infrastructure project connecting Ethiopia's capital, Addis Ababa, to the port city of Djibouti. This project represents an integrated planning effort between two cities in developing countries, aimed at boosting trade and economic integration in the Horn of Africa (Fekadu & Ababa, 2014; Wang et al., 2022). The railway is part of a broader transportation corridor that includes road networks and energy infrastructure. The project was supported by Chinese investment and expertise, reflecting a growing trend of international cooperation in infrastructure development in Africa. The railway provides a critical link for landlocked Ethiopia, offering access to the sea and facilitating the movement of goods (Gutu & Ababa, 2014; Tekalign, 2019).

The railway has significantly reduced the time and cost of transporting goods between Addis Ababa and Djibouti, enhancing Ethiopia's export potential and improving access to international markets. The project has also spurred economic activity along the route, creating jobs and improving infrastructure in towns and cities connected by the railway. Despite challenges such as financial sustainability and operational efficiency, the Addis Ababa-Djibouti Railway demonstrates the importance of integrated planning for regional development in Africa (Gutu & Ababa, 2014; Wang et al., 2022).

Developing-country experiences demonstrate that successful integrated infrastructure planning depends not only on infrastructure investment but also on strong institutional coordination, appropriate financing, community participation, technological innovation, integrated land-use and infrastructure planning, and context-specific solutions. These lessons provided a comparative basis for assessing whether the increasing functional interdependence between Addis Ababa and Sheger is matched by effective sectoral, spatial, institutional and financial coordination. The study therefore contributes by examining these issues specifically across the cities boundary.

2.3.8 Challenges in Infrastructure Integration

Many literatures argue that the international and similarly African context shows infrastructure integration as offering numerous benefits; it also presents a range of challenges that can obstruct effective planning and implementation (Straub, 2008). These challenges include financial constraints, governance issues, technological barriers, environmental concerns, and social acceptance (Ahl et al., 2022; Situmeang et al., 2022).

As the literature indicates, one of the primary challenges in infrastructure integration is a lack of adequate finance (Bhattacharyay, 2012a; Bisbey et al., 2020). Many large-scale infrastructure projects require substantial financial investment, which can be difficult to easily finance. At the same time, governments often face shortages of finances and competing priorities, making it challenging to allocate sufficient financial resources for comprehensive infrastructure integration. Additionally, the private sector's risk aversion and the need for attractive returns on investment can hinder reliance on public-private partnerships (PPPs)(Akintayo & Onajite, 2015; Bolomope et al., 2021).

According to the argument of Klievink et al. (2016), effective infrastructure integration requires strong governance frameworks that ensure coordination and collaboration among various stakeholders, including government agencies, private sector entities, and local communities. However, governance issues such as bureaucratic inefficiencies, lack of transparency, and corruption can hinder the planning and execution of integrated infrastructure projects (Ciborra, 2005; Gans-Morse et al., 2018). Poor inter-agency coordination and fragmented responsibilities can lead to delays, cost overruns, and suboptimal outcomes.

Similarly, technology plays a crucial role in infrastructure integration; it can pose significant challenges. The adoption of advanced technologies, such as smart grids, IoT, and digital infrastructure, requires substantial investment in research, development, and capacity building. Developing countries like Ethiopia may face difficulties in accessing and implementing these technologies due to limited technical expertise and infrastructure (Alemneh & Hastings, 2006). Moreover, integrating new technologies with existing systems can be complex and require significant upgrades and interoperability solutions (Owen et al., 2010).

Infrastructure projects often have significant environmental impacts, which can pose challenges for integration efforts. According to the explanation of (Adshead, 2020; Laukkonen et al., 2009), ensuring that infrastructure development aligns with environmental sustainability goals requires careful planning and mitigation measures. Projects that do not adequately address environmental concerns can face public opposition, regulatory hurdles, and potential legal challenges. This indicates that balancing economic development with environmental preservation is a critical challenge in infrastructure integration.

The other critical issue is that social acceptance and community engagement are vital for the success of integrated infrastructure projects (Prebanić & Vukomanović, 2023; Rathenam & Dabup, 2017). Local communities' resistance, often due to concerns about displacement, environmental impact, or changes to the local way of life, can delay or derail projects. Effective communication, stakeholder engagement, and inclusive planning processes are essential to gain public support and address concerns. On top of lagging infrastructure provision, failure to involve communities in decision-making can lead to social unrest and opposition.

Political instability and changes in government can also disrupt infrastructure projects. Therefore, policy continuity is essential for long-term infrastructure planning and implementation. Frequent changes in government priorities, policy reversals, and lack of political will can undermine the progress of infrastructure integration (Ahluwalia, 2011; Kallianos, 2018). Ensuring political stability and commitment to long-term infrastructure goals is crucial for successful integration.

Land acquisition for infrastructure projects can be a contentious and time-consuming process. Legal disputes, compensation issues, and resistance from landowners and landholders can all

contribute to the delay in project implementation (Muriithi, 2013; Shukla & Tiwari, 2022; Wanyoike, 2014). Establishing clear legal frameworks, fair compensation practices, and transparent processes for the land acquisition process are necessary to overcome these challenges.

The other very important issue in effective infrastructure integration is that it requires skilled professionals and institutional capacity (Desalegn & Solomon, 2021; Regan et al., 2014). Developing countries, in particular, may face shortages of skilled labor, engineers, and project managers, which can hinder the planning and execution of integrated projects. Capacity-building initiatives, training programs, and knowledge transfer from developed countries can help bridge these gaps (Black et al., 2022; Kilika, 2012). Addressing these challenges requires a multifaceted approach that includes strong planning, stakeholder collaboration, transparent and accountable governance, and innovative financing mechanisms. As stated (Adshead et al., 2019; Runhaar et al., 2009), policymakers and planners can enhance the effectiveness of infrastructure integration efforts by recognizing and mitigating these obstacles, ultimately contributing to sustainable development and improved quality of life.

In the Ethiopian context, the country encounters significant economic and financial constraints when it comes to funding large-scale infrastructure projects (Eberhard et al., 2016; Othman & Ahmed, 2013). While ambitious projects like the GERD and railways highlight the country's commitment to infrastructure development, funding remains a major problem. The reliance on foreign loans and aid can also lead to debt sustainability concerns.

Governance issues, including bureaucratic inefficiencies and corruption, can obstruct infrastructure integration in Ethiopia (Abagissa, 2019; Yilema & Gianoli, 2018). To tackle such problems, the government had taken various measures at different times. From such measure, strengthening institutional capacity and ensuring transparent and accountable governance frameworks are essential for effective project planning and execution. The shortage of skilled labor, engineers, and project managers is a significant challenge in many African countries and limited institutional capacity and expertise can hinder the planning, implementation, and maintenance of integrated infrastructure projects. Thus, capacity-building initiatives and knowledge transfer from developed countries are crucial to addressing these gaps.

Social acceptance and community engagement are vital for the success of infrastructure projects in Ethiopia. As International experience shows that resistance from local communities due to concerns about displacement, environmental impact, or changes to traditional ways of life can delay projects. For instance, housing and road projects in Ethiopia, including Addis Ababa, also experienced these issues (Prebanić & Vukomanović, 2023; Rathenam & Dabup, 2017). Therefore, effective communication, stakeholder engagement, and inclusive and participatory planning processes are essential to gain public support and address concerns.

Adopting advanced technologies in Ethiopia can be challenging due to limited technical expertise and infrastructure (Admassie & Ayele, 2010). Substantial investment in capacity building and technological infrastructure is necessary to ensure the integration of new technologies with existing systems and their accessibility to the local workforce.

Similar to, international and African contexts have shown that land acquisition for infrastructure projects can be particularly contentious in Ethiopia. Legal disputes, inadequate compensation, and resistance from landowners can delay project implementation (Muriithi, 2013; Shukla & Tiwari, 2022; Wanyoike, 2014). Like other contexts, establishing clear legal frameworks, fair compensation practices, and transparent processes for land acquisition are necessary to overcome these challenges. Recognizing and addressing these challenges within their respective contexts, policymakers and planners can enhance the effectiveness of infrastructure integration efforts. This approach will contribute to sustainable development and improved quality of life for communities in Ethiopia, Africa, and globally.

2.3.9 Integrated Urban Governance

The governance of metropolitan regions in Latin America has found much less attention than metropolitan governance in Europe or North America. At least many of the most-cited books and articles focus on Europe or Canada and the US (Fernández-Maldonado et al., 2014; Zimmermann et al., 2023). Latin American city regions offer, however, a rich and variegated experience of metropolitan governance (Nieto et al., 2022; Ortiz, 2024). This raises the question of whether the knowledge and the positions that are well-established in the scholarly debate have the same value in the context of Latin America a question that has met increasing attention in the debate on post-colonialism. Many contributions addressing the situation in Europe or the US and Canada were triggered by changing governance and state paradigms in the late 1990s and early

2000s (Bradford, 2003; Governance et al., 2007). The changing welfare state and territorialized competition in the globalized economy were the main focus.

In Latin America, the situation is slightly different. An overall trend toward decentralization, rapid urbanization, and regular economic and political disruptions are contextual factors (Campbell, 2003; Tulchin & Selee, 2004) having a strong influence on what happens in the biggest agglomerations of this region. In addition, metropolitan governance in Latin America evolves within a different type of statehood that is partly developmental and struggling with decentralization reforms (Faust, 2007; Zimmermann et al., 2023). Major issues of concern in Latin American metropolitan areas are inequality, unequal provision of services, environmental justice, provision of housing, security, and financing of metropolitan services (sewage, transport, and energy) (Irazábal, 2021; Fay, 2005). Many urban agglomerations in Latin America that poses a remarkable challenge for governance and governability which is also true for other megacity regions on other continents.

The process of institutionalization of metropolises in Latin America is also influenced by the economic context of being on the periphery of global capitalism and, in addition, a neoliberal model of development (Robinson, 2008). The preponderance of this economic dimension is the reason for the low preparedness for regional cooperation. It has as a premise, and as a consequence, the mobilization and greater representation of the local business community and consequently, the adjustment to the interests of the local political and economic elite. In this sense, the discussion on metropolitan governance must consider the plurality of institutional arrangements, the differences and dilemmas of the political-administrative culture(s), as well as the political interests at stake and the respective underlying policies (Zimmermann et al., 2023). A more functionalist reading, based on the experience of the theoretical and analytical approach from European or North American experiences, does not account for this complexity.

This poses the question of whether discussing metropolitan governance in Latin America needs a more tailor-made perspective also taking into consideration the debate of scholarly knowledge production in times of globalized urban studies (Hudson Correa, 2015; Nieto, 2021). Some of the established approaches and ways of seeing things in the scholarly debate on metropolitan governance may be universal. The design of institutions for governing metropolitan affairs would usually consider categories, such as economies of scale in the public sector, and the

legitimacy of supra-local institutions (Blatter, 2006; Neuman, 2007) Against this background, the political tension between regional integration (i.e., a stronger city-regional government) and decentralization (i.e., the empowerment of local self-government) is a contradictory logic inherent in every attempt to solve the problems of institutional fragmentation in city regions(Zimmermann et al., 2023). On a more practical level, the inter-municipal coordination of land use policy and public transport, among others, are essential elements to reach the goal of sustainable urban development, and we would expect this to be a problem in almost every city region around the globe.

Although the literature provides extensive discussion of metropolitan governance, decentralization, institutional fragmentation, and inter-municipal coordination in Latin American, European and North American contexts, comparatively limited empirical attention has been given to how these governance challenges affect integrated infrastructure planning in rapidly expanding African metropolitan regions, particularly where a major city and an emerging surrounding metropolitan city are institutionally distinct but functionally interconnected. Metropolitan infrastructure problems cannot be effectively addressed through fragmented municipal governance because infrastructure systems and urban functions frequently cross administrative boundaries; effective metropolitan development therefore requires context-specific institutions, inter-municipal coordination, shared planning, and mechanisms that balance regional integration with local autonomy.

2.3.10 Challenges and Models of Governance

As Belsky et al. (2013) state, there are several critical challenges associated with governance and institutions that impede successful urbanization. These challenges include: (i) the lack of a comprehensive national urban policy, (ii) the absence of a lead agency for urban development, (iii) deficiencies in the fiscal decentralization framework, and (iv) metropolitan fragmentation with weak mechanisms for inter jurisdictional coordination. Legal foundations, competent institutions, and financial instruments are essential for the design and construction of resilient, productive, and livable cities, which are essential components of an effective NUP (Kinyanjui, 2020). The national government's overall intentions and policies with regard to cities and metropolitan regions are defined by a NUP. The purpose of a NUP is to improve the economic, social, and ecological functioning of these regions, capitalize on the urbanization process for

national development, and direct it towards sustainable patterns (Feleki et al., 2018). In the past, the Philippines have lacked a national urban policy that is both comprehensive and effective. A clear vision for urban development should guide this policy, with strategies and interconnected actions supporting it to address issues arising from concentrated population and economic growth (Watson, 2009). The spatial pattern of urbanization in the Philippines has undergone a transformation, characterized by an over-concentration of development in Metro Manila and an underdevelopment of secondary cities (Rondinelli, 1997). This is a consequence of a lack of a clear vision and defined strategies for active management of urban development and expansion. Furthermore, the absence of a national urban policy contributes to the lack of well-functioning inter-jurisdictional coordinating mechanisms within the country's metropolitan areas (Isolana, 2020). The Philippines is undergoing rapid urbanization, and the formulation and adoption of a national urban policy are essential for (Manasan & Mercado, 1999), the HUDCC has directed the HLURB, one of its attached agencies, to develop a NUDHF as a macro framework for urban development and housing.

Despite having prepared three incarnations of the NUDHF since 1992, the country's governing administrations have not prioritized its adoption as an effective policy framework. The primary focus on housing issues, along with its limited authority and capacity as a coordinating body, has limited the HUDCC's ability to implement NUDHF recommendations (Du & Greiving, 2020; Navarro, 2016). Consequently, the NUDHF has not been a practical policy instrument for the national government to direct public interventions in urban areas and guide urban development. Essentially, the NUDHF serves as a strategy document, disconnected from a comprehensive national urban policy that outlines the national government's overarching objectives for urban development and establishes the roles and responsibilities of critical actors.

The institutional fragmentation among various supervision and sectoral agencies at the national level has further exacerbated the dysfunctional institutional environment for urban development (Galang et al., 2020). There is a lack of a proper institutional framework, which should include a clear national agency responsible for urban development, formalized methods for relevant oversight, and collaboration between sectoral agencies in metropolitan and urban areas. This implies that these agencies and LGUs are required to perform the same tasks multiple times or even have overlapping responsibilities (Llanto, 2012; Lowry et al., 2005). Despite the fact that

numerous national oversight agencies have direct responsibilities in relation to urban issues, no single agency is entirely accountable for the development and enforcement of urban development policies.

The formal mechanisms for both horizontal coordination (across sectoral agencies) and vertical coordination within urban areas are extremely weak due to the absence of a main agency for urban development. Various sectoral agencies in the main urban sectors of the Philippines, such as transport management, roads and bridges, solid waste management, housing, and social services, play significant roles due to the unitary system of government (Manasan & Mercado, 1999). The poor planning and quality of urban infrastructure and services in cities and urban areas are a result of the weak coordination between national and local government (Manasan & Mercado, 1999), both functionally and spatially, in the areas of planning, regulation, service provision, and investments.

The Philippines must establish and empower a main agency to supervise urban development in order to effectively develop and implement a national urban policy and reverse the negative urbanization outcomes associated with competitiveness, mobility, poverty, inequality, and environmental quality. We require such an entity to effectively address the fragmented institutional structure at the national and local levels. A lead agency is essential for supervising the implementation of a national urban policy, which includes providing support and oversight for the establishment of functional metropolitan governance arrangements among the country's main urban areas. Developing countries have recently established these institutions to tackle urban issues**.**

The authors assert that European cities face significant economic, environmental, social, and demographic challenges in the 21st century (Haase, 2011). The primary manifestation of these issues is in vast urban areas. Over the past few decades, economic development in these urban areas has resulted in the spatial expansion of metropolitan areas (Beghelli et al., 2020). The territorial borders of administrative entities are significantly regressive when compared to the spatial expansion of urban areas. As a result, the economic cities, or functional urban areas, are significantly larger than the administrative city. The current features of urban areas, such as the outdated institutional and territorial structure, influence the development of urban physical infrastructure (Couch et al., 2008). The authors suggest that a solution is necessary to establish a

competitive and suitable European city of the future that can effectively resolve the interconnected challenges and the governance system of urban areas. To make it easier to think, plan, and make decisions together, there is a need of new governance models on functional spatial levels and for these models and formal administrative structures to work together in the best way possible. These pieces of advice are also applicable to the study area of this paper, which is the city and the Sheger, which are struggling with the challenge of incompatibility between the formal administrative border and the metropolitan region's regional planning. As Robinson (2011) explained in his paper on the European city model, European cities possess unique characteristics that distinguish them from their American or Asian counterparts.

The author outlined the distinctive features of European cities, demonstrating significant variations in their implementation across the continent's nations (Goldberg & Mercer, 2011). At the end of the 19th century, local administrations were responsible for planning land use and new developments in most countries (Cullingworth et al., 2006). Secondly, local governments acquired land, thereby converting it into public property. This allowed them to build housing for the poor, which directly contributed to the compact development of cities. Consequently, the public authorities assumed control of basic utility services, including water and energy provision, as well as transportation systems, a process known as municipal socialization(Radford, 2003). Finally, from the second half of the 20th century onward, the transition from complete public authorities to public intervention began in the most impoverished areas of cities, with the exception of urban renewal, as observed in the United States. As a result of these historical developments, the public's influence on urban development remains a fundamental component of the European city model(Carmona, 2021). The conclusion of the 20th century marked the initiation of these public controls over urban development. Public housing experienced a significant decline, leading to its privatization. We used the term 'Americanization of the European city' to describe the growing influence of globalizing economic actors and the sale of public services and land. (Calafati, 2012)asserts that the progressive paradigm shift of European cities established the European model of territory. This model was defined by the objective of polycentrism, which involved the preservation, enhancement, and balance of territorial organizations. As a result of the divergent dynamics and directions of urban development in various regions of the globe in the 21st century,

Cafalti's proposed idea faced challenges in maintaining European specificity. For instance, China and some other rapidly urbanizing and expanding nations prioritize the creation of new cities and the reconstruction of demolished areas, while the United States distributes urban development throughout the country. Finally, the European territorial model, which exerted a substantial public influence on urban development, necessitated a new urban governance system that reduced the influence of the territorial process in urban areas (Camagni & Capello, 2013; Castelnovo et al., 2016).

The Cities of Tomorrow Meeting presented numerous examples of the current issues facing Europe's urban governance system. For instance, they can categorize the issues as either territorial or sectoral. The sectoral problems, as argued by (Nevens et al., 2013), are imperfect responses from the government to market failures. The desire to improve individual mobility has resulted in the dismantling of public transportation in numerous European cities, among other issues. On the other hand, the territorial categories of problems are characterized by the emergence of significant conflicts between the wealthy suburbs and the less wealthy central cities in tax collection, the challenges of cross-regional cooperation, and the absence of a comprehensive approach to addressing all environmental issues.

In our case some of the problems are not concerning, for instance, in tax collection there is no conflict in this metropolitan region. But concerning sectoral problems integrating public transport in these urban areas are manifested. Also cross border cooperation problem is seen in this area. It has been distinguished two different meanings of Metropolitan areas, which are MUA and FUA (Cardoso & Meijers, 2017; Rozenblat, 2020). According to this analysis the 1st one is focusing on defining the continuity of the built up areas with a defined level of density, whereas the second one is on the wider urban system including towns and villages that are economically and socially highly dependent on a major urban center which is usually delineated on the basis of commuting flows. The author point of view shows that the dis repellency between the administrative definitions of cities and their size in reality are the present spatial and social dilemmas in the development of urban areas.

In our specific situation, these are the fundamental issues that are apparent in the planning region. Therefore, what is the solution that will facilitate urban development integration? By providing local public services with inter-jurisdictional residual effects, metropolitan-wide

programs can address these issues. Nevertheless, this is only feasible if a higher-level law mandates it or if the municipalities of the region collaborate (Tosics, 2010). The European Union initiated European research initiatives that addressed governance and yielded varying outcomes. The METRO Gov. Initiative URBACTS (2005-07) has determined that the new city-region cooperation period will follow the previous one. This investigation endeavors to define a cooperative model that is adaptable and incorporates both the formal administrative region and the city-region or planning region. The outcome, which the result, which is accompanied by a new emerging concept, illustrates the necessity and concurrent application of both approaches for development and transformation. They are essential for the establishment of robust territorial land use control systems and regulatory functions. Flexible boundaries are more suitable. This allows for modifications to be made to the hips of a companion (METROGOV). The NODUS working group (2008–10) offered strategies for the development of functional, larger urban areas in impoverished communities. This method establishes a connection between the enhancement of tiny, impoverished neighborhoods and the development of strategies for larger, functional urban areas. This approach advocates for a focused approach that recognizes the necessity of economic and social intervention, as well as the necessity of physical improvements in impoverished communities. Another research result, revealed by the PLURE project, the FP6 program (2007-11), focuses on the conflicts that arise between various development strategies in historically developing regions. In recent years, there has been a conflict between residential sprawl and industry, agriculture, and recreation in terms of the height of land and infrastructure utilities in European cities per urban area (Leontidou et al., 2007). The research group deliberated on three primary issues that pertain to the formal government system and planning policy regime's overall capacity to regulate land use changes. The next inquiry involved spatial planning. Lastly, there are mechanisms for taxation and financial management. In this research problem, the group identified a governance gap in decision-making, fragmentation between government entities, a lack of legal strength and capacity for cross-border coordination, and a lack of influence on infrastructure provision. The European Metropolitan Regions require pertinent policy responses to address emerging challenges, including the local government financing system, the local taxation system, sectoral policies, and infrastructure subsidies.

Innovative practices can improve territorial governance in urban areas. Develop a strategy that facilitates the organization of various perspectives on the origins of the issues into four distinct

perspectives on the operation of urban areas (Nijkamp & Kourtit, 2013). The initial strategy is to establish a formal, designated metropolitan governance model. The late 19th century saw the development of two primary strategies to foster collaboration in urban areas adjacent to major cities (Agranoff & McGuire, 2003). One of the strategies that were mentored was the structuring of predefined city regions with the objective of bolstering the metropolitan and regional levels. Similar to French urban communities,

Scandinavian countries compulsorily establish settlement associations (Bolzoni & Donatiello, 2018; Mis, 2016). In 2007, Denmark implemented a top-down initiative for marginal municipalities, which resulted in a reduction in the number of municipalities from 275 to 98, while their average size increased. In spite of the failures of direct democracy, there were instances in which the central government allowed the local government to reach a consensus on merging within a designated timeframe (Bardhan & Mookherjee, 2006). Although the central government's concept allowed for direct democracy's losses, it occasionally allowed the local government to reach a consensus on how to merge within a specified timeframe. Despite the central government's intention to enhance the efficiency of public welfare services, it was unable to achieve this objective due to the absence of direct democracy and the complete participation and willingness of the municipalities. Roads, railroads, and other modes of transportation not only serve as communication channels but also integrate a variety of energy and telecommunications.

Effective metropolitan infrastructure planning requires governance arrangements that correspond to the functional scale of the urban region; where administrative fragmentation is not matched by effective inter-jurisdictional coordination, infrastructure planning and service delivery can remain fragmented despite increasing functional interdependence. The main theoretical lesson is that functional integration requires an appropriate governance scale. When urban functions and infrastructure networks extend beyond municipal boundaries, metropolitan coordination mechanisms become necessary to overcome institutional fragmentation and ensure integrated planning and service delivery. This is directly relevant to Addis Ababa and Sheger because transportation, drainage, sewerage and solid waste systems have spatial and functional relationships that extend across their administrative boundaries. Therefore, metropolitan governance provides the institutional perspective needed to understand why integrated

infrastructure planning may be constrained and what governance mechanisms are required to improve coordination.

2.3.11 Strategic Tools for Integrated Infrastructure Planning

2.3.11.1 Strategic Tools for Integrated Sewerage System Planning

Integrated Water Management (IWM) frameworks, like Melbourne's and Singapore's, align sewerage with broader water management goals, promoting sustainability and efficient resource use. Advanced treatment technologies in cities like Tokyo and San Francisco enhance wastewater treatment and sustainability (Capodaglio et al., 2016). Public engagement, as seen in Copenhagen and Toronto, is crucial for effective policy development and community involvement.

In developing regions, capacity building and technical training are essential. Nairobi and Dhaka focus on improving local expertise through targeted training programs (Fukuda-Parr & Lopes, 2013; Kuyvenhoven, 2014). Community-based planning, implemented in Accra and Colombo, involves residents in managing sanitation and infrastructure (Andoh, 2016; Ratnayake, 2019). Resource mobilization strategies in Lagos and Jakarta address funding challenges, while integrating informal sector practices into formal systems(Omilusi, 2020), as done in Manila and Dhaka, is crucial for comprehensive sanitation coverage.

Although international experiences demonstrate the importance of integrated water management, technological innovation, public participation, technical capacity and resource mobilization in improving sewerage systems, limited attention has been given to how these elements are coordinated across administrative boundaries in rapidly expanding metropolitan regions such as Addis Ababa and Sheger. Effective integrated sewerage planning requires more than expanding sewer networks; it requires coordinated water management, appropriate technology, institutional and technical capacity, sustainable financing, and meaningful stakeholder participation.

2.3.11.2 Strategic Tools for Integrated Drainage System Planning

Advanced modeling and simulation tools are vital for effective drainage system planning (Bach et al., 2014; Lund et al., 2018). Cities like New York and Tokyo use these tools to analyze system performance and manage flood risks. Integrated Urban Water Management (IUWM) frameworks, adopted by cities such as Melbourne and Singapore, coordinate drainage with water

supply and wastewater treatment to enhance sustainability. Green infrastructure solutions, like those in Portland and Philadelphia, manage stormwater through innovative approaches like permeable pavements and green roofs (Dhakal & Chevalier, 2017; Hammitt, 2010). Public engagement and policy development, as practiced in Copenhagen and Toronto, are crucial for involving residents and ensuring effective policy implementation.

Capacity building and technical training are essential for improving drainage system management in developing regions (Fukuda-Parr & Lopes, 2013; Kuyvenhoven, 2014). Nairobi and Dacca focus on training programs to enhance local expertise. Residents in cities like Accra and Colombo are involved in managing and improving drainage systems through community based approaches. Resource mobilization and financial planning strategies in Lagos and Jakarta address funding challenges for infrastructure projects(Omilusi, 2020). Integration with informal sector practices in Manila and Dhaka helps incorporate informal activities into formal drainage systems, requiring supportive regulatory frameworks and collaboration.

Existing studies demonstrate the importance of technical modeling, integrated urban water management, green infrastructure, community participation, capacity building and financial planning for effective drainage management. However, limited attention has been given to how these tools and institutional mechanisms are coordinated across administrative boundaries in rapidly expanding metropolitan regions. The present study addresses this gap by examining the practice and challenges of integrated drainage planning between Addis Ababa and Sheger. Effective integrated drainage planning requires the combination of technical tools, integrated water-management approaches, green infrastructure, institutional capacity, community participation, appropriate regulation and sustainable financing.

2.3.11.3 Strategic tools for integrated solid waste management planning

Cities like New York and Tokyo use data analytics and GIS to enhance waste management (Aquino Ficarelli & Ribeiro, 2021; Vinodkumar, 2016). New York city's “smart waste” system and Tokyo’s GIS tools optimize waste collection and recycling through real-time data(Berglund et al., 2020; Majumder et al., 2021). Copenhagen's "climate plan" and Melbourne's "waste and resource recovery strategy" exemplify integrated waste management frameworks, aligning waste management with climate and urban policies. PPP in cities like Paris and Sydney drive innovation and efficiency in waste services through collaborations with private sector partners.

Technological innovations in Singapore and Seoul include smart waste systems and automated processing technologies to improve management efficiency.

Cities like Nairobi and Dhaka, where targeted programs develop local expertise, prioritize capacity building and training (Fukuda-Parr & Lopes, 2013; Kuyvenhoven, 2014). Community-based approaches in Accra and Colombo involve residents in waste management through local programs that enhance segregation and recycling efforts (Andoh, 2016; Ratnayake, 2019). In Lagos and Jakarta, resource mobilization and financial planning focus on innovative financing and budget management to support waste management infrastructure (Omilusi, 2020). In Manila and Dhaka, integration with the informal sector incorporates informal waste workers into formal systems to improve collection and recycling rates (Aparcana, 2017; Linzner & Lange, 2013).

Although international experiences demonstrate the potential of GIS, smart technologies, integrated policy frameworks, public-private partnerships, capacity building, community participation and informal-sector integration to improve solid waste management, limited attention has been given to how these dimensions are coordinated across administrative boundaries in rapidly expanding metropolitan regions. This study addresses this gap by examining the practice and challenges of integrated solid waste management planning between Addis Ababa and Sheger. Effective integrated solid waste management requires the coordinated application of spatial information, technology, institutional capacity, sustainable financing, community participation, private-sector engagement and informal-sector integration across the entire waste-management chain.

2.3.11.4 Strategic Tools for Integrated Transport Planning

Multi-modal transportation planning is crucial for integrating various transport modes (Haas, 2019; Liu et al., 2021). Cities like London and New York use multi-modal frameworks to improve efficiency and accessibility by coordinating buses, trains, cycling, and walking. ITS, as seen in Singapore's "Smart Mobility 2030" and Seoul's "smart traffic management system," utilize technology for traffic management and optimization. Integrated land use and transport planning, practiced in Melbourne and Copenhagen, aligns transportation with urban development to support sustainable growth. Public engagement and policy development are vital for effective planning, with Toronto and Amsterdam involving residents in shaping transport policies and infrastructure.

Capacity building and technical training are essential in developing regions. Through training programs, Nairobi and Dhaka focus on enhancing local transport planning skills (Fukuda-Parr & Lopes, 2013; Kuyvenhoven, 2014). In cities such as Accra and Colombo, community-based approaches involve residents in transport planning and project implementation (Andoh, 2016; Ratnayake, 2019). Resource mobilization and financial planning are critical for funding transport infrastructure, with cities such as Lagos and Jakarta exploring innovative financing options (Omilusi, 2020). Integration with the Informal Transport Sector, seen in Manila and Dhaka, involves incorporating informal operators into formal transport frameworks (Aparcana, 2017; Linzner & Lange, 2013).

The international literature provides considerable evidence on how individual cities use multimodal transport, ITS, land-use integration, public participation, capacity building and innovative financing. Limited empirical attention has been given to how these transport-planning tools and institutional mechanisms are coordinated across administrative boundaries in rapidly expanding metropolitan regions such as Addis Ababa and Sheger. The study addresses this gap by examining the actual practice, level of coordination, and challenges of integrated transportation planning between the two cities, rather than examining transportation planning within a single municipality. The main takeaway is that integrated transport planning requires more than connecting physical transport infrastructure; it requires coordinated transport modes, land-use development, technology, institutions, financing, stakeholder participation, and formal–informal transport systems

2.4 Conceptual Review

2.4.1 The Concept of Integrated Urban Infrastructure Planning

The conceptual framework is based on the assumption that the rapid expansion of Addis Ababa and the emergence of Sheger City have created an increasingly interconnected urban region in which infrastructure systems do not follow administrative boundaries. Transportation networks, sewerage systems, drainage, and solid waste management are spatially and functionally interdependent. Consequently, infrastructure planning undertaken separately by the two cities can create gaps, duplication, inefficiency, environmental problems, and unequal service provision.

The framework therefore considers urbanization, population growth, spatial expansion, land-use change, and increasing infrastructure demand as important contextual drivers of integrated infrastructure planning. These pressures generate the need for integrated physical infrastructure planning between the cities. The framework further recognizes that the effectiveness of integrated infrastructure planning is influenced by institutional and governance conditions, including institutional mandates, legal and policy frameworks, intergovernmental coordination, information sharing, financial capacity, technical capacity, and stakeholder participation.

At the planning level, integrated infrastructure planning practices constitute the central process of the framework. These practices include joint planning, cross-sectoral coordination, infrastructure network integration, shared data and information, coordinated investment, spatial planning coordination and joint implementation and monitoring. The framework distinguishes between three major dimensions of integration:

1. **Spatial integration**: - physical and functional connectivity of infrastructure systems across the Addis Ababa–Sheger urban region.
2. **Governance/institutional integration**: - coordination and collaboration between the institutions responsible for planning, financing, implementing, and managing infrastructure.
3. **Financial integration**: - refers to the coordination, alignment, mobilization, and efficient allocation of financial resources for infrastructure planning, implementation, operation, and maintenance across Addis Ababa and Sheger. It includes coordinated investment planning, cost-sharing arrangements, resource mobilization, joint financing mechanisms, revenue and resource sharing, public–private partnerships, and efficient and transparent management of infrastructure funds.

The framework also identifies major challenges and constraints, such as fragmented institutional responsibilities, administrative boundaries, weak legal frameworks, inadequate financing, limited technical capacity, poor data sharing, overlapping mandates, and insufficient coordination. These factors may weaken the effectiveness of integrated infrastructure planning. The outcome of the process is reflected in the level and effectiveness of integrated infrastructure planning, including improved connectivity, coordinated infrastructure investment, efficient service delivery, reduced duplication, improved environmental sustainability, and better management of urban growth.

Thus, the framework proposes that effective integration between Addis Ababa and Sheger requires both spatial/physical integration and institutional/governance integration. Neither dimension alone is sufficient to achieve sustainable metropolitan infrastructure development. The summary of lessons learnt from the literature review section of the research is presented below as the conceptual framework in Figure 2.1

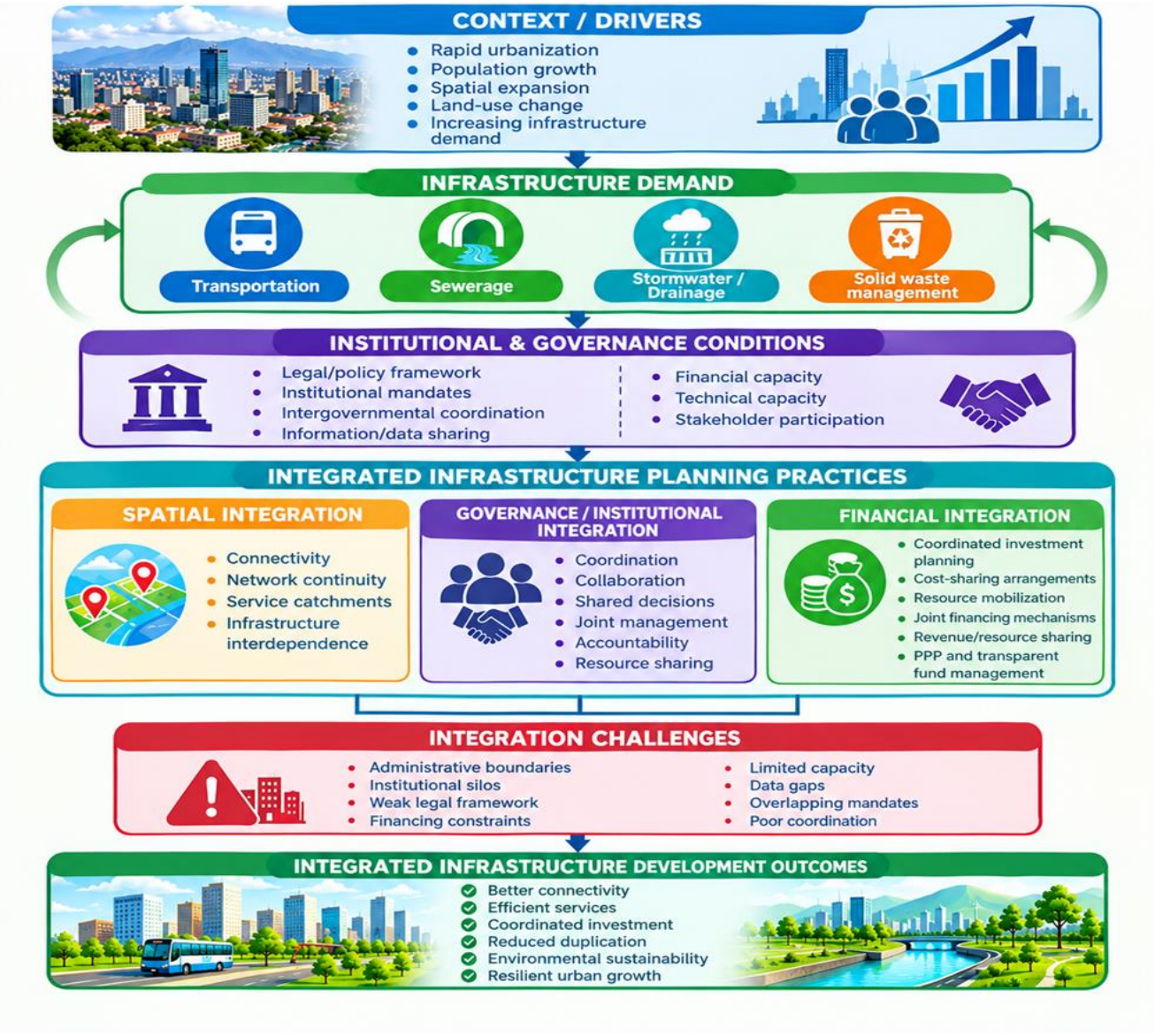

Fig. 2.1: Conceptual Framework of the Problem

Source: Own compilation

2.4 Research Gaps

While in Ethiopia many significant researches has conducted on urban governance and infrastructure planning, studies focusing on the interaction between Addis Ababa and Sheger City remain limited (Yilema & Gianoli, 2018; Abebe et al., 2020; Nigatu, 2024). Most existing literature examines urban challenges within individual cities or broader rural urban transitions without addressing the unique dynamics of neighboring metropolitan areas (Mohamed et al., 2020; OECD, 2020). This gap is particularly relevant given the increasing socio-economic integration of Addis Ababa and Sheger City. Additionally, the global literature on integrated planning often assumes governance systems with higher levels of decentralization and capacity than those present in Ethiopia. As a result, there is a need for context-specific research that examines the practices, challenges, and sustainable governance for integrated infrastructure planning in this study area.

There are several gaps in integrated infrastructure planning between Addis Ababa and Sheger metropolitan city, including lack of integration planning, a lack of coordinated policies, limited studies on governance structures, insufficient research on community involvement, under researched environmental and sustainability considerations, insufficient research on funding sources and financial models, and a lack of understanding of cultural and social factors. There is also a deficiency in geographic and spatial analysis, with only a handful of studies focusing on spatial planning practices and the connections between urban and rural areas (Cirolia & Harber, 2022; OECD, 2022; Mohamed et al., 2020). Finally, there is a lack of research on challenges and best practices in implementing integrated infrastructure planning, as well as gaps in monitoring and evaluation frameworks. Addressing these gaps is crucial for informed decision-making, improved planning, enhanced collaboration, and sustainable development.

CHAPTER III: RESEARCH METHODOLOGY

3.1 Study Area

3.1.1 Historical Background and Development of Addis Ababa

Addis Ababa, Ethiopia's capital, serves as its political, economic, and cultural hub, the location of numerous embassies and international organizations, and the seat of the African Union. Emperor Minilik founded, Addis Ababa, in 1889.

The spontaneous city growth model primarily guided the city's development, as it evolved organically without formal city planning practices and boasts rugged topography. Addis Ababa is the country's capital metropolis and the headquarters of numerous international organizations, embassies, the AU, and the ECA (Mitullah, 2020; Tessema & Haile, 2022). Only after the Italian occupation in 1935 did Addis Ababa introduce formal urban planning practices based on western traditions.

3.1.2 Geographical, Topographical and Climatic Characteristics of Addis Ababa

Addis Ababa experiences a subtropical highland climate with an average high temperature of approximately 23°C and an average low temperature of 11°C that remains consistent throughout the year (Bezu, 2020; Fazzini, Bisci, & Billi, 2015). Kiremt, the primary rainy season, spans from June to early October. Additionally, there is a brief period of rainfall known as Belg, which occurs between early March and mid-April. Nearly 80% of the annual precipitation occurs during the primary rainy season, with an average of approximately 1,200 mm.

It is geographically located in the heart of the nation, at 9o2’N latitude and 38o45’E longitude. Its average altitude is 2,400 meters above sea level, with the highest elevations at Entoto Hill to the north reaching 3,200 meters. This makes Addis Ababa one of the highest-altitude capital cities in the world.

3.1.3 Administrative and Demographic Characteristics of Addis Ababa

It is one of Ethiopia's two self-governing chartered cities, with the status of a special autonomous region within the national federal government system. Its council is accountable to both city

voters and the federal government. Urbanization in Addis Ababa is at its highest rate, with a population increase from 1,861,383 in 1991 to 4,793,699 in 2020. It covers a total area of 540 km2 of land, surrounded by a mountainous landscape.

Addis Ababa is experiencing the most rapid urbanization, with a population increase from 1,861,383 in 1991 to 4,793,699 in 2020. It is one of Africa's fastest-growing cities and a primate city in Ethiopia, with an estimated population of around five million, which is roughly 25% of the country's total urban population and more than ten times the size of Adama, the country's second-largest urban center (Taddese, 2017; Tadesse, 2023).

3.1.4 Urban Expansion and Relationship with Surrounding Towns

A number of towns, recently restructured as Sheger City, surround Addis Ababa. These towns, now called sub cities of Sheger City, include Sululta in the north-west, Lege Tafo-lege Dadi in the north-east, Sebeta in the south, and Dukem in the east.

It has emerged as one of the most rapidly expanding cities in Africa in recent years (Zewdie et al., 2018). Although this population growth initially stimulates an economic expansion, it ultimately poses obstacles (Kessides, 2006). In this regard, it is an extreme illustration of the economic dynamism and high demographic concentration that are characteristic of low-income country capitals (Demissie, 2013). Several inner-city renewal projects have been in progress since 2008, resulting in the demolition of substantial portions of the inner city and the displacement of their previous inhabitants (Zewdie et al., 2021).

3.1.5 Socio-economic Importance of Addis Ababa

Addis Ababa plays an essential role in Ethiopia's economy, hosting major industries, financial institutions, government offices, and international organizations (Mengistu, 2022). The city's economic activities contribute significantly to job creation, investment opportunities, and regional development. Because of its location and status, several people come to the city in search of employment opportunities and service. The city experiences an annual growth rate of two to four percent, with rural-urban migration accounting for roughly forty percent of this growth.

3.1.6 Infrastructure Development and Urban Challenges of Addis Ababa

Rapid population growth has created opportunities for economic development in the developing world, but it has also created social, environmental, and cultural challenges, leading to a mismatch between the demand and the supply of services. The government has been investing in various infrastructure development projects, such as transportation networks, water supply systems, waste management facilities, and energy supply infrastructure (Seife, 2019; Yilema & Gianoli, 2018). These initiatives are crucial for addressing urban challenges, enhancing livability, and supporting economic activities in the city. Its social and physical infrastructure has increased quantitatively in the past few decades, but it is still in need of significant improvement in terms of quality and distribution (Gebremeskel, 2020).

The government's strategies behind its extensive urban investments, which integrate the improvement of the urban environment with the creation of economic opportunities, especially for urban youth, have shown some promising results (Gebremeskel, 2020). However, we need to evaluate, modify, or replace the policies and strategies based on their contribution to alleviating the chronic problems of the city (Gebremeskel, 2020).

3.1.7 Establishment and Administrative Structure of Sheger City

Sheger city, a proposed urban development model, encircled Addis Ababa on October 22, 2022, with the intention of extending economic benefits and influence to other satellite communities. The administration, which is situated in the Saris area of Addis Ababa, is comprised of 12 sub-cities, 36 districts, and 40 rural kebeles.

3.1.8 Geographical and Climatic Characteristics of Sheger City

In general, the administration is located between latitudes 8°34′25″ and 9°32′41″N and longitudes 38°25′50″ and 39°07′53″E. The annual rainfall in the location under investigation ranges from 1043.87mm to 1316.6mm, while the temperature fluctuates between 10°C and 26°C.

3.1.9 Urban Development and Demographic Characteristics of Sheger City

It is a developing urban region that encompasses Addis Ababa and its environs, and it is undergoing significant urban expansion and population inflow (Abo-El-Wafa et al., 2017;

Mohamed et al., 2020). The Sheger Metropolitan Area is designed to support economic growth and urban livability by improving infrastructure, attracting investments, and accommodating the increasing population as part of Ethiopia's development plans. The city's present structural plan covers a total area of approximately 16,537 hectares.

3.1.10 Infrastructure and Urban Development Challenges of Sheger City

The Sheger Metropolitan area is confronted with a variety of challenges, including urban sprawl, environmental degradation, limited access to essential services in certain areas, and inadequate infrastructure to accommodate a growing population. Integrated planning and sustainable development strategies are necessary to confront these challenges.

3.1.11 Selection of Study Areas

3.1.11.1 Selection of Case Study Sub-cities

It was purposefully selected three sub-cities from the Sheger city due to their adjacency with Addis Ababa, namely Burayu, Sebeta/Furi, and Galan, as case study sites and the city Addis Ababa. It is experiencing significant population growth and urban expansion, leading to increased pressure on infrastructure and services. Examining the integration of planning processes and infrastructure investments across the Sheger Metropolitan Area provides insights into regional development dynamics and interdependencies.

3.1.11.2 Economic and Infrastructure Significance of the Selected Areas

In general, the researcher selected these cities because they are the economic powerhouses in Ethiopia and Oromia regions, are actively expanding their gray infrastructure to support the economy, and are experiencing rapid population growth, which is placing significant pressure on green spaces. Figure 1 shows the location of the study areas.

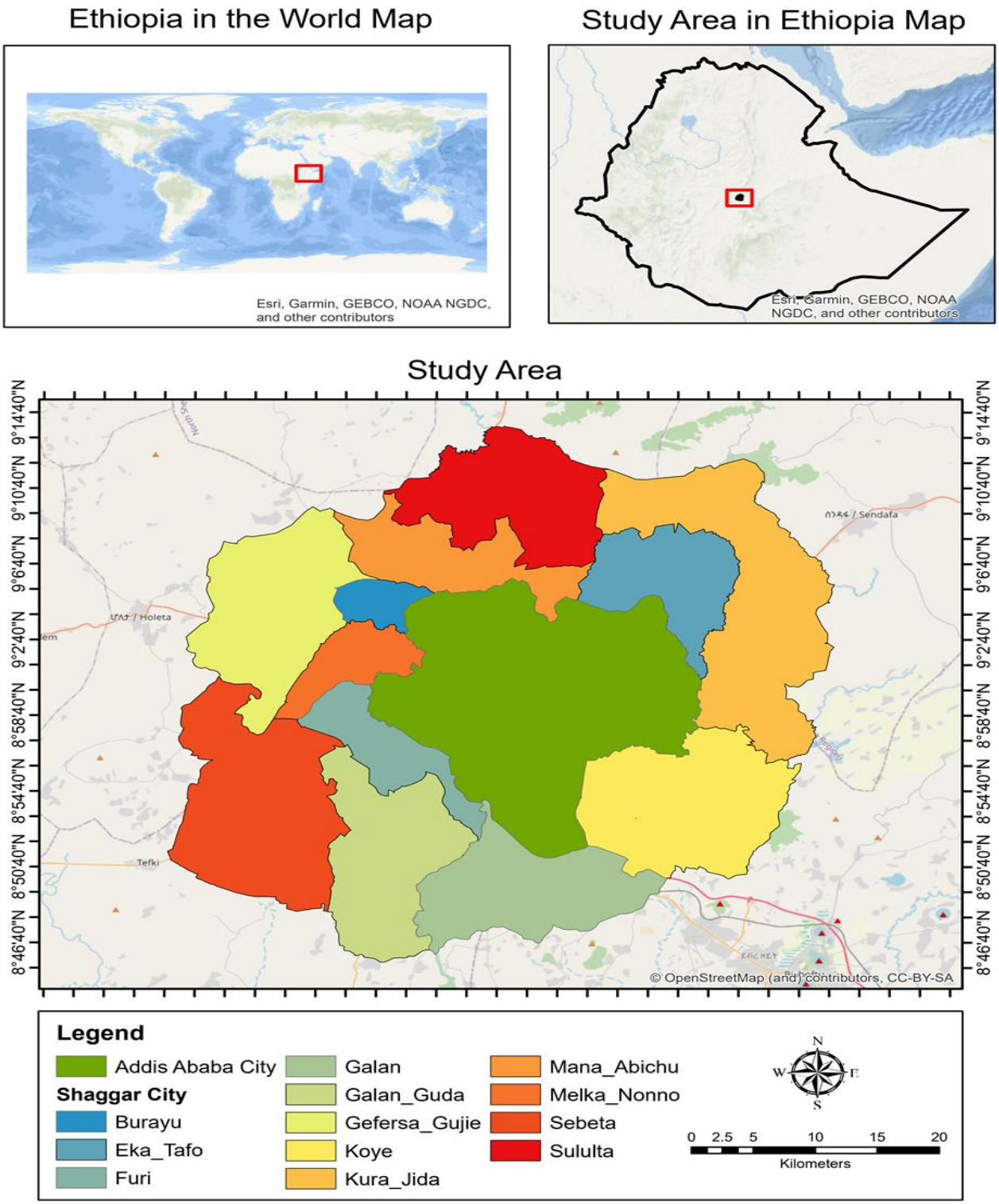

Fig. 3.1: Location map of the study area

Source: - Source: Author's GIS analysis, 2023.

3.2 Paradigm of Research

3.2.1. Philosophical worldview of the Research

In order to conduct sound research, it is necessary to disentangle the underlying philosophy and approach that align with the established objectives and produce data in a manner that is comprehensible to the researcher. The researcher conducted this research from a pragmatic philosophical perspective. The essence of pragmatism is its emphasis on the nature of truth. According to Given (2008), pragmatism maintains that truth is found in "what works" and is contingent upon the current circumstance.

The pragmatists adopt a philosophical perspective and situate their inquiry at the intersections of subjective and objectively held knowledge in order to comprehend the essence of reality (Given, 2008). With an epistemological justification and logic for combining approaches and methods, a pragmatist philosophy allows researchers to integrate perspectives and approaches (Johnson et al. 2007). In this regard, the current research endeavor, focusing on policy-related integrated infrastructure planning, aligns with a pragmatic approach that encourages the integration of both quantitative and qualitative methodologies through the use of mixed methods. The pragmatist position, according to McEvoy and Richards (2006), is based on the premise that neither quantitative nor qualitative methodologies are sufficient to produce a comprehensive analysis.

Pragmatists also considered critical realism, utilizing qualitative and quantitative research methodologies to comprehend social issues. One of the fundamental concepts of pragmatism is the essence of truth. According to given (2008), pragmatism posits that truth is found in "what works" and is contingent upon the current circumstance. Also, pragmatic philosophy provides a practical and outcome-oriented method of inquiry for the selection of methodological mixtures that can assist researchers in more effectively answering a significant number of their research questions (Johnson and Onwuegbuzie, 2004).

The critical realist approach is suitable for comprehending the fundamental issues of this research, as it examines the underlying mechanism and structure of the social issues and it is consistent with the principles of pragmatism. The research asserts that social mediation mediates the governance issues influencing the integration of infrastructure planning and subsequent policies and intervention strategies, and that social construction shapes infrastructure, its integrated planning, and management. From a critical realist perspective, this research recognizes that a multitude of interrelated issues embedded in society, institutions, and individuals lead to the the integration of infrastructure planning.

In accordance with pragmatic philosophy, this investigation regards urban planning as a field that endeavors to establish superior cities by enhancing processes, theories, and practices. It concentrates on issues that are pertinent to our urban existence and offers tangible solutions (Flyvbjerg, 2001). Finally, this study adds to the fields of urban planning and social science, especially sociology, by making it easier to talk about and problematize the ways that integrated infrastructure planning principles, policies, and strategies are put into practice through the use of governance approaches.

3.3 Research Design and Approaches

The research design model, consisting of the philosophical worldview, inquiry strategy, and research methodologies, was used (Al-Ababneh, 2020; Cresswell, 2013; Kivunja & Kuyini, 2017) in this study to assess the practice and challenges of integrated urban physical infrastructure planning and management in targeted regions. The research used a mixed-method research approach, combining quantitative and qualitative research methods, an explanatory sequential design, and a descriptive research design.

The explanatory sequential design collected quantitative data, analyzed the results, and used the results to plan the second qualitative phase (Baheiraei et al., 2016; Berman, 2017; Bowen et al., 2017). The descriptive design provided a detailed explanation of the initial quantitative results. The research focused on collecting, analyzing, and integrating both quantitative and qualitative data to gain a comprehensive understanding of the research problem (Almalki, 2016; Bryman, 2017; Taherdoost, 2022; Vogt et al., 2014).

Purposive sampling was used to identify four distinct areas and cases, each representing a unique form of urban physical infrastructure (Antwi-Afari, 2021; Fuseini & Kemp, 2016; Giyarsih &

Marfai, 2018; Mbusya, 2013). The research used a combination of FGDs and KIIs to enhance the robustness and richness of the data acquired, facilitating a thorough comprehension of the research topic (Cataldo & Kielmann, 2016; Ngure, 2021).

3. 4 Sources of Data

The data for this study were collected from primary and secondary sources. The primary sources were collected from Municipality, Water and Sewerage Authority, Road Authority, Planning Commission, and Transport Bureau of the study area. These three sets of data were collected from waste management systems, drainage and sewerage systems, and transport and road network systems. The secondary data was collected from reports, liteartures (published arcticles), from research findings, books, review articles, and field observations.

3. 5 Sampling Design

The study employed a non-probability sampling method to collect data from 257 experts working across five critical urban infrastructure sectors in Addis Ababa and three selected sub cities (Burayu subcity, Galan subcity, and Furi subcity) of Sheger city, as shown in Table 3.1 below. The human resource report of Addis Ababa and the subcities of Burrayu, Galan, and Furi in Sheger city indicate that 980 experts or professionals are relevant to the research topic. This approach allowed the researchers to focus on individuals with specialized knowledge and expertise in transport and road networks, waste management systems, and drainage and sewerage systems. The sampling frame consisted of the entire population of experts in the selected sectors, ensuring the inclusion of only qualified individuals with relevant educational backgrounds and professional experience.

The study used a convenient sampling technique to select participants from each sector, highlighting their professional relevance and contributions to integrated infrastructure planning. This deliberate selection process ensured the inclusion of those most capable of providing comprehensive and reliable data(Etikan & Bala, 2017; Lohr, 2021). Furthermore, the targeted selection allowed for efficient data collection, avoiding the unnecessary sampling of individuals with limited knowledge of the subject matter.

3.5.1 Sample Population

The study focused on a sample population of 257 experts working across five critical urban infrastructure sectors in Addis Ababa and three selected subcities of Sheger city: Burayu, Galan, and Furi. The human resource report from these areas indicated that a total of 980 professionals were relevant to the research topic. The selection process prioritized individuals with specialized knowledge and expertise in transport and road networks, waste management systems, and drainage and sewerage systems. The sampling frame included the entire population of experts in the selected sectors, ensuring that only qualified individuals with appropriate educational backgrounds and professional experience were included.

Additionally, the study incorporated qualitative data collection methods, involving Focus Group Discussions (FGDs), Interview and key informant interviews (KIIs). The FGDs included a total of 90 participants drawn from diverse population segments, such as community representatives, technical experts, and local authorities. Similarly, 50 informants were selected for interviews and 12 KIIs to gain in-depth insights into integrated infrastructure planning.

3.5.2 Sample Size

The study employed a sample size of 257 respondents for the quantitative data collection, distributed across various sectors and study areas. Table 3.1 provides a detailed summary:

Table 3.1: The number of respondents from different sectors responded for the questionnaires

No	Sectors	Study Areas				Total
		Addis Ababa	Burayu	Galan	Sabata/Furi	
1	Water and Sanitation Authority	18	11	10	9	48
2	Road Authority	36	11	11	11	66
3	Transport sector	14	10	12	13	52
4	Plan & Development Bureau	35	-	-	-	35
5	Municipality	14	12	9	12	47
	Total	118	46	46	47	248

Source: survey, 2022

For qualitative data, the study organized FGDs with 90 participants, in which each group of FGD consists of 10 participants ensuring representation from Addis Ababa and different sub cities.

Based on this, there were 3 groups of FGD in Addis Ababa and 2 groups in each sub cities of Sheger cities. Additionally, 12 KIIs and 50 informants were interviewed to complement the findings from the FGDs and questionnaire responses. These participants included government officials, urban planners, engineers, community representatives, and other relevant stakeholders.

The number of FGDs conducted in the study areas is shown in Fig. 3.2

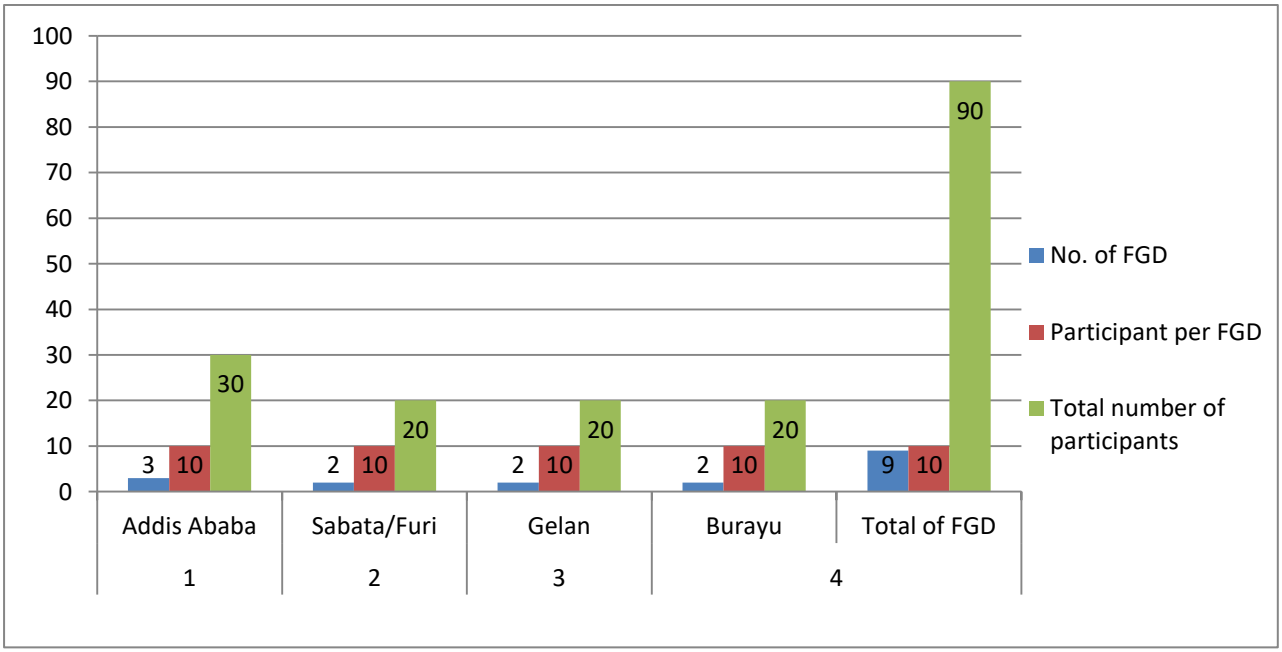

Fig.3. 2: number of FGDs conducted in the study areas

Source: survey, 2023

3.5.3 Sampling Technique

The study employed a non-probability sampling method, specifically purposive sampling techniques, to select participants. The use of convenient sampling allowed for the selection of participants based on their availability keeping the profession of the respondents is also related to the research topic. This ensured the inclusion of experts capable of providing comprehensive and reliable data.

Purposive sampling was used to target individuals with specialized knowledge and expertise in the research domains. This approach enabled the researchers to focus on individuals who could offer meaningful insights into integrated infrastructure planning. By deliberately selecting respondents, the study avoided the unnecessary inclusion of individuals with limited knowledge of the subject matter, thus enhancing the efficiency and depth of data collection.

FGDs were organized following the recommendation that each session should not exceed 10 participants. A total of 90 participants were divided into groups representing diverse population segments. The distribution of FGDs across the study areas is illustrated in Figure 3.3. Similarly, the selection of 50 informants for interviews ensured a manageable and in-depth exploration of the research topic, targeting community leaders, policymakers, urban professionals, and other relevant stakeholders, as shown in Figure 3.3.

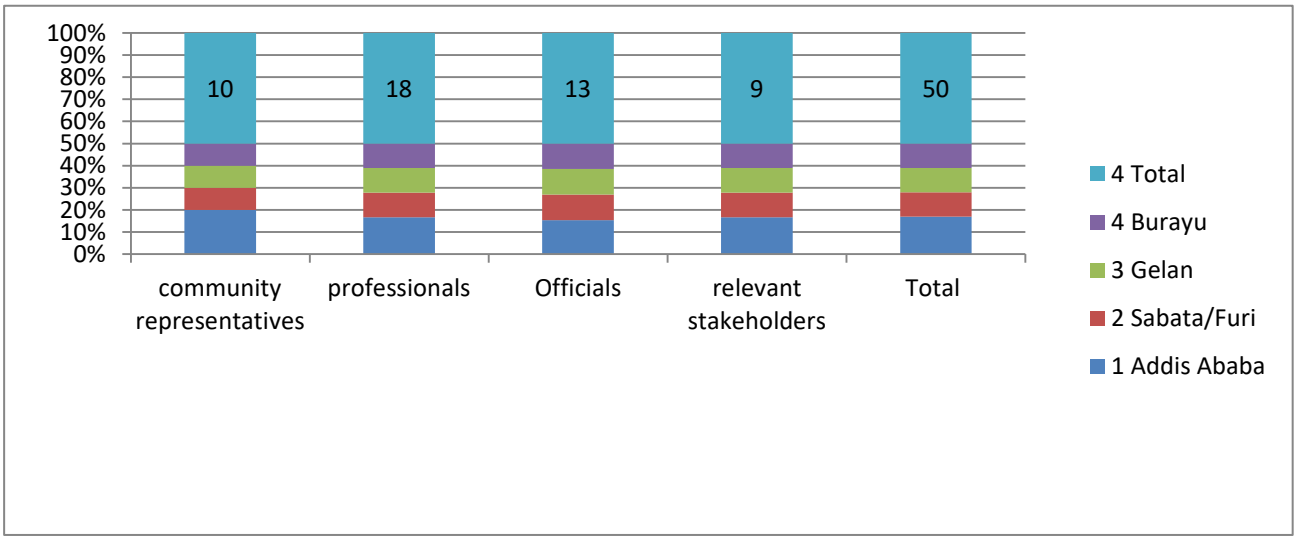

Fig. 3.3: Number of informants for interview
Source: survey, 2023

3.6 Methods of Data Collection

This study employed a mixed-methods approach to gather comprehensive data on integrated infrastructure planning between Addis Ababa and Sheger City. Both qualitative and quantitative methods were used to ensure a balanced understanding of institutional practices, community perspectives, and governance challenges. Key data collection tools included questionaries', pilot test, focus group discussions, interviews, field observations, and document reviews. These methods allowed for triangulation and validation of findings from multiple sources.

3. 6.1 Questionnaires

The questionnaire surveys were the most critical component of the fieldwork that occurred during the summer of 2023. This study implemented the "formal standardized questionnaire

method" in conjunction with other data collection methodologies. The primary objective of the expert survey was to acquire a deeper understanding of the planning of integrated infrastructure. The researcher distributed survey questionnaires to 257 purposefully selected and pertinent professionals in the five sectors of the study area. With the help of the data collectors, the researcher made significant efforts to ensure accurate completion and return of all questionnaires. The questionnaires consist of both open-ended and closed-ended queries in order to collect additional information regarding the knowledge gap. As part of a retrospective data-gathering strategy, the researcher was collecting current information. The initial stage consisted of the preliminary data collection and pre-survey preparation. Before the full-scale administration, the study verified that the queries were substantively significant, logical, and appropriate. The study involved 20 graduate students from various universities, who conducted data collection over a two-month period. The researcher conducted the investigation in two phases. The initial stage consisted of the preliminary data collection and pre-survey preparation. Before the full-scale administration, the researcher verified that the queries were substantively significant, logical, and appropriate. In conclusion, in total, the study disseminated questionnaires to 257 experts, and the study was able to collect 248 (96.5%) of them. Selected professionals with expertise in urban infrastructure planning comprised the cohort. In order to expedite the process of contacting respondents, researchers implemented convenience and snowballing sampling methods after determining the total number of respondents.

3. 6.2 Pilot Test

It was crucial to test and refine the questionnaire draft. The study first tested the questionnaires at the pilot level to ensure they aligned with the research objectives before distributing them to the targeted sample population. Next, the study distributed the questionnaires to the selected target groups.

The study to modified or delete questions, such as those asking respondents' views on political issues that the researcher anticipated would make respondents uncomfortable to respond to. Another benefit of the pilot was to demonstrate the importance of personal contact with respondents, which enhances the response rate in a relatively short period of time.

3. 6.3 Focus Group Discussions

The study areas used the FGDs to investigate various aspects of the challenges in integrated urban infrastructures, including experiences, attitudes, practices, and even testimonies. The study areas hosted both homogeneous and heterogeneous FGDs. Homogeneous FGDs involved different groups of people to represent a diverse cross-section of government officials, urban planners, engineers, and community representatives from the two metropolitan cities. Stakeholders were participated in heterogeneous FGDs.

3. 6.4 Interviews

This study utilized structured and semi-structured interviews and KIIs to gather data on integrated infrastructure planning. The research conducted the interviews on-site and in office, with permission, recorded them using an audio recorder to ensure accuracy and detail(Akyıldız & Ahmed, 2021; Hofisi et al., 2014). The study researcher conducted interviews with key stakeholders, officials, and community representatives and KIIs with officials and selected proffecinals to understand the challenges of integrated infrastructure planning in the study area. The study conducted the interviews in the study area, each lasting an average of 35 minutes. The interviews were focused on the city's policies, strategies, legal frameworks, challenges, and coping mechanisms.

3. 6.5 Field Observation

The study researcher utilized a methodology similar to, which involved extensive participant observation. The researcher conducted these observations using a camera and short notes to investigate and assess existing integrated infrastructure planning problems arising from poor integration, planning, and management, thereby providing a visual representation of the identified challenges.

3. 6.6 Documents Review

The study used secondary data in this study to develop information on legal and policy frameworks, reports, infrastructure development trends, and other critical data. As a result, we gathered secondary data from a wide variety of sources, such as academic journals, books,

published and unpublished documents, government policy documents, proclamations, and statistical data. The study collected the data from the documents listed in Table 3.2.

Table 3.2: Different documents reviewed in this research

S/N	Different documents	level of government	Year	Benefits of the Document
1	Urban Planning manuals	National	2015	To get insight the existing situation of integrated infrastructure planning of Ethiopian cities
2	National Urban Development Spatial Planning	National	2016	To review the content, policy direction and existing situation of Urban Development Spatial Planning
	Addis Ababa master plan	Addis Ababa	1986-1995	To review the content and the situation of infrastructure planning
3	Addis Ababa Master Plan Preparation Proclamation No. 17/2004	Addis Ababa	2004	To review the contribution of the Proclamation for legal frame work
4	The Urban Plan Proclamation No. 574/2008	National	2008	To review the contribution of the Proclamation for legal frame work
5	Addis Ababa master plan	Addis Ababa	2000-2006	To review the content and the situation of infrastructure planning
6	Addis Ababa structure plan	Addis Ababa	2017	To review the content and the situation of infrastructure planning
7	Sectoral yearly plan	Addis Ababa & Sheger	2015- 2025	To review the adequacy of human, financial and technological resources
8	AA city draft sewerage plan	Addis Ababa	2023	To review the content and the situation of sewerage plan
10	Transport policy of Addis Ababa	Addis Ababa	2011	To review the contents and direction of the policy
11	National transport policy	National	2020	To review the contents and direction of the policy
12	Centeral statistical Agency	National	2007	To get statistical data about poplation, infrastructure and etc

Source(s): document survey, 2023

3.7 Techniques of Data Analysis

The data were edited, coded, classified, and encoded into a computer for analysis using Microsoft Excel, ArcGIS, and Statistical Package for Social Science Version 26. The researcher analyzed the qualitative data using thematic content analysis. First, the researcher transcribed and organized the interview, open-ended questionnaire, FGD, and field-observation data. The researcher then read and re-read the transcripts to become familiar with the data. The researcher identified meaningful statements and assigned initial codes. Similar codes were grouped into categories, and related categories were developed into broader themes based on the research objectives and recurring patterns in the data. The researcher I then compared the themes across Addis Ababa and Sheger City and across the different infrastructure sectors. Finally, the researcher interpreted the themes and triangulated them with the quantitative survey results, field observations, GIS/CAD analysis, and documentary evidence. The results were presented using narrative descriptions, thematic summaries, and supporting quotations.

The study thoroughly read and re-read the transcripts and field notes to become deeply familiar with the content. The researcher structured the final report around the identified themes, incorporating supporting quotations and narrative summaries to illustrate each theme. The study presented the analyzed data in tables, incorporated GIS and CAD figures, and conducted field surveys.

In a non-numerical format, the researcher analyzed and presented qualitative data, which encompassed words, ideas, expressions, and phrases, obtained from interviews, open-ended questionnaires, and field observations. Initially, the researcher converted these data into text and subsequently categorized them according to the frequency of ideas. Subsequently, the researcher reorganized them into more extensive themes and conducted content analysis.

The study employed descriptive and inferential statistics to make sense of the numerical data from the questionnaires. The researcher used statistical techniques like frequency distribution to describe, present, and interpret the collected data.

3.8 Methods of Data Presentation

Tables, graphs, and charts, are employed to present the analyzed data. The GIS and CAD figures, as well as photos from the field survey are presented as evidences.

3. 9 Validation

The study were carefully prepared and reviewed the questionnaires to ensure the quality of the research instruments, and then conducted pilot tests at the study area to verify the applicability and workability of the data collection tools. The study revised and refined the questions based on the feedback. Additionally, the data collectors received training prior to the commencement of data collection. The study deployed twowenty first-degree graduates whose educational backgrounds aligned with the current research to collect data.

Afterwards, the study supervised the data collectors closely. The study encoded each piece of data into the SPSS software. Finally, to maintain consistency and control over the caliber of the data gathered, the researcher conducted the FGDs and KIIs alone.

3.10 Ethical Consideration

The study followed rigorous ethical standards to ensure its integrity and the protection of all participants in the research. The participants were transparently informed about the research objectives, ensuring their participation was voluntary and obtained consent. They prioritized confidentiality and privacy, ensuring anonymized information and secure data storage. The study aimed to minimize physical, emotional, and psychological harm to participants, and conducted communication fluently in both Amharic and English. The study was conducted the without conflict of interest, presenting findings objectively and free from bias. The study's purpose was to advance knowledge in integrated infrastructure planning, and the researcher provided background information to establish the authenticity and credibility of the findings.

CHAPTER IV: RESULTS AND DISCUSSION

4.1 Demographic Profile and Response Rate of Respondents

4.1.1 Demographic Profile

Table 4.1 presents the demographic and professional profile of the respondents who participated in the study on the practices and challenges of integrated infrastructure planning between Addis Ababa and Sheger City. Since the study employed an expert-based survey, the respondents were selected from institutions and professional groups directly involved in infrastructure planning, development, management, and implementation. The respondents were drawn from the Water and Sanitation Authority, Road Authority, Transport sector, Plan and Development Bureau, and Municipalities, and included civil engineers, water engineers, sanitary engineers, environmentalists, transport engineers, transport planners, urban planners, architects, and urban managers serving in different professional and managerial responsibilities. The distribution of respondents across Addis Ababa and the selected Sheger city sub-cities Burayu, Galan, and Furi provides representation from both sides of the metropolitan interface. This professional and institutional diversity was considered important for obtaining informed perspectives on the coordination, integration, implementation, and challenges of infrastructure planning across administrative boundaries. The table therefore provides the basis for understanding the professional composition and institutional representation of the respondents whose views were subsequently analyzed in relation to the objectives of the study.

Table 4.1: Demographic profile of respondents

No	0ffice	Profession	Responsibility	Frequency				Total
				Addis Ababa	Burayu Sub city	Galan Sub city	Furi Sub city	
1	Water and Sanitation Authority	Civil Engineer	Team leader	4	2	2	2	51
		Water Engineer	Quality Assurance	8	4	4	4	
		Sanitary Engineer	Director	4	3	3	3	
		Environmentalist	professional	2	2	2	2	

2	Road Authority	Civil Engineer	Director	22	6	6	6
		Highway Engineer	Team leader	10	3	3	3
		Electrical Engineer	Team leader	4	2	2	2
3	Transport sector	Transport Engineer	Director	3	1	1	3
		Transport planner	professional	7	4	4	4
		Management	Team leader	5	7	7	6
4	Plan and Development Bureau	Urban Planner	professional	18	-	-	-
		Architect	professional	6	-	-	-
		Urban Manager	Director	11	-	-	-
5	Municipality	Urban Manager	professional	4	6	6	6
		Planner	professional	3	3	3	3
		Environmentalist	professional	7	3	3	3
	Total		Team leader	118	46	46	47

Source: survey, March, 2023

4.1.2 Response Rate

Table 4.2: Response Rate

No	Office	Area of respondents				Distributed questionnaires	Returned questionnaires	%
		Addis Ababa	Burayu	Galan	Furi			
1	Water and Sanitation Authority	18	11	11	11	51	48	94.1
2	Road Authority	36	11	11	11	69	67	97.1
3	Transport sector	15	12	12	13	52	52	100
4	Plan and Development	35	-	-	-	35	35	100
5	Municipality	14	12	12	12	50	46	92
	Total	118	46	46	47	257	248	96.5

Source: Expertise survey, March, 2023

4.2 The Practices of an Integrated Infrastructure Planning

4.2.1 Practice of Urban Sewerage system

4.2.1.1 The existing sewerage infrastructure and the level of physical and institutional integration

This assessment was undertaken through a combination of document and plan review, field observation, GIS-based spatial analysis, and consultation with relevant water and sanitation authorities and professionals. Existing sewerage networks, trunk lines, treatment facilities, service areas, and their spatial connections across Addis Ababa–Sheger interface were examined to determine whether the sewerage systems of the two cities were physically connected and planned or managed as a single integrated system.

The GIS analysis and field observations were particularly used to examine the spatial distribution and connectivity of sewerage infrastructure, while institutional and planning documents were reviewed to determine whether there were common plans, coordinated investment arrangements, institutional responsibilities, and mechanisms for joint sewerage management between Addis Ababa and Sheger City. The assessment established the existing condition of sewerage integration and identified the absence or limited extent of an integrated sewerage system across the study area. Following this assessment, the study used questionnaires and interviews with relevant professionals to investigate the underlying reasons for the identified gap, including institutional, legal, financial, technical, planning, and coordination-related factors.

Thus, the analysis followed a two-stage process: (1) verification of the existing level of sewerage integration, and (2) investigation of the reasons underlying the identified absence or inadequacy of integration. This approach helped ensure that the reasons reported by respondents were examined in relation to the actual infrastructure and institutional conditions observed in the study area.

The existing sewerage infrastructure in Addis Ababa and the Sheger has not evolved over many decades. Initially designed to cater to a smaller population, the sewer systems have become increasingly inadequate due to rapid urbanization and population growth. The infrastructure primarily comprises a mix of centralized and decentralized systems, including septic tanks, pit

latrines, and limited sewer networks. The following maps show the landscape of the sewerage lines connecting the city regions to the treatment facilities.

4.2.1.2 The Reason of Absence of Integrated Sewerage System

Fig. 4.1: Maps of the fellow of sewer direction

Source: Source: Author's GIS analysis, 2025.

The absence of an integrated sewerage system between Addis Ababa and Sheger City can be attributed to a combination of historical, institutional, technical, and financial factors. Primarily, Addis Ababa is the only city in Ethiopia with an established sewerage infrastructure, which itself remains limited in coverage and capacity. Field observations also reveal that there is no integrated sewerage system between Addis Ababa and Sheger City. Addis Ababa stands as the only city in Ethiopia with a functioning sewerage system. However, even within Addis Ababa, sewerage coverage remains limited serving only a fraction of the total population. The existing sewer lines are primarily concentrated in the central and inner parts of the city, with the main trunk sewer lines directing wastewater toward the Kality Wastewater Treatment Plant, located in the southern periphery of the city. Peripheral areas, particularly those expanding toward the

Sheger boundary, often rely on on-site sanitation systems such as septic tanks and pit latrines, indicating that the infrastructure does not extend far enough to support inter-city integration.

In contrast, Sheger City, having been established recently, lacks a formal sewerage system altogether. This disparity creates a substantial barrier to integration, not only in terms of physical infrastructure but also in institutional and technical capacity. Sheger's current state of infrastructure development does not support the planning, implementation, or maintenance of a centralized sewer system, let alone a coordinated system with a major urban center like Addis Ababa.

This gap in integration poses significant challenges, particularly in fast-growing peri-urban zones along the administrative boundary, where poor sanitation systems threaten public health and environmental safety. Addressing this issue requires strategic planning and coordination. One approach is the creation of a metropolitan-level sanitation framework, supported by both cities. Such a framework should include joint technical assessments, co-financing models, shared responsibilities for sewerage services, and clearly defined roles among relevant institutions.

In conclusion, while there is currently no integration of sewerage systems between the two cities, there is strong potential for coordinated development. Success will depend on deliberate inter-municipal collaboration, infrastructure investment, and the political commitment to build a shared urban future that prioritizes public health and environmental sustainability.

Moreover, the survey data also indicates that respondents (85.7%) in the study areas indicated that there was no integrated sewerage system between the two cities under study, as revealed in Table 1 below.

Table 4.3: The reason for absence of integrated sewerage system

S/N	Issues	Frequency	percentage
1	Lack of agreement between the cities	60	24.18
2	Boundary disputes	33	13.3
3	Lack of a compensation mechanism	49	20
4	Lack of a legal framework	106	42.7

Total	248	100

Source: survey, 2023

The findings suggest that the lack of an integrated sewerage system between cities has serious implications for public health, environmental sustainability, and regional development. Key obstacles such as boundary disputes, absence of compensation mechanisms, and lack of a legal framework hinder collaborative infrastructure projects (Kliot et al., 2001; Wehrmann, 2008). This can lead to inefficient waste management, increased pollution, and strained inter-city relations, highlighting the need for cohesive policies and legal framework to support sustainable urban development

The issue of lack of sewerage integration between urban centers, as reported by the respondents, aligns with findings from various studies across both developing and developed countries (Andersson et al., 2016; TuCCi, 2008). Similar issues emerged in a Lagos, Nigeria, study, where municipalities struggled to integrate sewerage disposal due to a lack of cohesive planning frameworks and institutional cooperation (Aiyewunmi, 2023; Wahab, 2012). The findings of the present study are consistent with studies who noted the absence of an integrated sewerage disposal site, pointing to complex barriers that make inter-city coordination challenging. Findings from Southeast Asian cities (Duc et al., 2024; Nicolaisen, 2023) repeat the structural and political challenges in developing such systems, including the absence of agreement among cities. For instance, historical disputes or unclear jurisdictional delineations in Latin America often lead to boundary-related conflicts in many metropolitan areas (Anebo, 2016; Mumme, 2023). Additionally, inadequate compensation mechanisms can inhibit waste management initiatives, as affected communities and municipalities often demand assurances of equitable resource allocation and compensation (Swallow et al.). From all, the absence of a legal framework is crucial for successful inter-city infrastructure projects, as it provides guidelines, standards, and enforceable measures for collaboration. In Kenya, legal ambiguities in environmental and sanitation policies have led to stalled waste management initiatives between cities (Muriithi, 2022; Muthama, 2021). The absence of a legal structure may exacerbate existing disputes and complicate resource allocation, further delaying essential infrastructure development. The following Fig 4.2 and 4.3 show the treatment plant in the city.

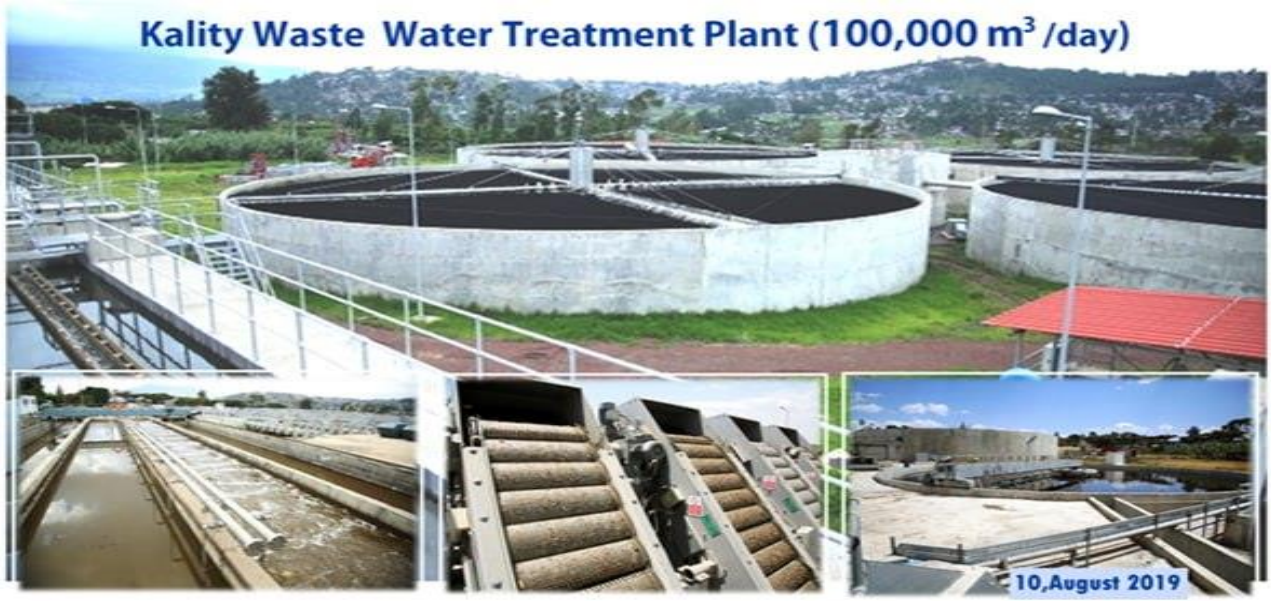

Fig. 4.2: Kality wastewater treatment plants

Source: Feld survey, 2024

Fig.4.3: Kaliti wastewater treatment process

Source: Feld survey, 2024

4.2.1.3 Impact of Shared Sewerage disposal site on Waste Management and Health

According to the study, (27.4%) stated that there is a common sewerage disposal area, while (69.1%) stated that there is no such common disposal site. The result suggests that the majority (69.1%) perceives an absence of a shared disposal site, indicating potential challenges in waste management and environmental health due to fragmented disposal practices. This lack of a unified system can lead to increased pollution, inefficient resource use, and possible health risks for surrounding communities (Daley et al., 2015; Keraita et al., 2003). Establishing a common disposal site could improve coordination and promote sustainable waste management across the cities involved. According to data from AAWSA, the sewerage infrastructures currently covers only approximately 39% of the city and lacks connectivity with other urban infrastructures or the Sheger metropolitan area and only have $19m^3$ capacity per day. Only three treatment plants currently serve the city, despite their availability. One of the Kalati treatment facilities serves the Koyefeche subcity, a recent addition to the city from Addis Ababa to Sheger city. According to the researcher's interview, the city administration is actively addressing these challenges by initiating projects to expand the sewer network and upgrade treatment facilities, with the goal of delivering more comprehensive and efficient wastewater management services. Currently, it covers only a fraction of the metropolitan area.

The majority of respondents indicated the absence/inadequate of a common disposal site, which is consistent with other rapidly urbanizing regions where waste management infrastructure often lags behind population growth, like in Dhaka, Bangladesh (Cele, 2018). The minority reported the existence of a common disposal site, potentially due to isolated efforts by certain neighborhoods or sectors, consistent with similar patterns observed in Jakarta, Indonesia (Lalasati, 2022; Paramita, 2019). The lack of inter municipal coordination and planning may also contribute to confusion and inefficiency in waste management, which is consistent with studies in metropolitan areas like Mumbai, India(Raju et al., 2018; Sarpotdar, 2021; Slack, 2019).

4.2.1.4 Institutional Challenges to Inter-Municipal Sewerage Planning and Coordination

The findings of the study showed that only 14.3% of respondents believe the institutional mandate allows cooperation with equivalent institutions, while 82.2% believe it does not, highlighted a significant systemic barrier to collaborative efforts. This result underscored the restrictive nature of institutional mandates and their impact on inter-institutional collaboration. The lack of

cooperation is likely to hinder knowledge sharing, resource pooling, and coordinated actions, all of which are critical for addressing complex, cross-disciplinary challenges. This finding signals the need for structural reforms to institutional frameworks to promote collaborative governance.

The results align with the study's objective of examining institutional constraints on cooperation. The overwhelming response indicating a lack of cooperative mandates validates the objectives those structural barriers within institutions significantly limit collaborative potential (Arakpogun et al., 2020; Harris-Lovett et al., 2018). These findings highlight the consistency between the data and the research framework, affirming the internal validity of the study. The clear majority response also strengthens confidence in the reliability of the survey design. When compared to similar studies globally, these findings reveal both parallels and distinctions. In many countries, institutional mandates often limit collaboration due to jurisdictional conflicts or rigid governance structures (Ananda & Proctor, 2013; Margerum, 2011). For instance, studies on inter-agency cooperation in disaster management frequently cite similar constraints. However, the high percentage (85.7%) indicating a lack of collaborative mandates in this study may reflect unique local governance issues that are more pronounced than in other regions. These results contribute to a broader understanding of how institutional frameworks influence collaboration across different contexts.

This study highlights the role of institutional mandates in fostering collaboration and provides a framework for assessing their impact on cooperation. It offers valuable insights for policymakers and institutional leaders. Despite its contributions, the study has limitations. The reliance on survey data from a limited group of respondents may not fully capture the diversity of perspectives on institutional mandates. Additionally, the study does not delve into the specific reasons why mandates are restrictive, such as legislative, cultural, or operational factors. Future research should use qualitative methods, comparative studies across regions, and longitudinal research to understand the underlying causes of restrictive mandates and the impact of policy reforms on inter-institutional collaboration.

4.2.1.5 Existing Frameworks for Integrated Infrastructure Planning

The finding that only 25.2% of professionals confirmed the existence of procedures, regulations, or legal conditions for collaborative initiatives, while the majority (71.4%) indicated their

absence, highlights a critical gap in the regulatory frameworks needed to support collaboration. This indicates systemic weaknesses that hinder the facilitation of cooperative efforts. The absence of such frameworks limits the ability of institutions to engage in multi-stakeholder initiatives effectively, which are crucial for addressing complex, cross-sectoral challenges (Arbeiter & Bucar, 2021; Ayala-Orozco et al., 2018). This result underscores the importance of developing comprehensive regulatory frameworks to enable and enhance collaborative endeavors.

The results align with the study's goal of identifying barriers to collaboration. The significant majority (71.4%) reporting a lack of frameworks validates the hypothesis that regulatory and procedural gaps are among the key impediments to collaboration. The internal consistency of these findings with the study objectives indicates that the survey methodology was effective in capturing the core issues. The balance between the minority who acknowledged existing frameworks (25.2%) and the majority who did not reflects a nuanced perspective, suggesting that while some structures exist, they may be insufficient or inaccessible to many stakeholders. When compared to similar studies in other countries, these findings reflect a broader trend in regions where institutional frameworks are underdeveloped or fragmented. Globally, the lack of supportive legal and procedural conditions is frequently cited as a barrier to collaboration, particularly in developing or transitioning economies (Burch, 2010; Mangla et al., 2018). However, the relatively high percentage of respondents (71.4%) indicating the absence of frameworks in this study may reflect specific local governance challenges. In contrast, countries with mature governance systems often report higher levels of established frameworks but face challenges related to their enforcement or adaptability (Abbott & Snidal, 2021; Anderies et al., 2013). These comparisons highlight the need for tailored approaches to framework development that consider regional socio-political and economic contexts.

This study explores the role of regulatory frameworks in fostering collaboration, quantifies deficiencies, and advances discussions on governance and cooperation. It emphasizes the need for legal and procedural reforms to create collaborative environments. However, the study has limitations, including potential bias and lack of specific reasons for absence. Future research should include detailed policy analyses, case studies, and longitudinal assessments to understand best practices and framework impact.

4.2.1.6 Inter-Municipal Approaches to Integrated Solid Waste Management

The results indicate that 50.2% of respondents are willing to jointly use waste disposal facilities with surrounding cities, while 34.9% prefer offering incentives, and 11.4% remain uncertain. These findings suggest that the majority of respondents recognize the value of collaborative resource utilization in addressing waste management challenges. Joint usage indicates an inclination toward cooperative approaches that optimize infrastructure and minimize redundancy. The preference for offering incentives reflects an understanding of the importance of fostering participation among stakeholders, even if direct collaboration is not feasible. However, the uncertainty among 11.4% highlights a potential gap in awareness or confidence regarding the benefits of cooperation.

The findings align with the study's goal of exploring willingness to cooperate among stakeholders for waste disposal solutions (Lu et al., 2015; Zhang et al., 2024). The significant majority (50.1%) indicating a preference for joint usage validates the objectives that collaborative strategies are widely seen as beneficial in managing shared resources(Ji et al., 2021). The substantial proportion opting for incentives (38.9%) also reflects the complexity of achieving cooperation, where financial or logistical encouragement may be necessary to overcome resistance. The smaller percentage of uncertain respondents (11.4%) suggests that while the majorities are decisive, there remains a need for clarity or additional information to address hesitations. These results demonstrate consistency with the study's objectives. Comparisons with studies from other countries reveal both similarities and contextual differences. Globally, the joint use of waste management facilities is a widely accepted strategy for optimizing costs and improving efficiency, aligning with the 50.2% preference in this study. Countries with decentralized governance structures commonly employ incentive-based approaches, as reflected in 34.9% of responses, to foster collaboration between jurisdictions. However, the relatively high proportion of respondents in this study favoring incentives may point to specific local challenges, such as political distrust or competition among cities that necessitate additional encouragement. 11.4% expressed uncertainty, underscoring the need to address these factors for effective collaboration.

The study explores stakeholder dynamics in waste management cooperation by quantifying preferences for joint usage and incentive-based collaboration. It provides a framework for

assessing attitudes towards cooperative strategies and highlights the need for targeted interventions to bridge gaps in confidence and awareness. However, the study has limitations, including potential bias and lack of exploration of reasons behind preferences and barriers to cooperation. Future research should include qualitative methods and longitudinal studies, such as focus groups or interviews, to provide deeper insights into the motivations and concerns influencing stakeholder decisions.

4.2.2 Practice of Urban Drainage System

Addis Ababa has seen significant efforts to develop its drainage and sewerage infrastructure, though challenges remain. The field observation conduced indicates that the city's drainage system includes a network of open and closed drains designed to manage stormwater and prevent flooding. Major drainage channels such as the Akaki river and its tributaries play a crucial role in directing drainage away from urban areas. However, rapid urbanization and inadequate maintenance have led to issues like blockages and overflow, particularly during the rainy season. Efforts are being made to improve the system through regular maintenance, expansion of drainage networks, and implementation of flood mitigation projects.

Sheger, a rapidly growing urban area adjacent to Addis Ababa, is in the early stages of developing its drainage and sewerage infrastructure. The expansion of residential and commercial areas in Sheger has increased the demand for effective drainage and wastewater management systems. Currently, the drainage infrastructure in Sheger consists mainly of basic open channels and ditches, which are often inadequate to handle heavy rainfall, leading to localized flooding and waterlogging issues. Plans are underway to construct a more robust and extensive drainage network to prevent such problems and ensure proper water flow. The following picture shows open channels and ditches often inadequate to handle heavy rainfall

The interview conducted with cities officials indicate that the existing drainage infrastructure in Addis Ababa and Sheger Metropolitan regions along the roads passing through both cities has been developed over many years, often in a fragmented and uncoordinated manner. Originally designed to handle smaller populations and less urban density, the system includes open drainage channels, underground sewers, and natural watercourses.

Despite the lack of data on the coverage of drainage systems in the study areas, an analysis of the document reveals that current drainage systems struggle with inadequate coverage and capacity, making it difficult to effectively manage the increased volume of stormwater generated by rapid urbanization. Many areas, particularly informal settlements, lack proper drainage facilities, leading to frequent flooding and waterlogging during the rainy season. The interview and the documents indicate that there is no coordinated drainage system planning, management, and provision in the city regions.

The Sheger Metropolitan Region and Addis Ababa have developed their drainage infrastructure in a disorganized and fragmented manner. Due to its initial design for smaller populations and reduced urban density, the current system struggles with inadequate coverage and capacity. The absence of adequate drainage facilities in numerous regions, particularly informal settlements, leads to frequent inundation and waterlogging during the rainy season. In the study areas, the lack of coordinated drainage system planning, management, and provision further exacerbates these issues. The accompanying figure illustrates the flow lines of the drainage system alongside the road network in the study areas.

The lack of coordinated planning and the fragmented development of drainage infrastructure have significant implications for the cities. The inability of the drainage system to manage the increased volume of stormwater due to accelerated urbanization has led to recurrent flooding and waterlogging, particularly in vulnerable informal settlements. This not only disrupts daily life but also poses health risks, damages property, and impedes economic activities. Additionally, the uncoordinated approach to infrastructure development may result in increased costs, inefficiencies, and a loss of resilience to the effects of climate change.

The findings emphasize the pressing necessity of a comprehensive and coordinated strategy for the planning and management of drainage systems in the Sheger Metropolitan Region and Addis Ababa. In order to confront the obstacles of rapid urbanization, it is necessary to renovate the existing infrastructure to accommodate the demands of an expanding population and an increasing urban density. A coordinated strategy would entail the integration of drainage planning with broader urban development plans, the provision of sufficient drainage facilities in new developments, and the retrofitting of older systems to enhance their capacity. Particular consideration should be given to informal settlements, as they are particularly susceptible to

inundation. In order to establish a drainage system that is both resilient and efficient, communities, urban planners, and government agencies must work together. This system must be capable of adapting to future challenges.

4.2.2.1 Evaluation of Urban Drainage Systems along Intercity Transport Corridors

Field observations reveal that there is limited to no practical integration of stormwater drainage systems between Addis Ababa and Sheger city. Addis Ababa possesses a relatively developed but aging drainage network, with key channels concentrated in central districts and some parts of the city's major transport corridors. However, the coverage remains incomplete and poorly maintained in many outer zones, particularly toward the urban fringes adjacent to Sheger city. In contrast, Sheger, as a newly emerging urban entity, lacks a comprehensive drainage master plan and infrastructure. Most stormwater management in Sheger is either informal or non-existent, resulting in frequent localized flooding, particularly during the rainy season.

From a planning and governance perspective, there is no evidence of a coordinated or integrated city-wide drainage master plan between the two cities. Addis Ababa's drainage systems have been designed without consideration for upstream or downstream impacts on Sheger, leading to disjointed infrastructure at the administrative boundaries. Moreover, differing institutional mandates and the absence of shared technical standards or protocols have hindered collaborative planning and implementation of drainage infrastructure.

To address this gap, it is crucial to move toward a metropolitan-scale drainage strategy. This requires developing a joint stormwater management framework supported by spatial data sharing, harmonized planning tools, and inter-jurisdictional coordination mechanisms. Supplementing physical network analysis with stakeholder interviews such as from urban planners, infrastructure experts, and municipal authorities can provide insights into institutional barriers and opportunities for collaborative solutions. Ultimately, integrating drainage systems will not only improve flood resilience but also support sustainable urban growth in cities.

Moreover, data reported by the Addis Ababa City Roads Authority (AACRA, 2021) indicate that 42.5% of the assessed road sections lacked drainage lines**,** highlighting significant gaps in drainage infrastructure provision across the city. The remaining 54.1% of road sections were

reported to have drainage facilities, indicating that drainage infrastructure is available in some areas but is not uniformly provided throughout the road network. These findings demonstrate the uneven provision of drainage infrastructure and underscore the need for more comprehensive and integrated drainage planning in Addis Ababa. This balance indicates that the practice was effective in capturing diverse stakeholder perceptions and providing an accurate assessment of the current state of drainage infrastructure. When compared to studies from other countries, in Sub Saharan Africa, these findings reflect common challenges faced by regions with underdeveloped infrastructure (Calderón & Servén, 2010; Dang & Pheng, 2015). Universally, the absence of drainage lines on roads is a frequent issue in rapidly urbanizing areas, where planning often lags behind urban growth. However, the relatively high proportion of roads without drainage lines (42.5%) in this study suggests more severe deficiencies compared to regions with established drainage networks. In countries with better infrastructure management, drainage coverage is significantly higher, underscoring the need for region-specific strategies to address these gaps. This comparison highlights the importance of benchmarking against international best practices to identify feasible solutions.

This study explores the role of drainage infrastructure in urban planning and provides a framework for assessing coverage. It emphasizes the need to integrate drainage planning into infrastructure projects for sustainable urban development. However, its limitations include its reliance on respondent perceptions and its failure to examine causes such as funding constraints or technical challenges. Future research should include field surveys, technical evaluations, and longitudinal studies to better understand and address drainage infrastructure gaps.

4.2.2.2 Assessment of existence of Coordinated Drainage Master Planning between the Cities

Field survey results reveal that observed areas indicated the absence of a common drainage master plan between the two cities. The absences of a shared stormwater master plan pose considerable risks, including heightened vulnerability to flooding, water pollution, and infrastructure damage. This lack of coordinated planning could lead to costly repairs, environmental degradation, and health hazards for residents. To enhance urban resilience and

address these challenges especially with the increasing frequency of extreme weather events due to climate change developing an integrated drainage management strategy is essential.

The lack of a common drainage master plan in urban areas is a significant gap in urban water management. Studies from other rapidly urbanizing areas, like Nairobi, Kenya, have reported similar findings, highlighting how the lack of an integrated drainage management system between neighboring jurisdictions has exacerbated flood risks, damaged infrastructure, and contributed to water contamination(Gikundi, 2014; Ran & Nedovic-Budic, 2016). The small percentage of respondents acknowledging a shared drainage plan suggests isolated agreements or fragmented efforts. In urban regions like Johannesburg, South Africa, partial or fragmented drainage management initiatives within city sections often create inconsistencies, failing to address broader drainage issues and placing isolated neighborhoods at higher risk during heavy rainfall (Mguni, 2015; Mguni et al., 2016). A coordinated approach to drainage management across cities can reduce flood risk, protect ecosystems, and improve urban resilience. Adopting a shared drainage master plan could offer environmental and economic benefits, reducing the need for costly repairs and providing better protection for residents (Dhakal & Chevalier, 2017; Jiménez Ariza et al., 2019). It also, underlies issues in inter-city governance, as seen in case studies from metropolitan areas in Asia. For example, in the Pearl River Delta region in China, studies have shown that competing priorities and inadequate policy alignment between neighboring cities often hinder the development of regional water management plans (Knopman et al., 2015; Nadin & Meng, 2023). Similarly, research in Latin America demonstrates that a coordinated approach to drainage management across cities can reduce flood risk, protect ecosystems, and improve urban resilience (Lamond et al., 2013; Vásquez et al., 2019).

Regarding strategies for flood protection in lower reaches, 16% of respondents reported the existence of strategies to protect people in lower reaches from floods. And 80.5% of respondents stated that there were no strategies in place to protect people in lower reaches from floods. The lack of flood protection strategies for lower-lying areas, as reported by 80.5% of respondents, suggests the high vulnerability of these communities to flood risks. This absence of protective measures increases the likelihood of severe damage to homes, infrastructure, and public health in these flood-prone areas.

- The study illustrates a critical vulnerability in urban flood management in lower-lying areas, which are increasingly susceptible to flooding due to their proximity to waterways and their location. This absence of strategic intervention, which is also evident in other rapidly urbanizing regions, such as Dhaka, Bangladesh(Ahmed et al., 2018), places low-lying areas at a high risk of flooding due to inadequate protective infrastructure and inadequate urban planning. In urban areas like Manila, Philippines, the small percentage of respondents who acknowledge the existence of flood protection strategies may suggest that these strategies are isolated initiatives or pilot programs that are specific to specific communities rather than a comprehensive municipal plan(Espina Jr, 2018; Yarina, 2018). This fragmented approach can result in disparate levels of protection, which places the most vulnerable communities at a higher risk. Fragmented policies, resource limitations, and a lack of intergovernmental cooperation frequently impede the development of comprehensive flood protection measures in urban resilience literature, particularly in Lagos, Nigeria(Kasim, 2014; Unegbua et al., 2024)). (Abbott, 2024; Ferdinand, 2015) conducted comparative studies in New Orleans, USA, demonstrating that the implementation of sturdy flood protection systems, such as levees and storm surge barriers, significantly reduces the risk of catastrophic damage in vulnerable areas. Additionally, the absence of flood protection strategies for the lower reaches may impact the urban ecosystem (Berndtsson et al., 2019; Cea & Costabile, 2022). The following Figure 4.4 illustrates the absence of an integrated planned drainage system in Addis Ababa.

Fig.4.4: Drainage failure causes creating potholes (a &b) and traffic disruption (c&d) due to surface flooding in Addis Ababa

Source: Feld survey, 2024

4.2.2.3 Institutional Mechanisms for Inter-City Collaboration in Drainage Planning

The overwhelming majority of respondents (78.1%) indicated that their organization intends to establish shared institutions with other cities in the future. However, a smaller proportion of respondents (18.4%) indicated that they do not or intend to prioritize such coordinating efforts at this time. The strong interest in establishing shared institutions suggests a significant desire for collaboration and coordinated governance among cities, which could enhance resource sharing and improve service delivery.

The finding of respondents express an intention to establish shared institutions with other cities signals a robust interest in collaborative governance as a means to address shared challenges. For instance, studies in the context of metropolitan governance in North America demonstrate that shared institutions can lead to improved service delivery, increased efficiency, and better alignment of regional development goals (Gertler & Wolfe, 2004). However, the respondents who do not prioritize establishing shared institutions highlight a significant minority perspective that warrants attention. This contrasts with the majority's enthusiasm and suggests potential

barriers or concerns regarding collaborative efforts (Cumming et al., 2020; Ostrom & Ostrom, 2014). For example, in metropolitan areas like Los Angeles, attempts to create regional governance structures have faced challenges due to entrenched local interests and skepticism about the benefits of cooperation (Thibert, 2016; Vogel et al., 2010).

Furthermore, the desire for shared institutions may not always translate into effective collaboration without addressing the underlying governance structures and processes. As noted in the literature, establishing shared institutions requires careful negotiation of governance frameworks that delineate responsibilities, authority, and accountability among participating entities (Koppell, 2008, 2010). The presence of a sizable minority who are not prioritizing coordination efforts suggests that there may be unresolved questions or concerns about how such shared institutions would function in practice. Moreover, this division in perspectives may also reflect varying levels of readiness or capacity among organizations to engage in collaborative governance. For instance, a study of inter municipal cooperation in Europe indicated that local governments with limited administrative capacity were less likely to engage in collaborative initiatives, opting instead to focus on internal improvements(Bailey, 2003; Goldsmith & Page, 2010).

4.2.2.4 Existing Legal Frameworks for Institutional Integration among Stakeholders

Regarding the existence of rules, frameworks, or other legal circumstances that support institutional integration among stakeholders, the survey's results showed that (46.3%) of respondents said "yes." (51.2%) of respondents, on the other hand, indicated that they did not have such laws or rules in place. The survey results reveal a significant gap in legal and regulatory structures necessary for effective collaboration among stakeholders, respondents acknowledging the existence of supportive rules or frameworks for institutional integration. The majority who indicate the absence of such support suggest challenges in fostering inter-organizational cooperation, potentially hindering efforts to address shared urban issues. This underscored the need for the development and implementation of clear legal frameworks that facilitate collaboration, enhance governance, and promote resource sharing among stakeholders to improve overall institutional integration.

In line with other research on urban governance (Lienert et al., 2013), survey respondents indicate a significant lack of the legal framework required for effective integrated infrastructure.

In many urban settings, the absence of such frameworks can lead to fragmented efforts, undermining the potential benefits of integrated governance. For instance, studies on regional governance in the United States have demonstrated that clear legal guidelines can facilitate partnerships between municipalities, resulting in more coordinated responses to complex urban challenges (Bengston et al., 2004; Brenner, 2002). The fact that a slight majority of respondents indicated that there are no supportive laws or rules in place suggests a significant obstacle to the institutional integration that many urban areas seek. This finding is consistent with research from metropolitan regions like Los Angeles, California; for instance, a lack of inter-jurisdictional agreements has led to inefficiencies in addressing regional issues like transportation and challenges in achieving integrated governance and environmental management (Barbour, 2016; Jonas & Pincetl, 2006).

Lack of legal frameworks in urban regions like Nairobi, Kenya, exacerbates governance capacity and institutional trust issues, leading to mistrust and reluctance to cooperate(Omenya & Lubaale, 2012; Ståhlberg, 2024). The study areas may exhibit a lack of trust among stakeholders, exacerbated by unclear legal frameworks, which may hinder the establishment of shared institutions for integrated governance (DeCaro et al., 2017; Stensaker & Vabø, 2013). The Greater Toronto Area in Canada has successfully implemented inter-city cooperation due to the presence of supportive legal frameworks among municipalities (Wolfe, 2014). The cities under study stand to gain from the development of these frameworks, as they can foster collaboration and improve governance outcomes.

4.2.2.5 Collaborative Projects through Shared Financing

Regarding the extent of collaboration between the cities through shared financing, 21.2% of respondents indicated that collaborative financial arrangements exist, while 75.3% reported that such collaboration is limited or not sufficiently evident**.** The findings from focus group discussions and key informant interviews, however, confirmed that the two cities currently have collaborative projects implemented through shared or coordinated financial arrangements. This indicates a discrepancy between stakeholders' perceptions and the actual practice of intercity collaboration. The difference may reflect limited awareness, inadequate communication, or insufficient visibility of collaborative projects among stakeholders. Therefore, strengthening information sharing, institutional communication and transparency regarding jointly financed

projects is important for improving stakeholders' understanding, trust, and participation in intercity infrastructure initiatives. Greater clarity concerning the mechanisms of shared financing could also contribute to stronger institutional cooperation and more effective implementation of collaborative infrastructure projects.

The survey findings highlight the complexity of fostering inter-city cooperation, as effective collaboration often hinges not only on the presence of projects but also on stakeholders' awareness and engagement with these initiatives(Irvine & Bai, 2019; Latham, 2007; Wei & Yang, 2024). In the context of the study cities, the perceived lack of collaboration could hinder the potential benefits of shared financial projects, indicating a need for improved outreach and education about existing initiatives. The discrepancy between the survey results and the verified existence of collaborative projects underscored the challenges inherent in promoting inter-organizational cooperation. For instance, studies in metropolitan regions like São Paulo, Brazil, demonstrate that even when collaborative projects are in place, local stakeholders may remain unaware due to insufficient communication strategies from governing bodies (Follador, 2017; Pfeffer et al., 2013). This suggests that, for the cities under study, enhancing communication strategies and providing clear information about collaborative initiatives is critical to bridging the gap between perception and reality. To address this issue, it is essential for city leaders to engage a broader range of stakeholders in discussions about ongoing projects, thereby fostering a sense of ownership and increasing awareness of shared financial initiatives.

Furthermore, the majority of respondents indicated "no collaboration," which may indicate structural or governance issues hindering the success of shared finance initiatives and requiring strong governance structures and mutual benefit commitments, as noted by (May & Winter, 2007). Successful collaborative finance projects in regions such as the European Union rely on the establishment of clear agreements, mutual trust, and equitable resource sharing among diverse stakeholders (Davies & White, 2012; Goedkoop & Devine-Wright, 2016). For the cities under study, addressing governance challenges and ensuring equitable frameworks for collaboration will be crucial for increasing both the visibility and effectiveness of shared financial initiatives.

4.2.2.6 Co-Financing Models for Collaborative Urban Infrastructure Projects

In response to a question concerning a project's funding source, participants gave the following breakdown: (19.2%) identified municipal funds, (30.8%) stated special savings, and (46.5%) confirmed government loans. The funding breakdown, identifying government loans as the primary source, indicates a reliance on external financial support for projects, which may impact sustainability and long-term planning. The significant portion suggests some proactive financial management at the local level, while the smaller percentage relying on municipal funds may reflect constraints in local budgets or priorities. These findings imply a need for diversified funding strategies to reduce dependency on government loans, enhance local fiscal capacity, and ensure the sustainability of projects**.**

Participants identified government loans as the primary funding source, highlighting a significant reliance on external financial support for project implementation. This is consistent with trends observed in urban infrastructure financing to bridge funding gaps, particularly in developing regions(Bluhm et al., 2018; Foster, Rana, & Gorgulu, 2022; Serageldin et al., 2008). For example, research on urban development in South Africa shows that excessive reliance on loans can lead to unsustainable debt levels, impacting future budgetary flexibility (Kamutiba, 2020; Sachs, 2021). In contrast, the respondents citing special savings as a funding source suggest some degree of proactive financial management among local stakeholders. Studies show that municipalities that establish dedicated savings funds for infrastructure projects can achieve greater financial stability and flexibility in funding decisions (Floater et al., 2017). However, the management practices employed and the adequate support from broader fiscal policies will determine the effectiveness of these savings mechanisms.

4.2.3 Practice of Urban Solid Waste Management System

The field survey and interview findings indicate that in recent years, efforts have been made to improve waste management in Addis Ababa. The Reppie Waste-to-Energy facility, inaugurated in 2018, is one of Africa's first large-scale waste-to-energy plants, converting waste into electricity. Additionally, there have been initiatives to promote waste separation at the household level, although these efforts are still in their infancy and face challenges in terms of public awareness and participation.

Addis Ababa faces significant challenges in managing solid waste due to its growing population and rapid urbanization (Diriba & Meng, 2021; Tassie et al., 2019). As the interviewees responded, the city's primary landfill site is Koshe, also known as Reppi, located in the southwestern part of Addis Ababa has been in operation for decades and is the largest waste disposal site in the city. Despite being a critical facility for waste management, Koshe has faced numerous issues, including overcapacity, inadequate waste segregation, and environmental hazards. Efforts have been made to modernize the site, such as the construction of a waste-to-energy plant that converts waste into electricity (Peckl, 2022), providing a partial solution to the city's waste management problems. Additionally, smaller transfer stations and temporary dumping sites are scattered across the city to manage waste collection before it is transported to the main landfill. However, the distribution of these facilities is uneven, and there is a need for more strategic planning and investment in sustainable waste management solutions.

Sheger, is also grappling with the challenges of solid waste management as its population and infrastructure expand. As seen during field observation, currently, waste disposal in Sheger relies heavily on the facilities available in each sub cites, with backward system. This shows that let leave with Addis Ababa, there is no common waste disposal site or land fill in the city. However, as the area grows, there is an increasing need to establish integrated modern waste disposal sites with Addis Ababa as plans are underway to develop new landfill sites and waste treatment facilities to cater to the rising demand. These new sites are expected to incorporate modern waste management practices, including recycling and composting, to reduce the environmental impact and enhance sustainability. In the interim, waste collection in Sheger is managed through local community initiatives and smaller temporary dumping sites, but these solutions are not sufficient to handle the long-term needs of the area. The development of comprehensive waste management infrastructure in Sheger is essential to ensure that the area can cope with its growth sustainably.

The solid waste management system in the study regions has evolved incrementally, primarily relying on traditional methods such as open dumping and basic collection services. Historically, waste management systems were designed to handle lower volumes of waste, and the rapid urban growth has outpaced the capacity of these systems.

The existing waste management infrastructure includes waste collection services provided by municipal authorities and private contractors. However, the coverage is inconsistent, with some

areas receiving regular collection while others experience irregular or inadequate services. The primary disposal method has been open dumping and sanitary landfills, with limited recycling or waste-to-energy initiatives.

The study conducted under line that currently, the system faces several challenges, including insufficient coverage, lack of proper waste segregation, inadequate infrastructure for recycling and composting, and environmental and health concerns associated with open dumping. The absence of a comprehensive waste management strategy exacerbates these issues, leading to inefficient waste handling and disposal practices.

4.2.3.1 Prevalence of common solid waste disposal sites

The survey revealed that a mere (20.5%) reported the existence of a common solid waste disposal site in the study area, while a substantial majority (76%) reported the absence of such a facility. The survey results reveal that the lack of a centralized disposal facility may lead to increased environmental degradation and public health concerns, as improper waste disposal practices could become prevalent in the absence of a designated site (Ferronato & Torretta, 2019; Regassa et al., 2011).The findings imply a pressing need for local authorities to prioritize the establishment of a common solid waste disposal facility to enhance waste management efforts, promote sustainability, and protect community health. Additionally, the issue of stakeholder engagement and awareness in the planning and implementation of waste management solutions suggests that improving communication and collaboration among community members and local governments is essential for effective waste management strategies.

The survey results reveal a significant gap in the perception of solid waste disposal sites in a region, with respondents recognizing the existence of a common site and asserting its absence. This disparity suggests that many people may be unaware of existing facilities or that they may not be effectively serving the community's needs. Inadequate waste disposal facilities can have serious implications for public health and environmental sustainability, contributing to pollution, vector-borne diseases, and negative health outcomes (Krystosik et al., 2020; Nor Faiza et al., 2019). The lack of a common disposal site suggests an urgent need for local authorities to develop effective waste management strategies that prioritize community health and environmental protection. The text emphasizes the significance of infrastructure investment and

planning in addressing solid waste management issues, emphasizing the need for effective waste management strategies and stakeholder engagement (Batista et al., 2021; McAllister, 2015).

4.2.3.2 The Reason for the Lack of a Common Solid Waste Disposal Area

Table 4.4: The reason for the lack of a common solid waste disposal area

S/N	Issues	Frequency	percentage
1	Lack of an integrated plan	84	33.9
2	Lack of agreement	5	2
3	Lack of Compensation mechanism	40	16.14
4	Administrative problems	119	48
	Total	248	100

Source: survey, 2023

As indicated in Table 4.4, these results mean that fixing inefficient administrative processes, creating an integrated waste management plan, and setting up ways for people to get paid will be needed to make it easier to build a common solid waste disposal area and improve waste management in the region as a whole.

Administrative problems pose a significant challenge in governance and management structures, contributing to the lack of a common solid waste disposal area. These issues, such as poor coordination, unclear responsibilities, and inadequate regulatory frameworks, often hinder effective waste management(Marshall & Farahbakhsh, 2013; Walters et al., 2024). Additionally, the lack of an integrated plan, a gap in strategic planning, can impede collaborative waste management efforts. Compensation mechanisms, which ensure equitable resource distribution and incentivize participation from various stakeholders, can enhance collaboration and facilitate the development of a common solid waste disposal area (Bong et al., 2017; Spoann et al., 2019). The survey findings highlight the need for improved governance, strategic planning, equitable resource distribution, and stakeholder engagement in waste management initiatives. The following Fig. 4.6 indicates distributions of landfills in the study areas.

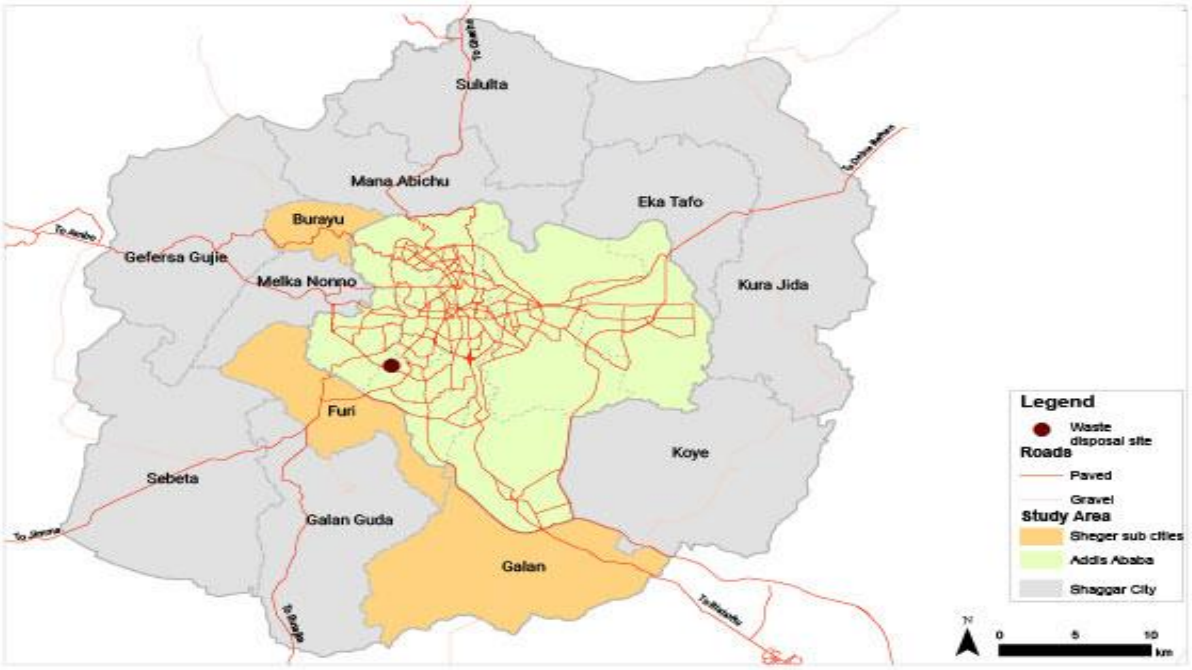

Fig.4.6: A map showing the only sanitary landfill in the study area

Source: Feld survey, 2024

4.2.3.3 Assessment of the Gaps of Integrated Solid Waste Management Plans

The document review indicates that there is no integrated solid waste management plan covering Addis Ababa and Sheger cities as an interconnected urban system**.** The reviewed planning and institutional documents show that solid waste management is largely addressed within separate administrative jurisdictions, with limited evidence of a jointly coordinated and integrated planning framework between the two cities. This absence of an integrated plan may constrain coordinated decision-making, resource allocation, infrastructure development, and long-term management of solid waste across the intercity urban area. It also highlights the need for a jointly developed and future-oriented solid waste management framework that promotes institutional coordination, shared infrastructure planning, and integrated service delivery between Addis Ababa and Sheger cities.

The survey results highlight a critical gap in integrated strategic planning for waste management; comprehensive waste management plans are essential for effective and sustainable waste disposal practices (Batista et al., 2021; Wilson, Velis, & Rodic, 2013). Without a formalized

plan, cities may struggle with waste collection, recycling, and disposal, leading to increased environmental pollution and public health risks. The absence of integrated solid waste management plan can significantly impede the effectiveness of waste management initiatives, as it requires an integrated approach that includes planning, financing, implementation, and monitoring (Memon, 2010; Zurbrügg et al., 2014). The findings also highlight the importance of developing a participatory approach in the formulation of integrated solid waste management plans, involving residents, businesses, and community organizations (Sinthumule & Mkumbuzi, 2019; Yukalang et al., 2018).

The alternative questions about who should assume responsibility for joint cooperation received representation from the mayor's committee (30%), a newly established institute (10.5%), and no institute (57%). The survey results highlight that without a clear coordinating body, there is a risk of disorganization and missed opportunities for effective collaboration, necessitating urgent attention from local authorities to facilitate cooperation in waste management efforts.

The survey results reveal the lack of designated leadership can lead to fragmented efforts and inefficiencies, inhibiting effective collaboration and the implementation of comprehensive waste management strategies. The lack of a designated institute may contribute to ineffective waste management practices and failure to address urban waste challenges (Lissah et al., 2021; Zurbrugg, 2002). The respondents' suggestion of a newly established institute as a coordinator presents an opportunity for innovation in waste management governance, but it requires clear mandates and sufficient resources.

Findings from the field survey and document review indicate that Addis Ababa and Sheger cities face significant gaps in sanitary landfill and solid waste disposal infrastructure. The field assessment revealed that the existing waste disposal facilities are insufficient to adequately accommodate the increasing volume of solid waste generated by the rapidly growing urban population. The document review further confirmed deficiencies in the availability, capacity, and spatial distribution of appropriate solid waste disposal facilities. These findings demonstrate the need for additional and properly planned sanitary landfill facilities to address current and future waste management demands. The shortage of adequate disposal infrastructure also raises

concerns regarding potential environmental degradation, public health risks, and the inefficient management of solid waste.

The survey results show that respondents believe cities need new sanitary landfill sites, highlighting the need for improved waste management infrastructure. This is in line with urban environmental studies, which show that inadequacies in waste disposal capacity can lead to environmental degradation, public health risks, and operational challenges (Agbor, 2016; Guerrero et al., 2013). The need for new sites indicates a critical awareness of the unsustainable nature of current waste management practices. The overwhelming support for new waste disposal sites may also reflect a desire for modern and sustainable waste management practices, such as recycling, composting, and waste-to-energy technologies (Das et al., 2019; Uyarra & Gee, 2013). It also suggests that local authorities should engage in comprehensive planning and community involvement in waste management decision-making processes.

4.2.3.4 Financing Solid Waste Collection: Analysis of Diverse Funding Sources

Table 4.5: Financing solid waste collection

No	Issues	Frequency	Percentages
1	From municipal funds	57	23
2	From the government treasury (resume budget)	144	58
3	From aid	10	4
4	From public contributions, and various savings	37	15
	Total	248	100

Source: Expertise survey, May, 2023

These results highlighted in Table 4.5 indicate the significant role of local and governmental financing in sustaining solid waste management (SWM) systems. The predominance of municipal funds and government treasury contributions (81% combined) underscores the dependency on institutional support, while the smaller proportions from aid and public contributions suggest limited external or community-based financing (Diokno-Sicat et al., 2020; Gómez & Atun, 2013). These patterns have implications for the sustainability of SWM systems, as over-reliance on government and municipal resources may hinder adaptability and innovation in the long term. The results are consistent with the study's goal of identifying the financial foundations for SWM systems in the area. The significant share of municipal funds (23%)

supports the local governments bear a substantial burden in financing waste collection efforts. The prominence of government treasury support (58%) aligns with the assumption that state-level involvement is critical in supplementing local efforts (Talukdar, 2023). Meanwhile, the relatively low percentages from public contributions and savings (15%) and from aid (4%) suggest a gap in community engagement or alternative financing mechanisms, highlighting areas for improvement. These findings validate the study's focus on financial sustainability as a core challenge in SWM planning. Comparing these findings to similar studies in other countries reveals parallels and differences. Globally, municipal and government funds are often the primary sources of financing for SWM, particularly in low- and middle-income countries (Aparcana, 2017; Massoud et al., 2021). However, countries with more advanced systems frequently exhibit higher proportions of community contributions or private-sector involvement. The low reliance on aid (4%) in this study contrasts with regions heavily dependent on international funding, suggesting a relatively higher degree of financial independence (Michalena & Hills, 2018; Pérez Niño & Le Billon, 2014). This comparison underscores the need to explore innovative financing mechanisms, such as public-private partnerships, to diversify and stabilize funding sources for SWM systems.

This study contributes to and explores the financial dynamics of solid waste management systems, focusing on institutional financing. It provides a framework for assessing financial sources and suggests diversifying financing mechanisms to reduce reliance on government and municipal resources. However, the study has limitations, including reliance on quantitative survey responses and lack of exploration of sustainability and efficiency. Future research should include qualitative methods, comparative studies, and pilot programs.

4.2.3.5 Methods of Collaboration between the Cities

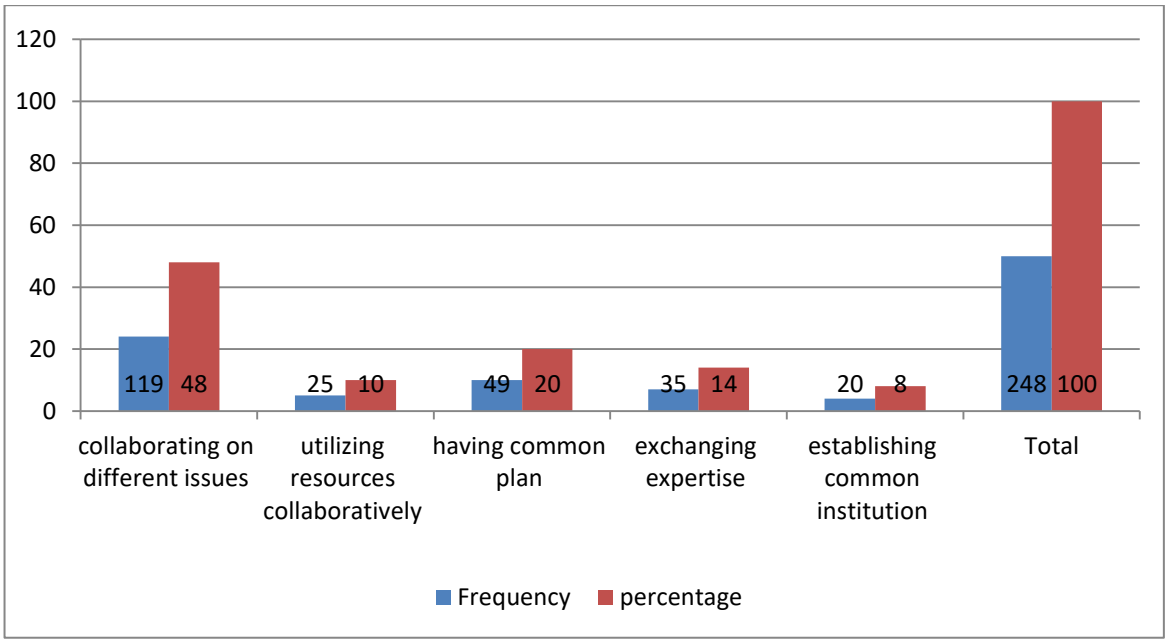

Fig 4.6: Methods of collaboration between the cities

Source: Feld survey, 2024

The implicational findings of Figure 4.7 suggest that cooperation between cities primarily focuses on collaborative efforts and joint planning, as these accounts for a significant portion of the responses (48% and 20%, respectively). This indicates that cities see the value in aligning goals and strategies to address shared challenges and opportunities. Additionally, the aspects of using resources together, exchanging experts, and establishing shared institutions highlight a broader understanding that effective cooperation requires resource sharing, knowledge exchange, and potentially formalized partnerships. These insights suggest that policymakers should prioritize the development of collaborative frameworks and planning mechanisms to ensure successful intercity cooperation.

The survey responses reveal a diverse approach to inter-city cooperation that aligns with research suggesting collaboration across cities is essential for addressing common urban challenges, such as waste management, infrastructure, and environmental issues (Robb et al., 2023). The preference for informal collaboration suggests that respondents may view flexibility as critical in building effective partnerships. Resource-sharing is a strategy that urban governance literature

supports as a means of achieving cost savings and efficiency gains (Dollery & Akimov, 2007; Szmelter-Jarosz et al., 2020).

Respondents support joint planning, acknowledging the advantages of coordinated urban development (Hall & Tewdwr-Jones, 2019); respondents support(Cyril Eze et al., 2013). A formalized approach to collaboration is supported by those who advocate for the establishment of a shared institution. These preferences align with literature emphasizing the benefits of flexible, informal arrangements in fostering effective partnerships while also highlighting the potential of structured approaches in certain contexts(McAllister, 2015; Oh & Hettiarachchi, 2020).

4.2.4 Practice of Urban Transport and Road Network system

As document reviews and field observations indicate, Addis Ababa boasts a diverse and expanding transport infrastructure that supplies its growing population (Tadele, 2009; Yilma, 2014). A well-developed road network, comprising major highways, arterial roads, and collector roads connecting various districts, serves the city. Public transportation options include buses operated by the Anbessa City Bus Service Enterprise, which cover extensive routes within the city (Berhan, Beshah, & Kitaw, 2013; Fenta, 2014). Additionally, the Addis Ababa Light Rail Transit (LRT) system, launched in 2015, provides a modern and efficient means of commuting, with two lines running from the north to the south and from the east to the west of the city. As Tsegay (2021) reveals Bole International Airport serves as a major hub for domestic and international flights, further enhancing the city's connectivity.

Sheger is not developing its transport facilities to accommodate the increasing population and urbanization. The document review reveals that the current road infrastructure in Sheger and the proposed plan do not align with the standards of Addis Ababa. The federal government has constructed roads that link the two cities in different directions. Private transport services, including buses and minibuses, and Anbessa city of Addis Ababa are becoming more prevalent, providing essential connectivity for residents. Because of its proximity to Addis Ababa, residents of Sheger can also benefit from the transport facilities available in the capital, such as the Addis Ababa Light Rail Transit and various taxi services. Additionally, plans are underway to further

enhance the transport network in Sheger, ensuring that it may keep pace with the area's growth and development.

It was approved during field observations that numerous terminals, bus stations, and parking facilities complement Addis Ababa's transport infrastructure, supporting the city's extensive transport network. Major bus terminals, such as Meskel Square, Merkato, and Megenagna, serve as key hubs for the Anbessa City Bus Service and other regional bus services, facilitating passenger movement across different parts of the city and beyond. The bus stations are strategically located to ensure quick access to various neighborhoods and business districts.

Addis Ababa's urban planning is increasingly integrating parking facilities, despite their ongoing development. Constructors are building multi-story car parks and designated parking areas to ease congestion and offer convenient parking options for both private and commercial vehicles. These facilities help to streamline traffic flow and improve the overall efficiency of the transport system.The following Fig.4.8 shows the distrbution of transport facilities/ Bus terminals in the study areas that found in Addis Ababa.

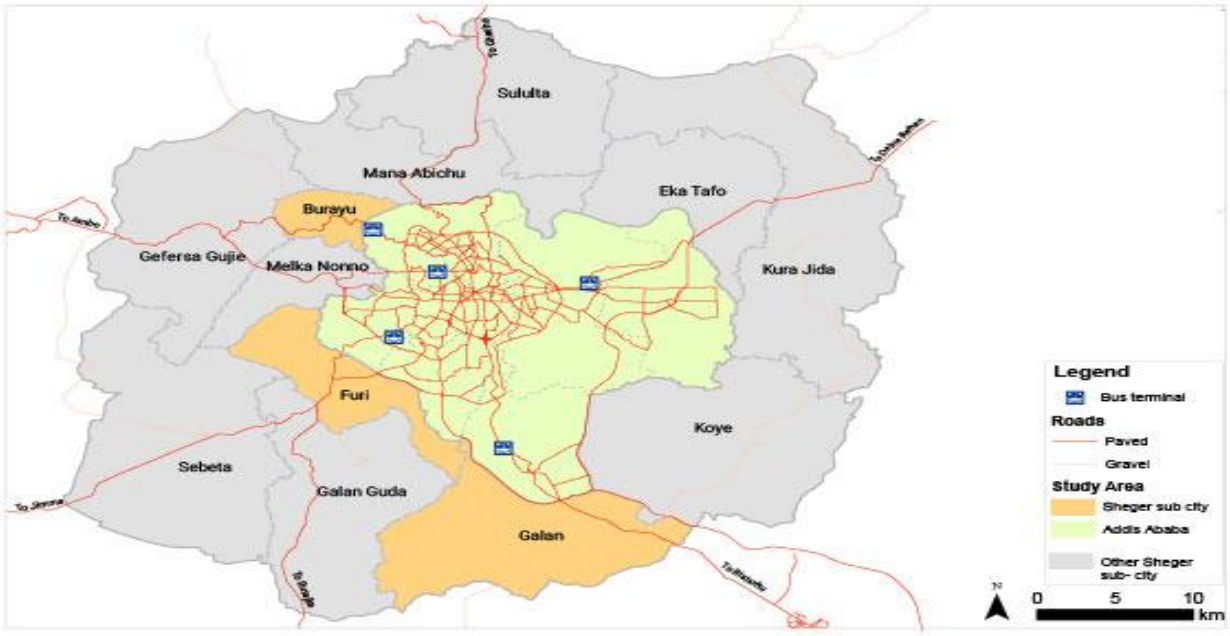

Fig.4.7: Distributions of bus stations in the study areas

Source: Feld survey, 2024

Sheger, as an emerging urban area, is also working towards establishing a robust network of terminals, bus stations, and parking facilities. Although the infrastructure is still in its growth phase, efforts are underway to ensure its seamless integration with Addis Ababa's broader transport network. It is developing bus stations and terminals to meet the growing population's needs and establish crucial connections to the city and other regions.

The transport system between the two metropolitan regions is characterized by a combination of road networks, public transit systems, and Addis Ababa Light Railway. Major roads and highways connect Addis Ababa's central areas with the surrounding sub cities of Sheger and suburbs, facilitating commuter and commercial traffic. Public transit options primarily include buses, minibuses (known as "taxis"), and a recently developed light rail system within Addis Ababa. However, the coverage and efficiency of these systems are often inadequate, leading to congestion, delays, and limited accessibility for some areas.

Evaluating the disintegration of the road network in the metropolitan regions requires a detailed examination of historical data, current conditions, and various contributing factors. Historical maps and master plans reveal that the original road networks were designed for a much smaller population and less complex urban needs. As these regions have expanded rapidly over the past few decades, the infrastructure has struggled to keep pace, leading to significant gaps and inconsistencies. Not only that, but there are only five national roads connecting the two cities, which had been under the control of the federai government. Reviewing urban growth data highlights how unregulated expansion and the rise of informal settlements have disrupted the planned connectivity, resulting in a fragmented road network. The following Fig 4.9 indicates the major roads connecting the two cities.

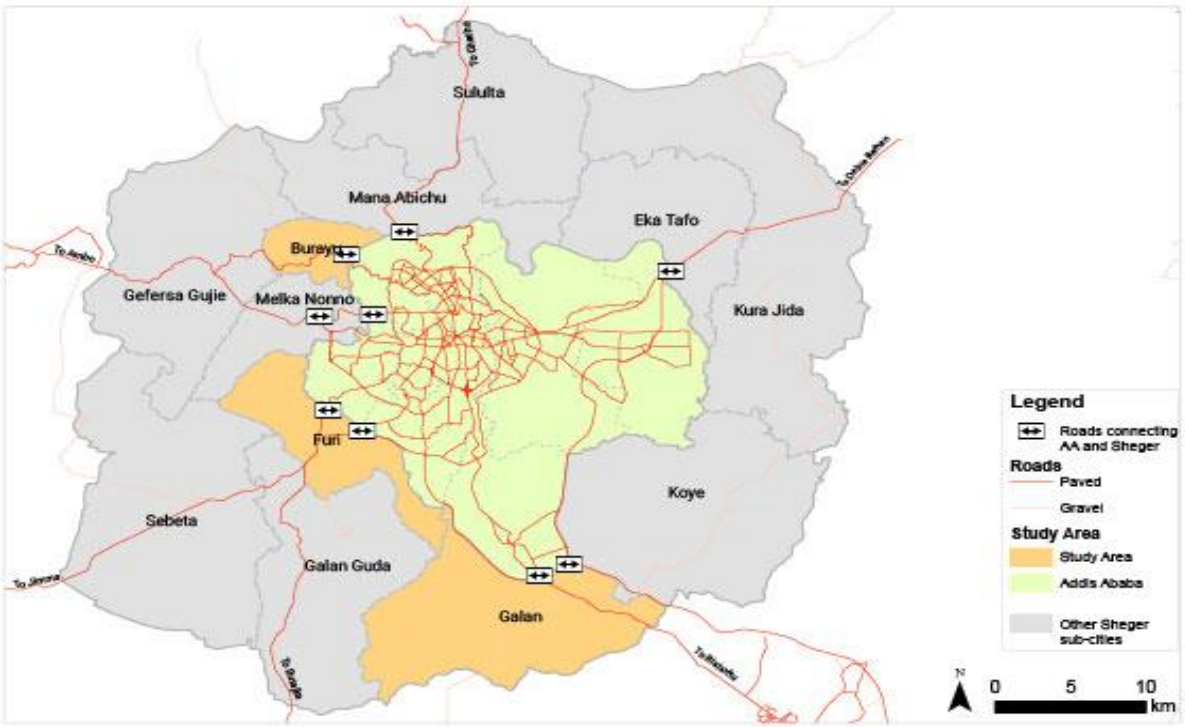

Fig.4.8 Maps of major road networks connecting the two cities

Source: Source: Author's GIS analysis, 2025.

Sample field observations show the current extent of disintegration. The surveys indicate that many roads are in poor physical condition, with numerous potholes, cracks, and erosion. The existing road network cannot efficiently handle the current volume of vehicles. Inadequate maintenance practices exacerbate these issues. Maintenance records reveal a pattern of neglect, with many roads not receiving timely repairs or upgrades, further contributing to their deterioration.

The FGDs examined the social and economic impacts of the disintegrated road network. It increased commute times, made it difficult to access essential services, and raised safety concerns due to poor road conditions. Businesses experience higher transportation costs and reduced efficiency, which negatively affect the local economy. Government and expert reports corroborate these findings, emphasizing the need for integrated infrastructure planning and management.

Here, policy and governance issues are also critical in understanding the road network's disintegration. A review of the document on budget allocations and spending on infrastructure

indicates that financial constraints and mismanagement have hampered effective implementation of the master plans. During FGDs, community representatives expressed concern that corruption and inefficiencies within the administration have resulted in substandard construction and maintenance, thereby rushing the deterioration of the network. These governance challenges underline the need for better coordination among government bodies and more transparent management of infrastructure projects.

4.2.4.1 Assessment of Inter-City Transportation Infrastructure Connecting the Cities

Findings from the field survey and document review indicate that transportation infrastructure connecting Addis Ababa and Sheger cities is inadequate to support the increasing demand for intercity movement. The assessment identified deficiencies in key supporting facilities, including parking lots, bus terminals, and other transport-related infrastructure that facilitate connectivity between the two cities. This finding is consistent with the survey results, in which 65.4% of respondents reported that the existing transportation infrastructure was insufficient**,** compared with 31.1% who considered it adequate. The evidence from the field assessment and reviewed documents further suggests that these infrastructure gaps create logistical and accessibility challenges for residents and commuters moving between Addis Ababa and Sheger. This deficiency likely hampers efficient commuting, economic activity, and urban integration between cities (de Andrade et al., 2016; Lyons et al., 2018). The lack of adequate infrastructure can lead to increased congestion, longer travel times, and limited options for residents and businesses relying on inter-city connections (Diao, Zhu, & Zhu, 2017; Niger, 2013).

The survey results reveal a significant lack of transportation infrastructure between two cities, highlighting the need for systemic improvements. The majority of respondents believe that adequate transportation facilities are crucial for urban integration and regional economic growth. Inadequate infrastructure can lead to increased congestion, reduced accessibility, and impeded economic flows, contributing to urban inefficiency (Niger, 2013; Zhu, 2017). The lack of connectivity can restrict labor mobility and limit access to essential services, exacerbate socioeconomic disparities, and contribute to environmental degradation. The survey also highlights the importance of sustainable urban planning, which emphasizes the role of efficient public transport systems in reducing traffic.

4.2.4.2 Assessing the Efficiency and Timeliness of Transportation Services

The results indicate that 66.2% of respondents reported that transportation facilities do not arrive on time, while 30.3% noted that they do. This suggests significant inefficiencies in the transportation system that could impact the overall effectiveness of waste management. The late arrival of transportation vehicles may lead to delays in waste collection and disposal, potentially resulting in environmental pollution, public health risks, and logistical bottlenecks (Sahu et al., 2022). The findings underscore the importance of timely transportation in maintaining an efficient and sustainable waste management system. Addressing these delays could lead to improved waste collection and disposal processes, enhancing both operational efficiency and public satisfaction.

The results align with the study's objectives of investigating the operational effectiveness of transportation and related facilities in the waste management system. By revealing that more than 60% of respondents observe delays in transportation, the study successfully identifies a critical weakness in the system. This supports the objectives that timely transportation is a challenge, corroborating the expectation that logistical inefficiencies exist within the waste management system (Multaharju et al., 2017; Rejeb et al., 2021). The large discrepancy between on-time and delayed transportation highlights an operational gap, validating the study's focus on improving transportation infrastructure to ensure timely waste collection and disposal. The findings are consistent with global studies on waste management that highlight transportation inefficiencies as a common challenge (Ferronato & Torretta, 2019). Urban centers often attribute delays in waste collection and transportation to insufficient fleet management, traffic congestion, and poor infrastructure.

For instance, studies in both developing and developed cities have pointed to transportation delays as significant barriers to effective waste management. The findings from other regions that report similar logistical issues align with the 64.4% of respondents who indicated late arrivals. However, the relatively higher proportion of on-time arrivals (34.6%) in this study might be an anomaly compared to other studies, where such timely transportation is less common (Hale et al., 2016). This suggests that, despite the challenges, certain parts of the system may function well, and we should concentrate our efforts on enhancing the less efficient areas.

This study highlights the importance of transportation efficiency in waste management, revealing that delays in transportation hinder consistent and effective waste services. It emphasizes the need for direct respondent feedback to assess operational inefficiencies and provides valuable empirical data for improving transportation planning and fleet management. However, the study's limitations include reliance on self-reported data, potential bias, and not examining root causes of delays. Future research should consider a mixed-methods approach, investigate environmental, economic, and social impacts, and compare results with other cities or regions congestion, emissions, and resource consumption (Letnik et al., 2018; Pojani & Stead, 2015; Wey & Huang, 2018).

4.2.4.3 Assessment of Transportation Infrastructure

The results showed that 26.9% of people rated the state and condition of the transportation infrastructure as good, 48% as medium, and 21.6% as terrible. The varied survey responses imply significant concerns about infrastructure quality and performance. The medium opinions suggest that while some areas or aspects of the infrastructure may meet basic standards, a substantial portion is perceived as subpar. This range of perspectives highlights the need for targeted improvements to enhance the reliability, safety, and accessibility of transportation infrastructure.

The survey results reveal significant disparities in perceived quality of transportation infrastructure in growing cities. The majority rated the infrastructure as "medium," suggesting that the transportation network is functional but may lack critical features of high-quality infrastructure, such as reliability, accessibility, and efficiency. This rating implies that while residents can navigate the current infrastructure, improvements are necessary to elevate its effectiveness, especially as cities expand and demand increases. The low percentage rating the infrastructure as terrible highlights there is a concern, pointing to deficiencies such as inadequate capacity, poor maintenance, or lack of integration in the transport network (Bofinger, 2011; Sohail et al., 2006). This disparity suggests that infrastructure quality may be inconsistent across different locations within the cities, with some areas enjoying better conditions than others. The mixed ratings of infrastructure quality are consistent with common challenges faced by rapidly urbanizing regions, where transportation systems often struggle to keep pace with population growth and demand (Bhattarai et al., 2021; Seto et al., 2014).

4. 2.4.4 Assessing Transportation Accessibility

Only 26.5% of respondents reported good accessibility for transportation from the origin to the destination, whereas 70% reported poor accessibility. The finding that 70% of respondents reported a lack of accessible transportation from origin to destination or back highlights a significant gap in transportation infrastructure or service availability. This disparity suggests that the majority of the population faces considerable difficulties in reaching their destinations efficiently, which could have cascading effects on economic productivity, education, healthcare access, and overall quality of life. It underscores the urgent need to improve transportation networks to ensure inclusivity and convenience for all users. Limited accessibility could also exacerbate social inequalities, particularly affecting vulnerable populations such as those in rural or underserved areas, individuals with disabilities, and lower-income groups (Oviedo, 2021). These populations often rely heavily on public or affordable transport options, and their exclusion from accessible systems could deepen existing disparities. Furthermore, the inefficiency in transportation may discourage investment and development in certain regions, thereby limiting economic opportunities (Jouanjean et al., 2022; Pojani & Stead, 2015).Addressing these accessibility issues requires comprehensive planning, resource allocation, and innovative solutions, such as expanding transportation infrastructure, optimizing routes, and enhancing the affordability and reliability of services. Improved accessibility can significantly contribute to sustainable development and social equity, benefiting both individuals and the broader community.

The results are consistent with the study's goals of investigating the operational challenges in waste management, particularly in relation to transportation accessibility. The large proportion of respondents (70%) who reported difficulties in this area validates the objectives that accessibility issues contribute to delays in transportation. These findings are internally valid as they directly address one of the key factors identified in the study transportation accessibility as a limitation in the system. The high percentage of respondents indicating poor accessibility further supports the assumption that logistical inefficiencies, such as poor road infrastructure or urban congestion, are significant barriers to effective transportation(Cheng & Chen, 2015; Rietveld & Bruinsma, 2012). This consistency bolsters the validity of the research design and the dependability of the data in achieving the study's goals. The results align with global trends identified in other studies

on waste management. Many cities worldwide commonly cite poor road infrastructure and access constraints as significant barriers to effective waste transportation (Sultana et al., 2019). Studies from other developing regions, for example, have identified poor accessibility as a primary factor in delays and inefficiencies in waste management. Research in urban areas, where infrastructure development has not kept pace with rapid urbanization, is consistent with these findings. The issues raised by the respondents in this study echo similar problems seen in other cities globally, suggesting that poor accessibility is a widespread challenge in the field of waste management. However, further comparison with cities that have successfully addressed these issues (through improved road networks, better traffic management, or more efficient waste transportation systems) could provide insights into potential solutions and best practices.

The study highlights the importance of considering infrastructure and logistics when designing and implementing waste management systems, particularly in urban settings. It provides new insights into the role of accessibility in waste collection and transportation efficiency. However, the study has limitations, such as reliance on questionnaire responses and lack of objective data on road conditions and traffic patterns. Future research should collect more granular data on specific barriers to transportation accessibility, examine the effectiveness of potential solutions, compare cities with successful accessibility challenges, and explore the long-term impacts of infrastructure improvements on waste management efficiency.

4.2.4.5 Factors Affecting the Integration of Urban Infrastructure Systems

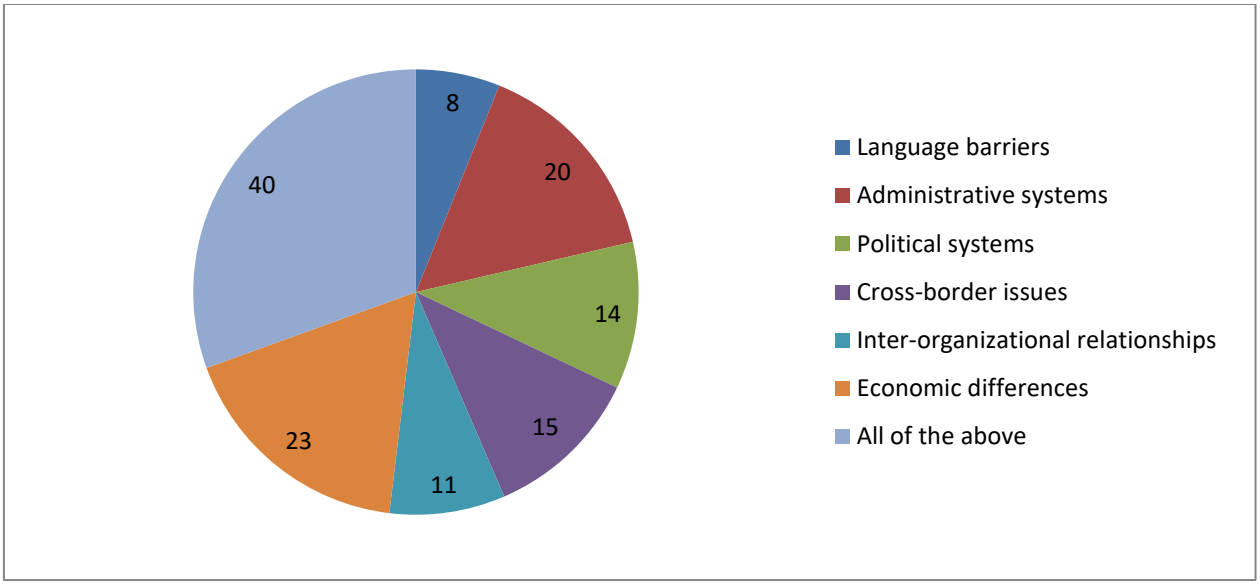

Fig.4.9: Factors influence integration

Source: survey, 2024

As the findings indicate in Figure 4.10, participants in focus groups and interviews reiterated similar arguments and added other elements influencing integration. Respondents acknowledge a complex array of factors that hinder integration efforts. Economic disparities, administrative systems, and cross-border issues particularly underscored the multi-layered challenges to integration. This implies that successful integration requires a holistic approach, addressing economic inequalities, harmonizing administrative and political systems, and fostering inter-organizational collaboration (Manda, 2017). Without a coordinated strategy that tackles these interwoven factors, integration efforts may be limited, with fragmented progress across different areas.

The survey results reveal a complex landscape of factors influencing integration efforts, with respondents identifying all these as barriers (Contu & Girei, 2014; Manda, 2017). Economic differences were the most commonly cited factor, highlighting economic inequality as a significant barrier to collaborative efforts across regions. The study also identified administrative systems and political systems as obstacles, underscoring institutional and governance-related barriers. The study identified cross-border issues as a significant barrier, necessitating logistical coordination and legal frameworks to account for shared resources and responsibilities. Organizational relations and inter-organizational relationships were significant, reflecting the importance of trust, communication, and collaboration among organizations. Despite being a minor factor, language barriers can still impede integration, especially when diverse linguistic groups are involved. The survey results emphasize the need for an integrated, multi-level strategy that addresses economic disparities, harmonizes administrative and political systems, and fosters strong inter-organizational relationships. Tailored solutions that incorporate both structural reforms (such as aligning regulatory frameworks) and relational strategies (such as building trust among organizations) are likely necessary to overcome these complex barriers and realize successful integration.

4.2.4.6 Effects of Population Growth on Integrated Transport Planning

Table 4.6: Effects of population growth on integrated infrastructure planning

S/N	Issues	Frequency	percentage
1	Increased demand for infrastructure	12	5.0
2	The need for collaborative management	11	4.5
3	Necessity of open finance	19	7.4
4	All these impacts were possible	206	83.1
	Total	248	100

Source: Expertise survey, 2023

Table 4.6's survey result highlights that Population growth significantly influences infrastructure planning; increasing demand and necessitating open financing and collaborative management, according to the survey. 83.1% of respondents acknowledge the combined impact of these factors, suggesting that infrastructure planning needs adjustments to facilitate sustainable growth. This means cities need integrated approaches that include resource sharing, transparent financial strategies, and coordinated efforts to meet increasing demands. Ignoring any of these factors could result in strained resources and inadequate infrastructure to support population expansion effectively.

Respondents indicated increased demand for infrastructure, indicating that urban population surges often outpace adequate development (Seto et al., 2014; Siedentop & Fina, 2010). This can strain existing systems, necessitating a reevaluation of infrastructure planning strategies. 83.1% of respondents noted the need for collaborative management, highlighting the importance of integrated approaches in addressing complexities introduced by population growth (Bryson, Crosby, & Stone, 2015). They acknowledged the interconnectedness of demand, collaboration, and financing, highlighting the need for a comprehensive strategy that considers social, economic, and environmental factors (Bhattacharyay, 2009; Chen & Wang, 2024). These findings underscored the critical need for coordinated efforts and innovative funding mechanisms to ensure sustainable infrastructure development for urban areas.

4.2.4.7 Factors Contributing to the Lack of Integrated Transport Planning

Table 4.7: The reasons for the absence of integrated infrastructure planning

S/N	Issues	Frequency	percentage
1	Hesitancy among stakeholders	25	10
2	Lack of support from policymakers	53	21.2
3	Lack of leadership	78	31.2
4	Lack of attention	90	36.1
	Total	248	100

Source: survey, 2023

Table 4.7's results indicate that the most significant obstacles to integrated infrastructure planning are a lack of attention and leadership. This suggests that effective planning requires both strong, visionary leadership and priority-setting. The absence of support from policymakers and stakeholder hesitancy further underscores the necessity for increased political commitment and confidence among all parties involved. This implies that policymakers and planners must take proactive measures to secure policy support and engage stakeholders, thereby mitigating hesitation and promoting integrated infrastructure planning. Additionally, they will need to increase their focus and leadership.

The survey results reveal several barriers to integrated infrastructure planning, including stakeholder hesitancy, lack of support from policymakers, a lack of leadership, and lack of attention. Stakeholder hesitancy can stem from fears of losing control over decision-making, resource allocation concerns, or apprehensions about the efficacy of collective efforts. Policymakers play a crucial role in facilitating or obstructing collaborative efforts, and advocacy for policy reforms that promote integrated planning and allocate resources can help overcome these challenges (Benner & Pastor, 2015). A clear strategic vision is also essential, as without a unified focus; stakeholders may become disengaged, leading to fragmented initiatives. Increasing awareness of the long-term benefits of integrated planning can address the institutional bias towards siloed planning efforts reflected in the lack of attention to integrated planning(Frick et al., 2015; Ganeshu, Fernando, & Keraminiyage, 2023).

Within the infrastructure-provider sectors, we observe the following patterns of coordination: There are three different levels of coordination: strong (26.9%), weak (57.7%), and unknown (11.9%). This indicates that people generally perceive infrastructure suppliers to be poorly coordinated. This can lead to inefficiencies and challenges in managing intricate, interdependent services. A dominant approach with weak coordination leads to a fragmented approach, where providers operate in silos. This fragmentation can lead to higher costs, duplicated efforts, and slow response times during crises, underscoring the need for standardized practices and improved communication.

Research on coordination in the infrastructure-provider sector reveals challenges and tendencies towards weak coordination.(Roehrich et al., 2020; Wood, 2010). This lack of cohesion can hinder service reliability and reduce operational costs. Addressing these issues could help improve data transparency and develop more rigorous assessment tools. Public administration literature, which emphasizes the difficulties in cross-sector coordination due to competing objectives and limited incentives for alignment, aligns with the perception of poorly coordinated infrastructure suppliers.

4.2.4.8 Financing Models for Integrated Transportation Infrastructure

The results revealed that a significant portion of respondents (50.5%) view their local treasuries as the primary source of financing for an integrated transportation infrastructure between the two cities, followed by grants (42%), and a smaller proportion (4%) view federal government subsidies as a viable funding option. These findings are important because they suggest a potential reliance on local financial resources for large-scale infrastructure projects, which can be both strength and a limitation. From a scientific standpoint, this reliance on local treasuries indicates that local governments may prioritize and control transport infrastructure projects, potentially leading to more tailored solutions for their specific needs. However, it also raises questions about the adequacy of local budgets for such significant infrastructure developments. The limited reliance on federal government subsidies could imply that local governments may face challenges in securing sufficient funds without external financial support, potentially hindering the timely and effective development of an integrated transport system.

The results are internally valid as they address the study's objectives regarding potential sources of financing for the construction and maintenance of an integrated transport infrastructure. The question specifically targeted potential funding avenues, and the answers obtained reflect the

perceptions of the respondents regarding available financial resources. Although the significant role of grants challenges the expectation that local governments will be solely responsible for funding urban infrastructure, the high reliance on local treasuries (Beecher, 2021; Oosthuizen & Thornhill, 2017). This result is consistent with the study's goal of understanding the financial mechanisms that support the development of integrated urban infrastructure (Oosthuizen & Thornhill, 2017). The finding also highlights a gap in the reliance on federal subsidies, which may suggest limited national governmental involvement in regional transportation development. These results are externally valid when compared to similar studies conducted in other countries, particularly in developing or rapidly urbanizing regions (Oosthuizen & Thornhill, 2017). Local governments in many countries are primarily responsible for financing infrastructure, especially in areas where national funds are either insufficient or diverted to other priorities. For example, in African cities such as Nairobi or Lagos, local governments often rely on municipal funds and external grants for infrastructure development, with limited support from the national government (Graham, 2016; Turok, 2016). Studies from Southeast Asia have underscored the crucial role of international development agencies in financing large infrastructure projects, especially when local budgets face constraints(Renwick, 2016). This external comparison underscores the importance of grants and external financial support, which can alleviate some of the burdens on local treasuries. The lower reliance on federal subsidies in this study is consistent with trends in other developing countries, where decentralization of funding responsibilities means that local governments often have to explore a variety of funding sources, including grants, private sector partnerships, and municipal bonds.

The study highlights the financial challenges and opportunities faced by local governments in developing integrated transport systems. Successful infrastructure projects often require a mix of local, federal, and external funding sources, especially in resource-constrained environments. The study also provides a nuanced understanding of the financial sources prioritized by local governments, which can inform policy and planning decisions. However, the study lacks specific details about the funding available through each source, and does not explore the sufficiency of funds or allocation to transportation projects. Future research could focus on administrative and political challenges faced by local governments in securing funding and assess the long-term financial sustainability of integrated transportation systems funded primarily by local treasuries.

4.2.4.9 Absence of a Centralized Institution for Managing Inter-City Transport Systems

The document review indicates that there is no clearly established joint institutional body responsible for the planning, and coordination of common transportation infrastructure between the cities. The reviewed institutional and planning documents show that transportation infrastructure and services are largely managed within separate administrative and institutional arrangements, with limited evidence of a dedicated intercity mechanism for coordinating shared transport infrastructure. This institutional fragmentation can contribute to disjointed planning, overlapping or uncoordinated responsibilities, limited accountability, and inefficiencies in the development and management of transportation infrastructure across the two cities. The finding is consistent with the survey results, in which 87% of respondents reported that there was no institution responsible for managing common transportation infrastructure**.** The absence of a formalized coordination mechanism therefore represents a significant institutional challenge to integrated transportation planning and highlights the need for an appropriate intercity governance and coordination arrangement to facilitate joint planning, implementation, operation, and management of shared transportation infrastructure.

From a policy perspective, this gap indicates that there might be significant challenges in ensuring that the transportation system is maintained, adequately funded, and effectively expanded over time. If no central institution exists to manage these functions, each city may independently operate its transportation services, which could lead to inconsistencies in service quality, standards, and the ability to make coordinated regional investments. The lack of institutional management underscores the importance of integrated governance structures for achieving sustainable urban transport systems (Bouraima et al., 2023).

The internal validity of the findings is solid, as the results directly address the study's regarding the existence of an institution managing the common transport infrastructure. The question was clear, and the responses were straightforward, indicating a lack of formal institutions in place for managing transport across cities. The study's goal of understanding the governance challenges facing integrated transport systems aligns well with the research objectives, confirming the need to establish management structures as a critical element. By focusing on the existence of such an institution, the study identifies a crucial gap that hinders the effective operation and integration of transportation infrastructure. The relatively high percentage of respondents indicating the absence

of such institutions underscores a common issue in the early stages of infrastructure development and integration, which is consistent with the study's goals of exploring challenges to creating a unified transport system. The results align with trends observed in similar studies from other regions, particularly in rapidly urbanizing areas or in cities experiencing significant infrastructure growth. For instance, research in cities like Nairobi and Lagos, where multiple municipal governments struggle to manage shared infrastructure effectively, often identifies the absence of a centralized body for managing transportation networks as a major barrier to integrated systems (Agunbiade & Olajide, 2016; Cartwright et al., 2018). Similarly, studies in Latin America, particularly in cities with high levels of congestion and fragmented governance (such as São Paulo), have revealed that the lack of an institution coordinating regional transport is a critical issue(Lane, 2017; Schabas, 2012). In these cities, the absence of institutional management frequently results in inefficiencies, as localities operate independently and make decisions without considering a regional perspective. This result is consistent with findings from other developing countries, where fragmented governance structures often hamper large-scale infrastructure projects. The external comparison reinforces the relevance of the study's findings and highlights a common governance challenge across cities with ambitious urban development plans.

The study highlights the importance of institutional integration and governance frameworks in managing shared transport infrastructure. It suggests that even with technical solutions and funding, urban transport systems may not reach their full potential without an effective management body. This highlights the role of governance in sustainable urban development. The study also highlights the need for further research on the institutional frameworks required for effective management of integrated transport systems. It also suggests that future research could explore the reasons behind the absence of a managing institution, such as political challenges, funding shortages, or bureaucratic inefficiencies. It also suggests that understanding the political, legal, and financial feasibility of setting up a managing institution could be crucial for future transport integration projects.

4.3 The Challenges of Integrated Urban Infrastructure Planning

4.3.1 Challenges of Urban Sewerage system

4.3.1.2 Major challenges of Sewerage management system

Table 4.8:- Major challenges of Sewerage management system

S/N	Issues	Frequency	Percentage
1	Lack of financial resources	126	50.9
2	Lack of coordination among stakeholders	81	32.7
3	Lack of skilled human power and geographical Landscape	41	16.4
4	Total	248	100

Source: survey, 2023

The data in Table 4.8 reveals significant challenges in infrastructure development, with (50%) of respondents citing a lack of financial resources as the most pressing issue. This indicates that financial constraints significantly hinder the ability to implement and maintain essential sewerage treatment plant projects. The lack of coordination among stakeholders, cited by (32.2%) of respondents, suggests that even when resources are available, inefficiencies and misalignment between municipalities, private sectors, and local communities, as also observed from FGDs, prevent effective project execution. Additionally, (14.3%) of respondents point to a lack of skilled human power, and geographical landscape means terrain such as mountains, hills, and uneven surfaces found in the study areas can complicate construction efforts and increase costs. The slope in the study areas is gentle, and the flow line from the sewerage to the treatment plant is from the upper area to the bottom, in contrast to the present literature, as indicated by the respondents' responses. Additionally, some specific areas prone to flooding or with unstable soil conditions require specialized engineering solutions to ensure structural stability and long-term functionality.

The results align with the study's objectives of identifying and analyzing challenges in sewerage management. The prioritization of financial resources as the primary issue validates the hypothesis

that resource constraints are a fundamental barrier to sustainable sewerage systems (Gollakota, Gautam, & Shu, 2020; Spoann et al., 2018). For example, in India, inadequate funding for sewage treatment plants has contributed to widespread water pollution issues. Furthermore, the inclusion of stakeholder coordination and technical capacity issues supports the study's premise that these challenges are interrelated and require a holistic approach to address them effectively. Effective liquid waste management requires collaboration and coordination among various stakeholders, including government agencies, private sector entities, and community organizations (Batista et al., 2021). For instance, in Kenya, fragmented governance structures have hindered efforts to improve sanitation services in urban areas (Laquian, 2005; Rakodi, 2003). Insufficient human resources and terrain significantly influence the design and functionality of sewerage systems, which primarily rely on gravity flow to transport wastewater. Gravity can effectively transport effluent in regions with a consistent, moderate slope, thereby minimizing the necessity for mechanical pumps. However, level terrains pose challenges (Nelson & Murray, 2008), as an inadequate slope hinders the natural flow, often requiring the installation of costly pumping stations and increasing the risk of stagnation. In countries like Nepal, the rugged terrain and shortage of trained personnel have hampered efforts to provide adequate sanitation services in remote areas (Paudel et al., 2018). The absence of established formal structures for coordinating urban development and infrastructure provision exacerbates the challenges associated with sewerage systems (Ferguson et al., 2013; Rees, 2006) highlight the importance of multi-stakeholder collaboration and partnerships in urban infrastructure development. Integrated urban planning approaches that consider multiple sectors and stakeholders are essential for addressing complex urban challenges holistically. Examples from cities like Curitiba, Brazil, highlight the benefits of integrated planning in improving urban infrastructure and quality of life (Bush & Doyon, 2019; Castelnovo et al., 2016; Mrak et al., 2022).

The findings suggest a pressing need for a multi-faceted approach to address the identified challenges, involving increased investment, improved coordination among stakeholders, capacity building, technological innovation, and coherent policy frameworks. Addressing these challenges requires a comprehensive strategy that acknowledges the interconnectedness of urban development and waste management issues. The difficulties in managing sewerage systems in the study areas are indicative of broader patterns observed in urban areas globally, highlighting the

need for a holistic approach to tackle wastewater management challenges. The challenges identified are consistent with findings from similar studies in other developing countries. Research from regions such as South Asia and sub-Saharan Africa has highlighted financial limitations as a primary obstacle to effective sewerage management (Khan et al., 2022; Nansubuga et al., 2016). For example, studies in India and Kenya have shown that inadequate funding leads to poorly maintained sewerage systems, exacerbating public health risks. Similarly, the lack of stakeholder coordination has been recognized as a global challenge, emphasizing the need for integrated planning and governance frameworks (Francesch-Huidobro et al., 2017). The alignment of these findings with the current study underscores the universality of these challenges in under-resourced urban contexts. The study highlights the need for a systems-based approach to address financial, organizational, and technical barriers in sewerage management. It provides a model for analyzing issues, highlighting targeted investments and collaborative governance.

4.3.1.3 Impact of Rapid Urbanization on Sewerage systems

The findings indicate that rapid urbanization is a major factor influencing the adequacy and performance of the sewerage system, as reported by 85.7% of respondents**.** The continued expansion of urban areas, accompanied by population growth and increasing residential, commercial, and institutional development, generates a corresponding increase in wastewater volumes. When sewerage infrastructure does not expand at the same pace as urban development, existing systems can become overloaded, resulting in inadequate service coverage, increased environmental pollution, and public health risks. Therefore, the finding underscores the need to integrate sewerage infrastructure planning with urban growth management and to expand sewerage networks and treatment capacity in line with current and projected urban development. In the context of Addis Ababa and Sheger cities, coordinated and long-term sewerage planning is particularly important because wastewater flows and infrastructure needs extend beyond administrative boundaries. This underlines the strain urbanization places on existing sewerage infrastructure, making it clear that traditional methods are insufficient to handle the rising demands.

The key informant interviews conducted further validate these findings, highlighting the substantial financial investments required to construct and maintain modern sewerage systems and

lines in urban regions. This result indicates a strong correlation between urban growth and the increasing complexity of infrastructure challenges, particularly in sewerage management. The results directly align with the study's goals of understanding the effects of urbanization on sewerage systems (Yazdanfar & Sharma, 2015; Zhou, 2014). The confirmation by respondents and interviewees reinforces the validity of the data, showing consistency across different sources. Additionally, the identification of technological needs and financial constraints supports the study's premise that urbanization not only increases system demands but also necessitates comprehensive planning and resource allocation to address these challenges effectively.

The findings highlighted the urgent need to address the impact of rapid urbanization on sewerage systems and the importance of investing in innovative solutions to effectively manage increased wastewater volumes in the study areas (Bieker et al., 2010; Obaideen et al., 2022).These challenges highlighted the necessity for coordinated efforts among various stakeholders to develop and implement sustainable solutions for urban wastewater management. The challenges in managing sewerage systems in the study areas are representative of broader urbanization-related issues seen globally. Both developed and developing countries design contemporary integrated sewerage management systems in city regions to tackle the challenges of urbanization, environmental protection, and public health (Daigger, 2007; Jiboye, 2011). Integrated urban planning techniques that consider various sectors and stakeholders are crucial for enhancing urban infrastructure and quality of life, as evidenced by successful examples such as Curitiba, Brazil (Jordán et al., 2012; Kühner et al., 2021).The challenges identified in this study are consistent with global trends observed in other rapidly urbanizing cities. For example, studies in cities like Lagos and Mumbai have shown that rapid urbanization exacerbates the strain on sewerage systems, leading to higher volumes of wastewater and requiring significant technological innovation and financial investment (Sukanya & Tantia, 2023; Weeks, 2009). The findings also align with research highlighting the complexity of urban sewerage systems in developing regions, where outdated infrastructure struggles to cope with rapid growth. These similarities confirm that the issues faced in the study area are part of a broader global phenomenon. This study explores the relationship between urbanization and sewerage system challenges, emphasizing the need for innovative technology and adaptive solutions, using quantitative survey data and qualitative insights for future research.

4.3.1.4 Institutional gaps in sewerage service coordination

The results reveal a critical gap in sewerage service coordination, with 86% of respondents indicating the absence of formal or informal institutions dedicated to organizing sewerage services in the study area. This indicates a lack of institutional frameworks for planning, coordinating, and managing essential sewerage infrastructure. The absence of such structures can lead to uncoordinated efforts, inefficiencies, and the inability to address growing urban sewerage challenges effectively. These findings underscored the fundamental role of governance and institutional mechanisms in ensuring the functionality and sustainability of urban sewerage systems. The identified challenges in sewerage management highlight the necessity for comprehensive interventions that encompass institutional reforms, legal frameworks, financial investments, government attention, awareness-raising efforts, and institutional cooperation.

The absence of formal institutions and legal frameworks to coordinate sewerage management reflects broader challenges in urban governance and infrastructure development, particularly in developing countries (Allen et al., 2006; Jones et al., 2014; Rouse, 2013).The observation of comparable challenges in urban sanitation in other countries, such as Nigeria and Bangladesh, underscored the significance of robust institutional capacity and coordination mechanisms(Adorsu-Djentuh, 2018; Akpabio, 2012)

The results are consistent with similar findings in other rapidly urbanizing regions of developing countries. Studies in cities like Dar es Salaam, and Dhaka, have highlighted the absence or inefficiency of formal institutions as a major impediment to effective sewerage management(Rana, 2016). These cases have linked weak governance to inadequate planning, underfunded infrastructure, and public health risks. The alignment of these findings with global patterns reinforces the broader relevance of the current study, situating its conclusions within the context of international urban infrastructure challenges. The study underscores the importance of institutional frameworks in urban infrastructure management, emphasizing the need for robust governance structures to address complex infrastructure challenges and establish or strengthen institutions for sustainable sewerage management in rapidly growing urban areas.

4.3.2 Challenges of Urban drainage system

4.3.2.1 Challenges of integrated drainage system development

Table 4.9: Challenges of integrated drainage system development

No	Issues	Frequency	Percentage
1	Lack of collaboration among multiple stakeholders	110	44.5
2	Inadequate financial resources	70	28.3
3	Inadequate skilled man power	47	19
4	Insufficient machinery	21	8.2
	Total	248	100

Source: survey, 2023

The findings in Table 4.9 highlighted the critical need for enhanced collaboration among stakeholders in addressing integrated infrastructure challenges. The respondents cited the absence of collaboration, highlighting how disjointed efforts between users, designers, developers, and other parties hinder progress. This lack of coordination underscored the importance of fostering stakeholder engagement and joint planning to streamline efforts and maximize impact. Additionally, resource-related issues, including insufficient funding, skilled manpower, and machinery, further exacerbate the situation. These limitations indicate that a comprehensive strategy to allocate resources effectively and build local capacity is essential.

The results align well with the study's objectives of identifying key obstacles to integrated municipal infrastructure planning. The prioritization of challenges confirms that stakeholder collaboration is a critical factor, directly impacting resource allocation and capacity building. This suggests that the development of an integrated urban drainage system in the study area necessitates the coordination and collaboration of a variety of stakeholders (Bach et al., 2014; Hoang & Fenner, 2016). However, a lack of effective coordination mechanisms can lead to resource inefficiency, conflicting priorities, and duplication of efforts, as confirmed during focus group discussions and key informant interviews.

For example, there is no agreement between the two cities regarding the location of a solid waste disposal site or the construction of a dam for drinking water. Hence, effective infrastructure development and maintenance necessitate sufficient financial, human, and technological resources (Foster & Briceño-Garmendia, 2010; Rinaldi et al., 2001; Roelich et al., 2015; Thacker et al., 2019). As document analysis indicates, there were no common financial sources for the development of integrated urban infrastructure like roads, dams, flood protections, and others. A lack of adequate resources can impede the implementation of integrated urban infrastructure projects and the resolution of urgent issues, such as flooding (Costa et al., 2016; Jha et al., 2012).

Other developing countries facing rapid urbanization have documented similar challenges. Studies from sub-Saharan Africa, South Asia, and Latin America consistently highlight the importance of stakeholder coordination and resource mobilization in infrastructure planning (Gutman et al., 2015; Nnadozie et al., 2017). For instance, research in Kenya and India emphasizes that collaborative frameworks significantly improve project efficiency and sustainability. These parallels validate the relevance of the findings within a broader global context, demonstrating that the issues faced by Ethiopian metropolitan cities are part of a larger pattern in comparable regions.

The study contributes to the theoretical advancement of urban infrastructure planning by emphasizing the interplay between collaboration, resource availability, and technical capacity. Conceptually, it underscored the necessity of adopting a systems-based approach, where multiple stakeholders work cohesively to address shared challenges. Methodologically, the study provides a framework for identifying and prioritizing barriers, which can guide future research and policy formulation in similar urban contexts.

4.3.2.2 Perspectives and Challenges in the Adequacy of Urban Drainage System

The study's findings highlight a critical issue regarding the inadequacy of drainage systems in the study area. The significant disparity in perceptions, with only 17.6% of respondents considering the system sufficient and 78.9% deeming it inadequate, underscores the urgent need for improved drainage infrastructure. Field observations corroborate this perception, revealing the absence or scarcity of both open and closed drainage systems, particularly in older road

networks. These results suggest systemic neglect in urban infrastructure maintenance and planning, which poses risks of flooding, road degradation, and public health concerns. Such areas lack drainage facilities, indicating inadequate upgrades or maintenance to meet contemporary needs. This phenomenon is frequently observed in rapidly urbanizing regions, where drainage system development is unable to keep pace with population growth and urban expansion (Buhaug & Urdal, 2013; Rana, 2011; Wei & Ewing, 2018). The findings align with the study's objectives of assessing infrastructure challenges and highlight drainage as a critical bottleneck in urban planning.

The overwhelming perception of insufficient drainage systems highlights a potential gap in urban infrastructure planning and investment. The absence of proper drainage system, particularly on older roads, points to a need for systematic retrofitting and upgrading of outdated infrastructure (Liu et al., 2024; Modena et al., 2014). Urban planners and local governments must prioritize drainage in their planning agendas to ensure that both new and old parts of the cities are resilient to environmental stresses. Additionally, the study suggests that the focus on building flood drains only along newly built highways is an example of an approach to development that puts more emphasis on building new infrastructure than on installing new systems and making them better. The mismatch between infrastructure provision and community requirements underscored the significance of meaningful community engagement and participation in infrastructure planning and decision-making processes (Calder & Beckie, 2013; Sinclair, Diduck, & Vespa, 2015). Inadequate consideration of local knowledge and preferences can result in a disconnection between infrastructure solutions and the realities and priorities of residents (Berman, 2016; Nugroho et al., 2018).

The results mirror challenges observed in other rapidly urbanizing regions in developing countries. For instance, studies in cities like Nairobi and Dhaka have similarly identified insufficient drainage infrastructure as a significant urban challenge. These cases linked poor drainage systems to increased flooding, erosion, and public health risks. The parallels between these findings and the current study indicate that the challenges faced in Ethiopian metropolitan cities are not unique but part of a broader trend in under-resourced urban environments. This study underscores the significance of drainage systems in older road networks for urban

infrastructure planning, emphasizing the necessity for a thorough assessment and prioritization of infrastructure upgrades in rapidly expanding urban areas.

4.3.2.3 Challenges in Consensus Building for Citywide Integrated Drainage Planning

The finding that only 26.9% of respondents provided positive feedback on a citywide integrated drainage plan, while 69.6% expressed negative responses, highlights a significant challenge in achieving consensus on urban drainage strategies. This disparity underscores a potential lack of awareness, trust, or perceived feasibility regarding such plans among stakeholders. Integrated drainage plans are critical for addressing urban flooding, waterlogging, and efficient water management (Green et al., 2021; Zhao & Yue, 2023). The low positive response rate may reflect concerns about implementation challenges, insufficient stakeholder engagement, or gaps in the proposed plan's design. These results emphasize the importance of fostering inclusive participation and transparency to build support for integrated urban drainage systems.

The findings align with the study's objective of evaluating stakeholder perspectives on urban infrastructure planning. The significant majority (69.6%) expressing negative responses supports the objectives that integrated drainage planning faces substantial resistance, possibly due to technical, financial, or political barriers. The lower proportion of positive responses (30.4%) validates the assumption that stakeholders are not uniformly convinced of the plan’s benefits. These results are consistent with the study’s goals, demonstrating that the methodology effectively captured the underlying attitudes and concerns related to integrate drainage planning. When compared to similar studies globally, these findings are consistent with trends in urban drainage management, particularly in regions where integrated planning initiatives are in their promising stages(Mguni, 2015; Zhou et al., 2024). Internationally, resistance to integrated drainage plans often stems from stakeholder anxieties about costs, disruption during implementation, and unclear benefits(Oladunjoye et al., 2020; Oluwayemi, 2021). However, the high percentage of negative responses (69.6%) in this study may reflect unique local challenges, such as insufficient communication of the plan’s objectives or a history of failed infrastructure projects. Studies from more developed contexts typically show higher acceptance rates, highlighting the need for tailored approaches to stakeholder engagement and education in this region(Sherman & Ford, 2014).

This study explores stakeholder dynamics in urban infrastructure planning, particularly integrated drainage systems. It highlights the importance of diverse perspectives and the need for targeted strategies to address concerns. However, the study has limitations, including a lack of in-depth qualitative feedback and specific reasons for resistance. Future research should use qualitative methods, compare studies across different regions, and track changes in stakeholder attitudes after targeted engagement efforts.

4.3.3 Challenges of Urban Solid Waste Management

4.3.3.1 Challenges in Integrated Solid Waste Management Planning

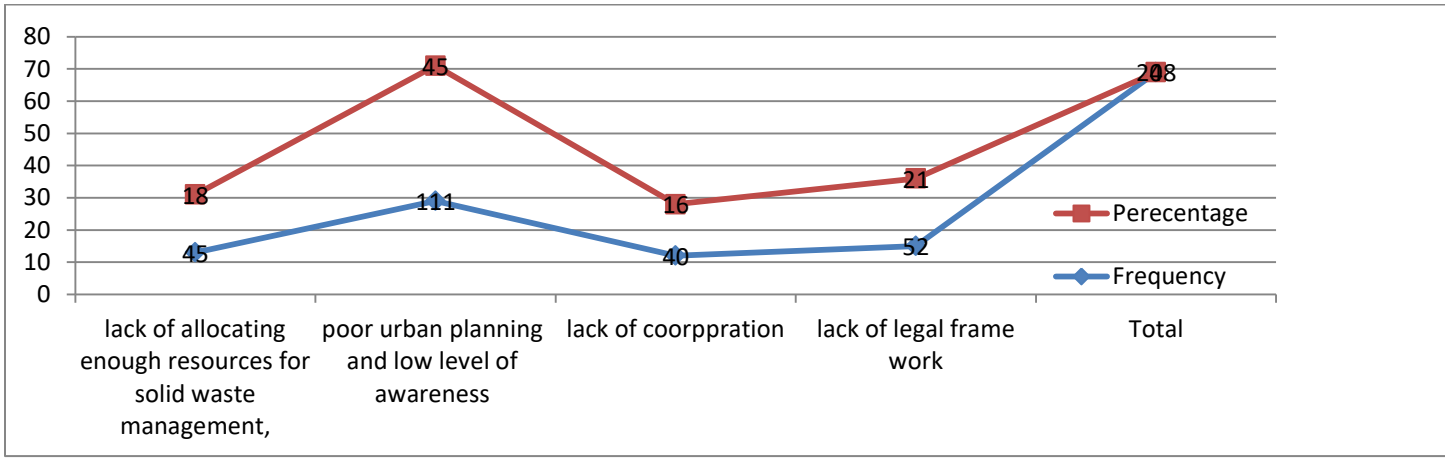

Fig. 4.10: Challenges in integrated solid waste management planning

Source: Feld survey, 2024

The results revealed on Fig. 4.11 emphasize the multifaceted nature of challenges in solid waste management, where both systemic issues (e.g., urban planning) and organizational barriers (e.g., cooperation and legal frameworks) are interrelated. The predominance of urban planning and awareness challenges suggests the need for comprehensive educational and policy interventions(Watson, 2011); while the lesser emphasis on resource allocation highlights that addressing operational inefficiencies may hold more immediate promise than solely increasing budgets(Schick, 2014).

The results align with the study's objectives of identifying barriers to effective waste management planning. The distribution of challenges indicates consistency with the addressing solid waste management requires a multi-pronged approach, balancing structural, policy, and

behavioral considerations(Das & Panda, 2024; John & Ajibade, 2024). For instance, the significant proportion (42%) emphasizing poor planning and awareness supports the goal of evaluating strategic gaps in city-wide initiatives, while the relatively high recognition of legal frameworks (21%) validates the assumption that regulatory deficiencies remain a key bottleneck. These findings underscore the reliability of capturing diverse stakeholder perspectives on the issue. When compared to studies conducted in other countries like Nigeria, these findings resonate with global challenges in integrated solid waste management (Abdulfatah, 2023; Mbah & Nzeadibe, 2017). Poor urban planning and low awareness often emerge as primary obstacles in developing and transitioning economies, where rapid urbanization outpaces infrastructural and behavioral adaptations. Similarly, legal and cooperative gaps are commonly cited as barriers in regions where governance structures are fragmented or underdeveloped(Nelles, 2013; Shackleton et al., 2015). However, the comparatively lower emphasis on resource allocation (18%) in this study contrasts with findings from countries where financial constraints dominate the discussion, suggesting that operational or strategic inefficiencies may play a more critical role in this context. These comparisons highlight the importance of tailoring solutions to local conditions while drawing on international best practices.

This study contributes to the theoretical understanding of integrated waste management by highlighting the interconnected nature of systemic, regulatory, and behavioral challenges. It provides a framework for prioritizing interventions and emphasizes the need for a balanced approach combining policy reform, capacity building, and public engagement. However, the study has limitations, including limited stakeholder responses and a lack of causal relationships. Future research should include larger sample sizes, stratified sampling, longitudinal studies, comparative analyses, and qualitative methods.

4.3.3.2 Barriers to Effective Multi-Stakeholder Collaboration in Infrastructure Planning

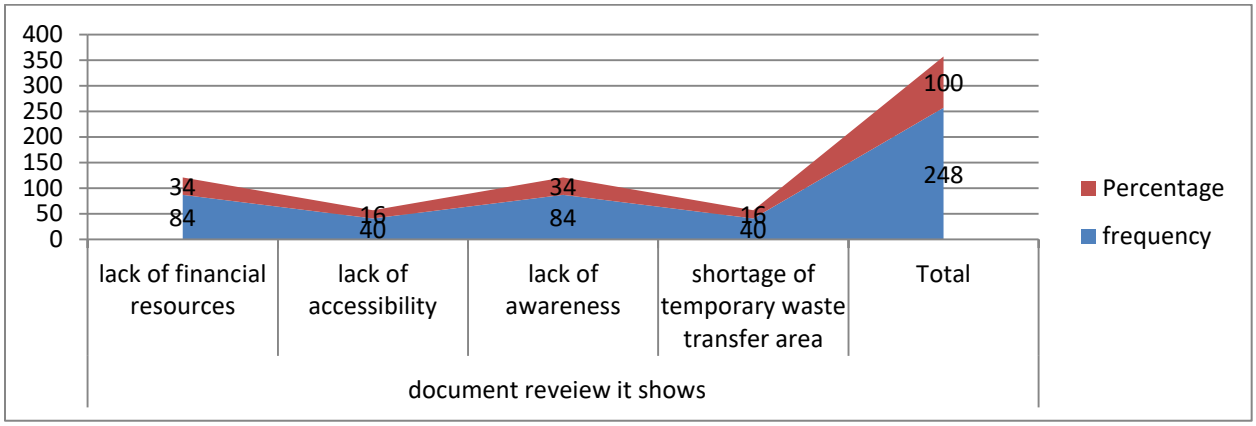

Fig.4.11: Challenges in Multi-Stakeholder Collaboration

Source: Feld survey, 2024

The responses of the respondent summarize on Fig. 4.12 reveals four key challenges faced solid waste collection stations. The two most frequently cited issues lack of financial resources and lack of public awareness each account for (34%) of the responses. Accessibility issues and a shortage of temporary waste transfer areas, affecting (16%) of respondents each, were also noted. Site observations further support these findings, showing poor solid waste management practices in Burayu, Gelan, and Sebata sub-cities, where solid waste is scattered throughout the area. Additionally, the Raphi solid waste dumping site in Addis Ababa was found to be incompatible with other land uses.

The lack of financial resources, noted by (34%) of respondents, is a significant obstacle to effective solid waste management. This insufficient funding limits investments in infrastructure, staff, and proper collection of the waste. Similarly, a lack of public awareness, also affecting (34%) of respondents, suggests that many individuals may not understand proper waste disposal methods. This lack of awareness was observed during field observations, where scattered solid waste was prevalent in several sub-cities. Accessibility challenges, cited by (16%) of respondents, imply that certain areas may have poor infrastructure or difficult-to-reach locations, which can hinder the efficiency of waste collection. Additionally, 16% of respondents pointed to a shortage of temporary waste transfer areas, indicating logistical issues in the flow of waste

from collection points to final disposal sites. The Raphi solid waste dumping site's incompatibility with surrounding land uses, as seen in Addis Ababa, further complicates the situation.

The lack of financial resources suggests that the waste collection system is severely underfunded, affecting the overall efficiency and effectiveness of solid waste management in the areas. Without sufficient funding, it becomes challenging to improve infrastructure, hire adequate staff, or implement proper waste management practices. This underfunding likely contributes to the poor solid waste management practices observed in Burayu, Gelan, and Sebata sub-cities, where waste is scattered and poorly managed. Public awareness also plays a crucial role. The scattered waste in the observed areas indicates that residents may not be fully informed about proper solid waste disposal practices. This lack of awareness, compounded by the lack of financial resources, exacerbates environmental and public health risks. Additionally, accessibility issues and the shortage of temporary transfer stations further slowdown the waste management process, contributing to the accumulation of waste in certain areas. The incompatibility of the Raphi dumping site with other land uses in Addis Ababa suggests poor urban planning. The lack of integration between waste management facilities and surrounding land uses creates conflicts and inefficiencies in the broader urban environment, further complicating waste management efforts.

The challenges outlined and supported by site observations reveal a waste management system that faces both financial and logistical constraints. The top two challenges lack of financial resources and lack of public awareness are deeply intertwined. Without adequate funding, authorities cannot improve infrastructure or run effective public awareness campaigns, leading to a cycle of poor waste management and scattered waste, as seen in Burayu, Gelan, and Sebata sub-cities.

Accessibility issues and the shortage of temporary transfer areas further complicate the situation, pointing to weaknesses in urban planning and logistics. When solid waste collection sites are difficult to access or there are insufficient places to temporarily store waste, the entire system becomes inefficient, leading to the accumulation of waste in neighborhoods (Hazra & Goel, 2009; Yukalang et al., 2017). The incompatibility of the Raphi dumping site with residential the

land use type highlights the need for better integration of waste management within broader urban planning efforts to prevent conflicts and improve sustainability.

4.3.3.3 Key Challenges in Integrated Solid Waste Management

The study highlights several key challenges in integrated solid waste management. The most significant issue, as indicated by (88%) of respondents, is weak urban planning and a lack of understanding of waste management at the household level. When households are unaware of how to sort, handle, and dispose of waste correctly, it leads to improper segregation, increased littering, and reliance on unsanitary methods like open dumping or burning. This behavior not only overwhelms waste collection systems but also contributes to environmental pollution, public health hazards, and inefficient recycling processes. Ultimately, without proper education and awareness, household-level waste management becomes a critical bottleneck in the overall waste disposal system. This suggests that both infrastructure planning and public awareness regarding proper waste disposal practices are insufficient.

Additionally, (74%) of respondents identified the lack of financial support for waste management agencies, while (22.5%) cited poor coordination and the absence of a legal framework. Insights from interviews and focus group discussions reinforce these findings, with weak planning, insufficient public awareness, and inadequate funding emerging as primary obstacles to effective waste management. Governance issues, including the absence of appropriate legal frameworks and federal structures, hinder the progress of integrated solid waste management initiatives. Financial constraints, institutional aspects, political factors, lack of integration among stake holders, and outdated policies contribute to the challenges faced in solid waste management in the areas as identified during focus group discussion. Also, inadequate logistics, such as storage, collection, and transportation of solid waste, are significant reasons for inadequate waste management in many third-world countries.

The results align with the study's objectives that waste management challenges stem from a combination of governance, planning, and resource-related issues. The high prevalence of weak urban planning and inadequate household waste management understanding emphasizes the importance of integrating community-based and systemic approaches (Bardosh et al., 2017;

McAllister, 2015). The identification of financial and legal barriers reinforces the study's framework by validating its focus on structural challenges as key areas of concern.

These findings indicate that without strong urban planning and public engagement, waste management systems will continue to be ineffective. Weak urban planning contributes to poorly design waste collection systems, while a lack of awareness at the household level leads to improper waste disposal, complicating management efforts (Yukalang et al., 2017). The lack of financial support for agencies also impedes their ability to invest in necessary resources, further weakening the system. The absence of coordination and legal frameworks suggests that regulatory oversight and stakeholder cooperation are inadequate, which hinders the development of a cohesive and efficient waste management strategy (Wang, Lee, & Mokhtar, 2021). The combination of weak urban planning and lack of public awareness highlights the need for more holistic and integrated approaches to solid waste management. Local governments must prioritize better urban planning, including robust waste disposal systems, while also launching educational campaigns to raise public awareness about responsible waste management at the household level. The lack of financial support for waste management agencies suggests that a more sustainable funding model is required, possibly through public-private partnerships or government subsidies (Ma et al., 2020; Yang et al., 2017). Moreover, the lack of coordination and legal frameworks indicates a governance gap, necessitating stronger laws, policies, and inter-agency cooperation to align all stakeholders and streamline waste management processes. Strengthening both regulatory and financial structures will be key to improving waste management outcomes in the study areas.

These findings align with challenges identified in other urban contexts, particularly in developing nations. For instance, studies in Nairobi and Dhaka have similarly reported weak urban planning, insufficient funding, and lack of legal frameworks as major obstacles to waste management(Alam & Ahmad, 2013; Rahman, 2017). The lack of coordination among stakeholders is a recurring theme globally, often cited as a significant impediment to implementing sustainable waste systems. This alignment situates the study within a broader body of literature, emphasizing the universal relevance of the identified challenges. The study emphasizes the importance of financial, governance, and social factors in urban waste

management, emphasizing the need for community education and systemic planning. It provides a framework for future research and practical insights.

4.3.3.4 Major Challenges in Waste Transportation

The findings indicated that of the 96% of waste collected in the cities is only 83% is transported to disposal sites, leaving a significant gap in waste management. The primary hindrances to full-capacity collection are a lack of trucks (50%), lack of resources (20.5%), and lack of accessibility (26%). these results highlight logistical and infrastructural deficiencies that undermine the effectiveness of waste collection systems. The shortage of trucks, as the most cited issue, points to systemic operational limitations, while the lack of resources underscores financial constraints. Accessibility challenges reflect urban planning inefficiencies, such as inadequate road infrastructure or poorly located waste disposal sites (Breukelman et al., 2019; Hardoy et al., 2013). These findings emphasize the importance of integrated planning and investment to improve waste management capacity, reduce environmental impacts, and promote public health.

The results align with the study's goal of identifying barriers to effective waste collection and disposal. The disparity between waste collection (96%) and transportation to disposal sites (83%) validates the objectives that inefficiencies exist within the system, particularly in the logistics and allocation of resources. The identification of specific hindrances trucks, resources, and accessibility demonstrates the study's success in pinpointing operational challenges (Sanchez-Diaz et al., 2020). This internal consistency underscores the reliability of the data collection methods in addressing the study's objectives. The findings resonate with waste management challenges reported in similar studies globally. In many developing and transitioning urban areas, logistical constraints such as inadequate vehicle fleets and financial limitations are common barriers(Sahu et al., 2022; Schachenhofer et al., 2023). Regions where urban expansion outpaces infrastructure development also frequently observe accessibility issues. However, the relatively high waste collection rate (96%) reported in this study exceeds the averages of some regions with similar socio-economic contexts, suggesting strengths in initial collection efforts. The lower transportation rate to disposal sites (83%) is consistent with global findings, emphasizing the need for improved logistics (Kwakye et al., 2024; Mak et al., 2019). These comparisons

demonstrate that while the study area faces typical challenges, its collection efficiency provides a foundation for further improvements.

This study focuses on the broader discourse on optimizing waste management systems by identifying logistical and operational constraints. It provides a roadmap for addressing waste collection and transportation gaps, emphasizing the importance of targeted investments in vehicle fleets, financial planning, and infrastructure. However, the study has limitations, such as potential biases and a lack of exploration of the systemic reasons behind issues. Future research should include field assessments, comparative studies across cities, and longitudinal studies to assess the effectiveness of interventions.

4.3.3.4 Challenges in Establishing Shared Solid Waste Disposal Systems

Table 4.10: barriers to establishing shared solid waste disposal areas

No	Issues	Frequency	Percentage
1	Lack of confidence in administrative boundaries	26	10
2	Lack of policy direction	69	28
3	Lack of communication on the distribution system	84	34
4	Lack of accessibility	69	28
	Total	248	100

Source: survey, 2023

The results of the study in Table 4.10 highlight key challenges faced in establishing common solid waste disposal areas. These findings emphasize the critical role that governance, policy, and communication play in managing urban waste. Lack of confidence in administrative boundaries reflects the challenges of jurisdictional overlaps and unclear responsibilities, which hinder coordinated efforts to establish waste disposal systems. The lack of policy direction points to the absence of a comprehensive waste management framework, while inadequate communication complicates the proper allocation of resources. Finally, accessibility issues, which affect both waste collection and transportation, underline the logistical difficulties in

creating efficient waste disposal infrastructure. These findings underscored the need for better governance, clearer policy frameworks, and improved communication strategies to overcome barriers to solid waste management.

The findings align with the study's objectives to identify and assess the challenges in setting up common solid waste disposal areas. The prominence of communication and policy-related challenges validates the objectives that waste management systems are often impeded by systemic governance issues. These results support the idea that a lack of coordination and clear policy direction at both local and regional levels complicates waste management efforts, confirming the study's focus on administrative and planning challenges (Nunan et al., 2012).

Gaps in communication, lack of policy direction, and lack of accessibility are the main negative effects on the management of common solid waste disposal sites (McAllister, 2015). The un-integrated solid waste management planning is widely observed in the study area, reflecting a need for comprehensive strategies to address the identified challenges. Addressing the challenges of setting up common solid waste disposal areas requires integrated strategies that encompass policy direction, governance mechanisms, communication and coordination efforts, resource allocation, and institutional capacities(Marshall & Farahbakhsh, 2013; Mmereki, Baldwin, & Li, 2016). Striking the right balance between policy, governance, institutional mechanisms, and resource provision and allocation is crucial, especially in low-income countries; to effectively manage solid waste.

The challenges identified in this study are consistent with waste management issues reported in other urban regions globally. Studies in cities like Dhaka and Jakarta have similarly found that lack of coordination between governmental bodies, insufficient policy frameworks, and accessibility challenges are common barriers to effective waste management (Regmi, 2024; Suryawan & Lee, 2023). In these cities, fragmented administrative boundaries and policy inconsistency have been identified as key constraints in implementing unified waste management strategies. The alignment with international case studies underscores the universality of these challenges in urban settings worldwide and provides external validation for the current study’s findings. The research emphasizes the importance of integrated waste management systems, focusing on governance, communication, and accessibility (Abdel & Qutb, 2023; Guerrero et al.,

2013). It explores barriers to common disposal areas and uses expert surveys to identify challenges. The findings highlight policy coherence, administrative clarity, and effective communication among stakeholders.

4.3.4 Challenges of Urban Transport System and Road net work

4.3.4.1 Challenges in Intercity Commuting: Accessibility, Congestion, and Transportation Planning

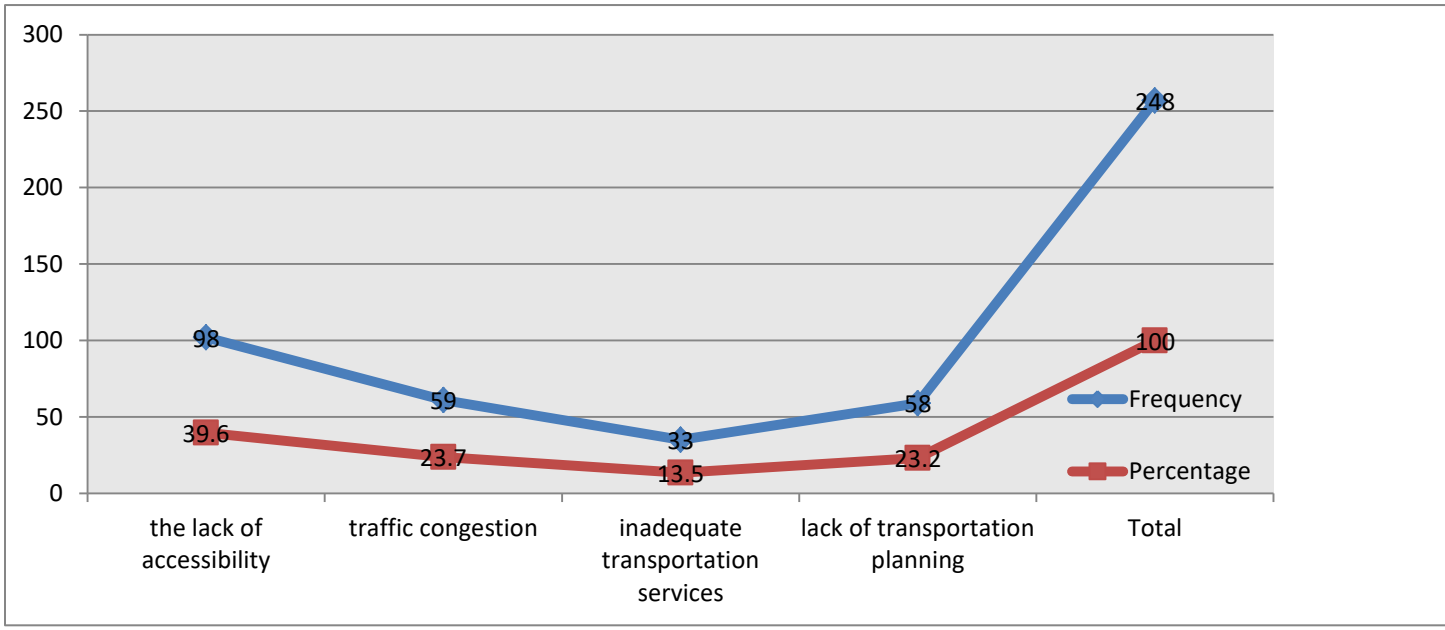

Fig. 4.12**:** Challenges in intercity commuting: accessibility, congestion, and transportation planning

Source: Feld survey, 2024

The study conducted in Fig.4.13 reveals that the transportation system between the two metropolitan cities is inefficient in meeting the basic needs of commuters, particularly in terms of ease of access and overall service quality. The study areas manifest a systemic shortfall in designing a cohesive, commuter-friendly transport network, as evidenced by the prevalence of issues related to transportation planning. It involves developing policies and infrastructure to create an efficient, integrated, and sustainable transportation network that meets both current and future demands (Gudmundsson et al., 2016; Schiller & Kenworthy, 2017). It involves the design of infrastructure, the forecasting of needs, and the coordination of various modes of transport, all of which can lead to inefficiencies and inadequate infrastructure, as field observations have

shown. Poor infrastructure challenges often create physical and logistical barriers that hinder people's ability to reach their destinations, resulting in extended travel times and decreased mobility. A lack of services, meanwhile, means insufficient or low-quality transportation options, such as limited public transit routes or unreliable vehicles, further restricting people's ability to access essential services and opportunities.

Poor accessibility has been caused by inadequate infrastructure, such as insufficient roads or poorly designed transit routes, which make travel difficult, time-consuming, and often unreliable in the study areas, have been observed. This results in residents facing longer travel times or struggling to access public transport in the study areas, thereby reducing their overall mobility and impacting their quality of life. Slow-moving traffic in congested areas extends travel times, potentially increasing commuter stress and reducing productivity (Louis & Fiawoyife, 2019; Ndatho, 2018). In the study areas, heavy traffic can exacerbate delays and diminish the reliability of transportation systems. It can also contribute to increased vehicle emissions, worsening air quality, and overall environmental impact. Addressing congestion often involves measures such as optimizing traffic signal timings, implementing congestion pricing, and investing in alternative transportation options to alleviate pressure on busy roadways.

In the study areas, inadequate transportation services lead to overcrowding, long wait times, and difficulty in reaching destinations efficiently. This problem may particularly affect low-income or underserved communities that rely heavily on public transport. According to the interview, poor transportation planning results in inefficient transport networks, a lack of integration between different modes of transport, and a failure to anticipate future growth and demand (Bruton, 2021; Vuchic, 2017). In the study areas, inadequate planning might lead to poorly designed transit systems that do not address current or future transportation needs, contributing to problems such as traffic congestion and accessibility issues.

The findings suggest that the lack of accessibility and transportation planning are critical areas that require immediate attention. The relatively high percentage of respondents indicating accessibility as a major issue suggests that many commuters struggle to access transportation options, which could lead to greater reliance on private vehicles and contribute further to traffic congestion. Furthermore, inadequate transport planning exacerbates the challenges, as it may

result in poorly coordinated transport routes, inefficient timetables, and an inability to accommodate growing demand. Without addressing these planning deficiencies, long-term traffic congestion is likely to worsen, which could reduce the overall efficiency of the city's economic and social activities. The results are consistent with the study's objectives, which sought to identify and analyze the challenges affecting intercity travel. The prioritization of accessibility challenges aligns with the hypothesis that systemic and infrastructural deficits are the primary impediments to efficient mobility. The identification of traffic congestion and inadequate transportation services complements the study's focus, confirming the need for both immediate and long-term planning solutions.

The interconnected nature of accessibility, transportation services, and planning highlights the need for holistic approaches to improving the city's transport (Curtis & Scheurer, 2010). Poor planning can often cause a lack of accessibility, while inadequate transportation services may result from insufficient strategic foresight. Improved transport planning could help address both accessibility and service-related challenges by designing transport routes that better meet commuter demand, creating more equitable access to transportation, and reducing congestion (Cheng & Chen, 2015). Additionally, targeted investments in alternative modes of transport, such as public transit or bike-sharing programs, could reduce reliance on personal vehicles, mitigate traffic congestion, and improve environmental sustainability. The findings align with transportation challenges identified in other urban and peri-urban contexts. Studies in rapidly urbanizing cities like Mumbai, India, and Lagos, Nigeria, have similarly cited accessibility, traffic congestion, and insufficient transportation services as major impediments to commuter mobility. These challenges are often compounded by poor transportation planning, as seen in global studies, which further supports the external validity of the current findings. The alignment of these results with broader global trends highlights the universal nature of transportation challenges in urban areas experiencing rapid growth. The study highlights the interconnectedness of urban transportation, emphasizing the importance of integrated systems for accessibility and efficient traffic management (Pojani & Stead, 2015; Suzuki, Cervero, & Iuchi, 2013). It provides a framework for analyzing commuter challenges and suggests strategies for enhancing road networks and public transportation options.

4.3.4.2 Assessing Professional Capacity and Expertise in Integrated Transport Planning

The survey results indicate a significant concern regarding the adequacy of professionals available to prepare integrated transport plans. A majority of respondents (86.7%) expressed that there is a shortage of professionals in the study areas qualified to carry out such planning. On the other hand, (9.8%) of respondents believed that there was no problem with the availability of professionals, pointing to a discrepancy in perceptions about the sufficiency of expertise in the field. This disparity suggests a divided opinion on the matter, potentially reflecting varying experiences or exposure to professional services in different areas. Focus group discussions and interviews also support the notion of insufficient experienced infrastructure planners in the study areas. Literature highlights the limited knowledge on integrating environmental aspects into transport planning processes, which is crucial for sustainable urban development. The literature confirms the shortage of experts in integrated transport planning and emphasizes the importance of considering environmental, social, and economic factors in transportation plans (Schiller & Kenworthy, 2017; Wey, 2019). This is an indication that there is a lack of enough experts who work on integrated transport infrastructure planning with in the metropolitan cities. Focus group discussions and interviews also confirmed that there are not enough experienced transport planners in the study areas. Countries like the Netherlands have invested in education and training programs to develop skilled transportation planning professionals, contributing to successful transport policy implementation(May et al., 2017; Thomas et al., 2018). Also, global studies have shown that the lack of skilled professionals is a significant barrier to implementing successful transport systems, especially in developing and rapidly urbanizing regions. The findings of this study align with these international observations, suggesting that the challenge of professional shortages in transportation planning is a widespread issue faced by cities worldwide. Countries like Sweden and Singapore have developed comprehensive transport planning frameworks leveraging multidisciplinary professionals to effectively address urban transportation challenges (Bibri & Krogstie, 2020). These findings point to the importance of human capital in shaping the success of urban transportation planning. The shortage of professionals directly impacts the ability to plan and implement comprehensive, forward-thinking transport systems,

and underscores the necessity of investing in education and training programs to build the expertise required for these crucial tasks.

The disparity in responses regarding the adequacy of professionals for integrated transport planning suggests a need for more comprehensive workforce development and training in the field (Sinha & Labi, 2011). The significant proportion of respondents citing a shortage suggests a broader expertise gap that requires attention to ensure equitable development across regions, even though some areas may receive adequate service. To bridge this gap, increased investment in education, training, and recruitment of transport planners and engineers is essential. Additionally, encouraging collaboration between government, educational institutions, and the private sector can help to create a more robust pipeline of professionals capable of managing complex, integrated transport projects (Farquharson & Yescombe, 2011; Greve & Hodge, 2013). The study highlights the importance of human resources in urban transportation planning, highlighting the need for qualified professionals to ensure efficient and suitable transportation networks. It provides a data-driven analysis of human resource constraints, highlighting the need for professional development and educational programs to address the human capital deficit.

4.3.4.3 Challenges in Integrated Transport Planning and Design

Table 4.11: Challenges in integrated transport planning and design

No	Issues	Frequency	Percentage
1	Poor technology	57	23.1
2	A gap of knowledge	48	19.5
3	Lack of rules and procedures	48	19.2
4	Lack of financial resources	58	23.6
5	Absence of standards	37	14.6
	Total	248	100

Source: FGDs survey, 2023

The survey results in Table 4.11 highlight several key challenges that experts identify as major obstacles in integrated transport planning and design. A substantial portion of respondents

attribute these challenges to poor technology, indicating that the lack of modern, effective tools and systems is hindering efficient planning and design processes. This is a significant finding in scientific terms, as it underscores the growing need for advanced technological solutions in urban transport management. The respondents who cited a knowledge gap further emphasize the importance of enhancing expertise in the field of transport planning, suggesting that education and training are crucial components for overcoming these barriers. Additionally, respondents pointed to a lack of rules and procedures, highlighting the absence of standardized frameworks to guide planning processes. This lack of structure can lead to inconsistent approaches and ineffective outcomes. Other respondents identified the issue of insufficient financial resources, a challenge that is not unique to the study area but is prevalent across many cities, especially in developing countries. Finally, the absence of clear standards is seen as a contributing factor, reinforcing the need for universally accepted norms and guidelines in transport planning. Collectively, these findings emphasize that integrated transport planning is constrained by technological, institutional, financial, and knowledge-related deficiencies.

These results align directly with the study's goals, which aimed to identify key barriers to effective integrated transport planning. The findings validate the objectives that multiple challenges are contributing to the inefficiency of transport planning and design. The study's methodology using a combination of surveys, interviews, and focus group discussions ensures that these identified problems are not only perceived by experts but also observed through various methods of data collection. The consistency across responses about poor technology, knowledge gaps, lack of rules, and financial constraints suggests that these are indeed central factors in the challenges faced by urban transport planning in the study areas. Furthermore, the diversity in responses points to the complex, multi-dimensional nature of the problem, which requires comprehensive solutions.

The substantial number of respondents who identified inadequate technology as a primary cause suggests that outdated or insufficient technological tools and systems may be impeding the effective development of infrastructure (Ata-Agboni et al., 2024; Nteziryayo et al., 2024). This could result in increased maintenance costs, delayed project execution, and suboptimal designs. The necessity of capacity-building initiatives to provide professionals with the necessary skills for contemporary integrated transport planning and design is underscored by the knowledge

divide. Similarly, the absence of financial resources, rules, and procedures highlights systemic deficiencies that can result in inconsistent or incomplete planning and project delays (Chandra & Idrisova, 2011; Sherman et al., 2016). The absence of standards indicates that a uniform framework for transport development is either weak or absent, which may lead to inconsistencies across initiatives and regions.

The multitude of causes that have been identified underscores the necessity of a comprehensive approach to resolving transport planning and design issues (Mehmood et al., 2017). Modern tools and systems that can improve project outcomes and expedite the design process will likely be necessary to address technological deficiencies. Furthermore, the quality of integrated transport planning and design can be improved by addressing the knowledge deficit through professional development and training programs (Dye, 2020; Sherman et al., 2016). The implementation of distinct rules, procedures, and standards through the reformation of institutional frameworks will enhance accountability and consistency. Lastly, the long-term sustainability of transport networks and the successful implementation of initiatives are contingent upon the acquisition of sufficient financial resources. In an effort to establish a more efficient and well-integrated transportation system, it will be necessary for governments, private sectors, and international partners to coordinate their actions properly.

The challenges identified in this study are consistent with those observed in other urban settings, both in developing and developed countries. Similar studies in cities like Jakarta, Indonesia, and Nairobi, Kenya, have highlighted poor technology, financial constraints, and a lack of standardized procedures as significant barriers to effective transport planning(Venter et al., 2019; Yanocha et al., 2021). For example, research in Nairobi pointed to the absence of technological innovation in transport planning tools, as well as a lack of regulatory frameworks, which mirrors the results of this study. Additionally, the issue of financial resource constraints is a commonly cited challenge in urban transport planning in both low- and middle-income countries, as seen in studies from cities like Lagos and Cairo(Alves, Mjahed, & Moody, 2023; Thondoo et al., 2020). This external validation of the results underscores the relevance of the study's findings within a broader, global context, indicating that these challenges are not isolated but rather part of a larger issue faced by many cities.

The results of this study are significant both conceptually and methodologically. The study suggests a holistic approach to urban transport planning, incorporating technological innovation, capacity building, and strong regulatory frameworks, based on a mixed-methods approach, addressing technological, financial, and knowledge barriers.

4.3.4.4 Challenges in Integrated Transport Planning

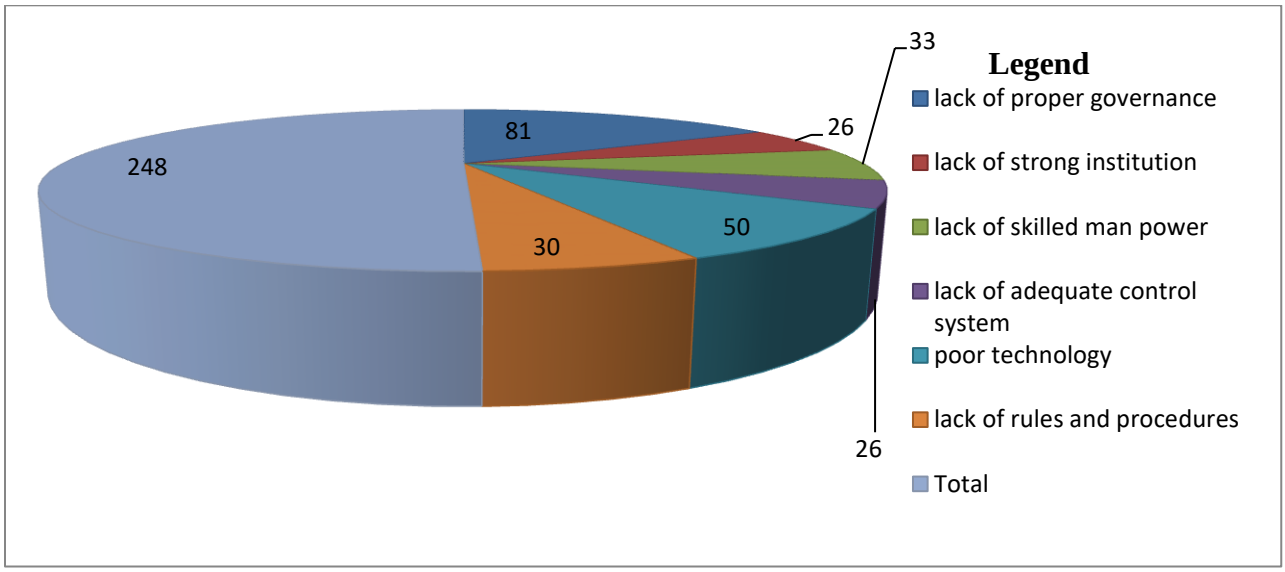

Fig.4.13: challenges in the integrated transport planning

Source: Feld survey, 2024

The results in Fig.4.14 underscore the crucial obstacles that undermine the effectiveness of organizations. The most prominent issue, a lack of appropriate governance (32.5%), indicates a substantial leadership and oversight gap. The lack of competent manpower (13.4%) and poor technology (19.1%) further limits operational capability and human resource development. The absence of defined rules and procedures (12.2%), control systems (10.5%), and strong institutions (10.3%) is indicative of systemic weaknesses in accountability and organizational structure. It is essential to address these issues in a comprehensive manner in order to promote resilience, enhance performance, and achieve sustainable growth.

These findings highlight critical barriers that need to be addressed in order to improve integrated transport planning. In scientific terms, these challenges are indicative of systemic weaknesses within the governance, institutional, and technological support transport planning. Effective

governance, strong institutions, skilled professionals, and robust monitoring systems, technology are foundational to creating integrated transport systems that can meet the demands of rapidly urbanizing areas. Previous literatures consistent with study findings, governance are the backbone of coordinated planning and execution (Laquian, 2011). Without a clear governance structure, separate agencies often plan and manage different transport modes, such as buses, trains, and cycling infrastructure, with little collaboration. This results in inefficiencies, as the various modes fail to complement each other, leading to higher operational costs and poor service quality. Integrated transport systems require, technology upgrades, and sustainable operations. Without adequate funding, cities are unable to invest in modern transport solutions like electric buses, smart traffic management systems, and sustainable infrastructure, leading to a reliance on inefficient and outdated modes of transportation.(Curtis & Low, 2016). Without these, institutions struggle to manage planning processes and facilitate collaboration, leading to inefficiencies and delays. Lack of skilled manpower affects the quality of transport planning and operation, affecting the adoption of advanced technologies like intelligent transport systems (Baldwin & Lin, 2002).

These results directly align with the study's central hypothesis that challenges in governance; technology, institutional weaknesses, and lack of skilled personnel hinder effective integrated transport planning. The significant concern raised about governance corroborates previous research, which has indicated that successful transport planning depends heavily on the capacity and effectiveness of governance structures (Veeneman & Mulley, 2018). The identification of institutional weaknesses and technological challenges further supports the premise that without a strong, coordinated approach, transportation systems cannot be planned, developed, and maintained effectively. Additionally, the recognition of skill shortages and inadequate control systems reinforces the objectives that better capacity-building and stronger regulatory frameworks are essential for successful integrated transport systems.

The lack of proper governance in urban transport systems leads to limited connectivity, increased congestion, and project delays (Laquian, 2011). Weak institutions lack technical expertise, leading to substandard infrastructure and regulatory violations. Strengthening institutions through capacity building and reform is critical. The shortage of professionals in the transport sector hampers innovation and limits the ability to optimize transport networks. Investing in

education and training programs is necessary to build local expertise. Modern control systems, such as intelligent traffic management and data-driven decision-making tools, are essential for improving operational efficiency and enhancing the commuter experience. Additionally, the study's emphasis on skilled manpower and control systems contributes to the theoretical advancement of the field by framing human resource development and monitoring as key components of urban transport success. This insight adds to existing literature by broadening the understanding of the challenges involved in creating integrated transport systems, and provides a foundation for future studies to explore solutions to these systemic issues. This study highlights key issues for improved integrated transport planning, including governance, institutional capacity, financial support, and professional training. It identifies research and policy interventions needed in developing regions and offers insights for strengthening governance structures and institutional capacities.

4.3.4.5 Challenges in Achieving Urban Connectivity

The finding that 73.4% of respondents reported the absence of an integrated transport plan between the cities is crucial, as it points to a significant gap in urban planning and regional connectivity. The lack of an integrated transport plan may result in inefficiencies, such as increased travel times, higher transportation costs, and potential disruptions in service delivery. It may also exacerbate issues like traffic congestion, environmental pollution, and limited mobility for residents of both cities. The results suggest that the absence of a well-coordinated transport system will impede waste management and other municipal services, including healthcare and emergency response, which heavily depend on timely and efficient transportation. Furthermore, the lack of an integrated transport network indicates a missed opportunity for enhancing regional development and fostering economic growth through improved accessibility between urban and suburban areas.

The results are internally valid in terms of addressing the studies suggested that there may be challenges related to transportation infrastructure between Addis Ababa and Sheger. The objectives of fragmented transportation systems between the cities, likely to hinder effective critical services, finds support in the majority of respondents reporting the absence of an integrated transport plan. This data validates the assumption that lack of coordination in transport planning could be a barrier to both operational efficiency and economic development in the

region. Moreover, since the question directly asked respondents about the existence of such a transport plan, the results provide clear evidence regarding the current state of transport planning between the two cities. These findings resonate with broader trends in urban planning and transport infrastructure seen in other developing countries. Various cities where fragmented or non-integrated transportation networks across municipalities limit regional cooperation and impede efficient service delivery face similar challenges (Rode, 2016). Studies from regions such as Southeast Asia, Sub-Saharan Africa, and Latin America often point to the lack of integrated transport planning as a major constraint on urban development (Porter, 2008). For example, research in cities like Nairobi and Lagos highlights the negative impacts of disconnected transportation systems on waste management, economic mobility, and public health (Otuoze, 2021). By comparing these global patterns with the findings of this study, it becomes evident that the issues of fragmented transport systems are not unique to Addis Ababa and Sheger but rather part of a larger pattern observed in rapidly growing urban areas facing similar infrastructural challenges.

The study underscores the significance of transportation infrastructure in urban and regional planning, emphasizing the absence of an integrated transport plan connecting Addis Ababa and Sheger. This lack of integration undermines regional economies and urban sustainability. The study also highlights the need for effective public service delivery, such as waste management and emergency response. However, it acknowledges limitations, such as relying on subjective data and not exploring specific barriers to integration. Future research should focus on identifying underlying reasons for the lack of integration, such as governance issues, resource allocation, and stakeholder coordination. Longitudinal studies could also provide insights into the evolution of integrated transport systems.

4.4 Urban Governance for Sustainable Infrastructure

4.4.1 Institutional integration

Metropolitan governance denotes the frameworks that enable multiple municipalities and potentially other levels of government to collaborate in the provision of services and decision-making within a metropolitan area (Post, 2004; Shaw & Tewdwr-Jones, 2017). It encompasses mechanisms for the coordination of policies, the management of common resources and

infrastructure, and the resolution of shared challenges, including transportation, housing, and economic development (Iaione, 2016; Luo & Shen, 2009).

4.4.1.1 The Impact of the Lack of Formal Governance on Integrated Infrastructure Planning

Experts participated in the questionnaire filling procedure, irrespective of the governance of the city region. 17.6% of the experts expressed agreement with the existence of formal metropolitan governance in coordinating integrated infrastructure planning in the region in response to the query. Although 78.43% of respondents affirm that there is no formal metropolitan governance in the region. The findings suggest a significant gap in metropolitan governance structures for integrated infrastructure planning in the region. With only experts affirming the presence of formal governance mechanisms, the absence of a coordinating body hinders the ability to manage infrastructure needs effectively across city boundaries. This lack of integration likely results in fragmented planning, potentially leading to inefficiencies, redundancies, and missed opportunities for cohesive development. Consequently, both cities may face challenges in addressing shared infrastructure demands, such as transportation, water, and waste management systems, which require coordinated regional planning for sustainable growth and resilience.

Applying these findings to the study area context highlights the challenges and potential opportunities for regional infrastructure coordination in rapidly urbanizing areas. Ethiopia's urban centers, particularly Addis Ababa and its surrounding cities, are growing quickly, creating increased demand for integrated infrastructure and services. However, similar to the findings, Ethiopian cities often lack formalized metropolitan governance structures to facilitate coordinated planning across jurisdictions. This absence of a cohesive governance framework can hinder the delivery of essential services like transport, water supply, and waste management, which depend on well-coordinated infrastructure planning to meet both current and future needs (Netshiswinzhe et al., 2023).

Comparative literature on metropolitan governance in other countries illustrates the benefits of formalized coordination structures. For instance, the success of metropolitan governance in cities like Bogotá, and Johannesburg, demonstrates that formal governance bodies can significantly improve infrastructure integration and service efficiency (Andersson, 2014; McCarney, 2010).

Such governance structures enable cities to plan for region-wide issues collectively, making it easier to attract investment, allocate resources efficiently, and respond to the needs of interconnected urban areas. The contrast between these successful cases and the study area context suggests that introducing similar frameworks could benefit Ethiopia's cities, fostering more sustainable and inclusive urban growth.

Conversely, other studies reveal that formal metropolitan governance structures are not always essential for achieving coordinated regional planning. In some European regions, for example, informal collaboration among cities has proven effective in aligning planning efforts without creating new formal institutions (Fox-Rogers & Murphy, 2014; Storper, 2013). Applying this insight to the study area could suggest that even without establishing formal governance bodies, promoting inter-municipal cooperation and strategic partnerships could enhance infrastructure planning. However, given Ethiopia's unique socio-political environment and the rapid pace of urbanization, informal collaborations alone may be insufficient. Instead, a hybrid approach combining formal governance with flexible, cooperative arrangements could address both the structural and contextual demands of the cities more effectively (Toxopeus et al., 2020; Yahia et al., 2021).

4.4.1.2 The Role of Informal Coordination Mechanisms in Infrastructure Planning

The current investigation poses the inquiry, "In the absence of formal metropolitan governance, does any informal organization, or arrangement coordinate a variety of activities in the regions?" Consequently, 74% of the respondents declined, while 22.5% responded in the affirmative. Additionally, the interviews and focus group discussions with city leaders who participated in the study revealed that they establish and manage a temporary joint committee in response to joint federal government agendas, sporadic or seasonal security events, and a variety of common issues. The finding that respondents reported no informal organization or arrangement coordinating activities in the absence of formal metropolitan governance suggests a significant gap in collaborative mechanisms within the regions. This lack of informal coordination may lead to isolated decision-making, where regions operate independently without addressing cross-regional issues like infrastructure planning or resource management. The absence of such arrangements indicates a need for developing either formal or informal governance structures to bridge the coordination gap in metropolitan areas (Ahrend et al., 2014).

Urban governance encompasses the collective decision-making processes of various stakeholders, including public, private, and civil society actors, to manage resources and services across city regions (Da Cruz et al., 2019; Lovan et al., 2017). The aforementioned analysis has shown that there is no informal coordination between the two cities' involvement in a variety of activities. Multiple metropolitan governance models exist, but there is no consensus on a single formula, as per (Giersig, 2008; Lange et al., 2013). Nevertheless, (Giersig, 2008; Lange et al., 2013), differentiates four primary metropolitan governance models according to their institutionalization level. In an article captioned, the four governance models that pertain to this matter are consolidation model, decentralized governance model, Network governance model, and special status cities. There are four distinct models, each with its own legal frameworks, institutional structures, cooperation mechanisms, and service delivery systems. In metropolitan areas, governance must address challenges such as transportation, housing, and infrastructure planning, which often transcend municipal boundaries. Ethiopia’s rapid urbanization and complex socio-economic needs make governance a critical factor in achieving sustainable urban development. The need for coordinated governance structures is evident to mitigate fragmented decision-making and enhance efficient urban management.

The consolidation model merges adjacent municipalities into a single regional entity to centralize decision-making and streamline service delivery (Anway, 2011; Slack, 2019). Toronto underwent amalgamation in 1998, merging six municipalities into one. This reduced administrative redundancies and improved resource allocation (Fanelli, 2016; Roman, 2011). However, critics argue that local needs were sidelined due to centralized decision-making. While this approach can reduce inefficiencies and enhance regional integration, its implementation in the study area is fraught with challenges. The country’s federal system and strong emphasis on regional autonomy could hinder consolidation efforts, as local governments and communities may resist ceding control over their jurisdictions. A careful balance between regional coordination and local autonomy would be essential to implement this model effectively, but it might not align with Ethiopia's political and cultural landscape.

Decentralized governance model allows multiple municipalities to coordinate without merging while maintaining local autonomy within a shared governance framework (Dafflon, 2015; Slack & Bird, 2013). The Swiss governance model emphasizes decentralized collaboration. Each

canton manages its affairs independently but cooperates on national or regional issues, such as public transportation or environmental policy(Keuffer & Horber-Papazian, 2020; Kiessling & Pütz, 2020). This model aligns with Ethiopia's federal system and could work well in city-regions like Addis Ababa and Sheger. However, as seen in Switzerland, success requires strong institutional frameworks, which Ethiopia must develop; decentralized governance offers a practical approach but requires significant capacity building and the establishment of trust among municipalities. Inter-municipal agreements, resource-sharing mechanisms, and capacity-building initiatives would be critical to implement decentralized governance effectively.

Network governance model emphasizes collaboration among public, private, and civil society actors to address metropolitan issues (Bixler et al., 2020; Klijn & Koppenjan, 2015). It is particularly effective in contexts where formal institutions are weak. In the Netherlands, city-regions like Randstad utilize network governance to involve municipalities, businesses, and civil society in regional planning and economic development (Spaans & Zonneveld, 2016; Spaans et al., 2020). This approach fosters innovation and inclusivity, though it can be challenging to maintain coherence. For the study area, network governance presents opportunities for flexible, stakeholder-driven solutions to challenges such as housing and transportation. However, this model relies heavily on strong leadership and well-developed relationships, which can be difficult to achieve in a resource-constrained environment. While network governance could complement formal structures, its informal and ad hoc nature may limit its scalability and consistency in addressing metropolitan challenges.

The regional governance model establishes a metropolitan-level organization or council with decision-making authority across a region.(Miller, 2018; Ye, 2014; Zimmermann, 2014). This approach balances centralization and autonomy, offering a structured yet collaborative framework. The Portland Metro in Oregon, USA, is a regional authority responsible for land use, transportation planning, and waste management (Liberty, 2017; Sullivan, 2014). It operates through a formalized structure with legal mandates, providing a balance between centralization and municipal autonomy. For Ethiopia, regional governance could address the absence of formal metropolitan institutions while leveraging the cooperative potential of networked governance. The establishment of metropolitan councils with clear mandates and funding could facilitate effective planning and service delivery. However, this model would require significant

legislative support and mechanisms to ensure the authority and resources necessary for operation.

These findings are also influenced by the supra municipal authority models, in addition to the four-model system. Supra-municipal authorities are governance structures established above individual municipalities to coordinate and manage regional issues across multiple jurisdictions (Casula, 2020; Fricke, 2015). They promote regional collaboration without undermining local governance structures, addressing infrastructure development, regional planning, and transportation. The study area could establish supra-municipal authorities to address fragmented governance, such as housing shortages, transportation networks, and environmental concerns. However, challenges such as lack of legislative frameworks, resistance from local governments, and limited institutional capacity may arise. Despite these obstacles, supra-municipal authorities offer a cooperative and adaptable governance model that can help resolve metropolitan governance challenges and facilitate sustainable urban development.

In the absence of formal governance structure (informal coordination and polycentric governance), informal coordination mechanisms arise when formal governance structures that are weak, relying on ad hoc collaborations to address regional challenges. Such mechanisms are often inconsistent, inefficient, and difficult to scale, reflecting broader issues of weak institutional frameworks and fragmented decision-making. According to the theory of polycentric governance, successful metropolitan regions require multiple overlapping institutions to manage complex, cross-jurisdictional issues effectively (Kaiser, 2020; Zimmermann, 2020). In Indian metropolitan areas like Bengaluru, informal coordination has emerged to tackle issues like waste management and traffic congestion (Idiculla, 2022; Raju et al., 2018). While these efforts demonstrate grassroots innovation, they are often inconsistent and unsustainable without formal support. Ethiopia's fragmented governance landscape hinders the development of both formal and informal coordination systems, exacerbating inefficiencies in urban management.

Each metropolitan governance model offers unique strengths and challenges in addressing the study area governance needs. Consolidation may face resistance due to cultural and administrative factors, while decentralized governance aligns with Ethiopia's federal structure but requires strong institutional capacity. Network governance provides flexibility and inclusivity but struggles with consistency and scalability. Regional governance given the

country’s federal structure and strong regional identities offers a structured solution, though it demands legislative and institutional reforms. Informal coordination mechanisms, while adaptive, cannot substitute for formal governance structures. In Ethiopia, supra-municipal authorities could be a stepping stone toward formal regional governance by fostering collaboration without threatening local autonomy. Ethiopia's path to sustainable urban development requires a hybrid approach that respects local autonomy, builds institutional capacity, and fosters collaborative governance at multiple levels.

4.4.1.3 Assessing the Prevalence of Metropolitan Governance Practices

In response to the question of whether metropolitan governance practices exist in the research region, 82.4% of respondents said they do not, and 14.1% said that they do. The finding that respondents believe metropolitan governance practices do not exist in the research region indicates a significant governance gap. This suggests that without formal or informal metropolitan governance structures, city-regions may struggle to address shared challenges such as infrastructure planning, resource management, and urban development (Moore-Cherry, Pike, & Tomaney, 2021; Oedl-Wieser et al., 2020). This gap points to the need for establishing metropolitan governance frameworks that can promote collaboration and integration across regional boundaries, ensuring coordinated urban growth and efficient service delivery. However, respondents acknowledged the existence of metropolitan governance practices, indicating some efforts to coordinate activities across regions, even if they were minimal. Despite the lack of formalization or widespread implementation, these practices underscored the potential for enhancing current initiatives. Recognizing and formalizing these efforts could provide a foundation for more structured and effective metropolitan governance in the future. In general, these findings underlined the necessity of developing and institutionalizing metropolitan governance practices in the region.

The finding that respondents believe metropolitan governance practices do not exist in the study area reinforces the theoretical argument that effective governance structures are necessary to manage the complexities of urban regions. According to the theory of metropolitan governance, urban regions with multiple jurisdictions require coordinated governance frameworks to address cross-border issues like infrastructure, transportation, and housing (McGuirk, 2007). In the study area, where urbanization is rapidly increasing, the absence of formal metropolitan governance

presents challenges in managing interconnected urban systems. Without a formal governance structure that includes various levels of government and non-government actors, regions can experience inefficient coordination, missed opportunities for joint planning, and the inability to address metropolitan-scale challenges effectively (Shrestha, 2018). This lack of formal governance highlights the need for a more unified and integrated governance framework that spans multiple jurisdictions within Ethiopian city regions.

In contrast, the respondents who recognized the existence of metropolitan governance practices, even if minimal, suggest that some coordination efforts are happening informally. The existence of informal governance mechanisms, as noted by (Chiodelli et al., 2021), plays a key role in managing metropolitan areas where formal institutions may be lacking. These informal networks often created through voluntary cooperation among local governments, community groups, or private sector actors, can facilitate the management of regional issues. While informal governance mechanisms can address short-term problems, they are generally less effective at tackling large-scale, systemic challenges due to their lack of formal authority, resources, and sustainability (Kelly, Ellis, & Flannery, 2018). This underscored the need for formalized governance structures to provide the necessary authority, resources, and consistency to handle urban development challenges at the metropolitan level.

Furthermore, comparative literature from other developing countries with similar governance structures, such as Kenya, provides insight into the benefits of formal metropolitan governance frameworks(Ambole et al., 2019). This contrasts with the Ethiopian context, where no equivalent formal body exists, leading to fragmented governance and a lack of coordinated regional development efforts. These comparative examples highlight the potential benefits of establishing formal metropolitan governance institutions in Ethiopia to manage the growing challenges of urbanization and regional development.

4.4.2 Spatial integration

4.4.2.1 Assessing the Potential for Coordinated Service Delivery in Metropolitan Governance

In terms of the potential for coordinating responsibilities to encompass service delivery, 80.4% of respondents agreed, while 16.2% disagreed. The findings suggest a strong consensus on the

value of coordinating responsibilities to improve service delivery, indicating that most respondents recognize the benefits of a more integrated approach. This high level of agreement implies that there is significant support for establishing mechanisms that enhance cooperation and shared responsibility among urban areas. However, the respondents who disagreed highlighted potential concerns or barriers to coordination, such as administrative challenges or the complexity of aligning diverse interests across jurisdictions.

The high percentage of agreement regarding the potential for coordinating responsibilities to enhance service delivery demonstrates the substantial interest in the advantages of a structured, collaborative approach to regional governance. This discovery is indicative of the significance of coordinated service delivery in the study area context, where accelerated urbanization poses a challenge to the existing infrastructure. Effective coordination can alleviate fragmentation, which often leads to disparities and inefficiencies in resource distribution (Feiock, 2013).

In other developing urban regions, coordinated service delivery has resulted in positive outcomes, as evidenced by comparative literature. Metropolitan governance structures in South Africa, such as those in Gauteng province, facilitate centralized planning and administration across multiple cities, thereby enhancing service accessibility and consistency (Du Toit, 2023; Maphangwa, 2023). In stark contrast, the limited coordination mechanisms in Ethiopian cities can impede the effective provision of services across jurisdictions. The South African model demonstrates that centralized or shared governance structures can improve resource allocation, accountability, and planning. This suggests that Ethiopia could take advantage of similar frameworks to enhance inter-city collaboration and optimize service delivery.

In contrast, other research emphasizes that formal metropolitan governance structures are not the sole solution to successful service delivery. For instance, European research has demonstrated the effectiveness of informal coordination among municipalities, allowing for more flexible management of intercity services (Demirel, 2023). These informal mechanisms could provide a more flexible solution to Ethiopia's distinctive context, where formal governance systems may be difficult to implement due to administrative and resource constraints.

4.4.2.2 Roles of Civil Society in Inter-Jurisdictional Coordination

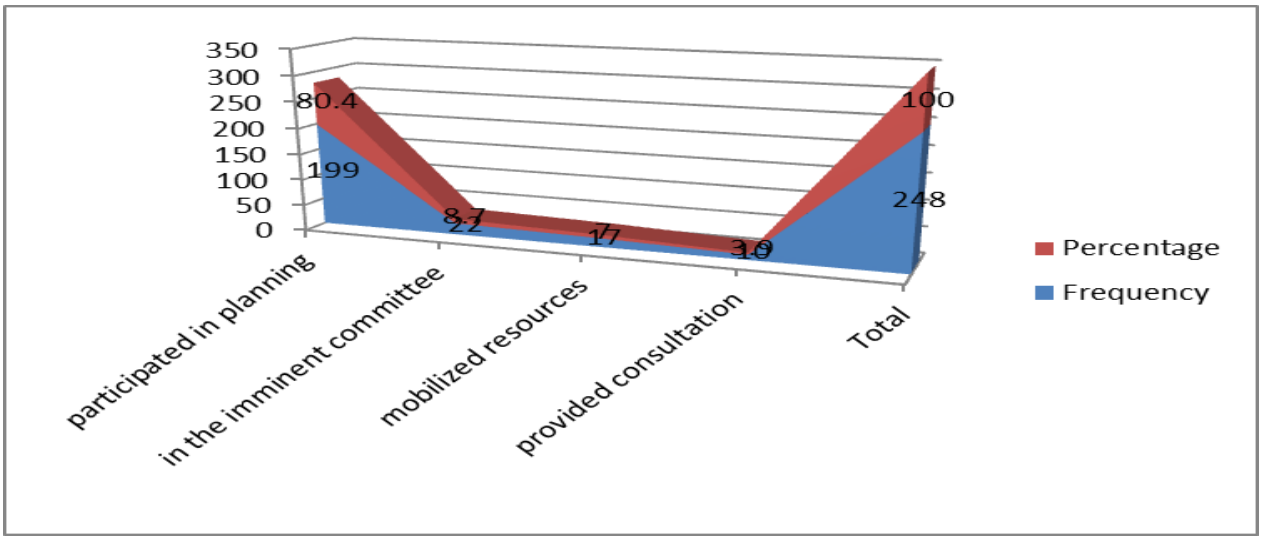

Fig.4.14: the roles of civil society in inter-jurisdictional coordination

Source: Feld survey, 2024

The findings on Fig.4.15 indicate that while respondents are actively involved in planning, the roles of civil society in other areas, such as resource mobilization, committee participation, and consultation, are notably limited. This suggests that while civil society plays a significant role in the planning stages of inter jurisdictional coordination, its involvement in other crucial areas, such as resource mobilization and decision-making, remains minimal. This could suggest an underutilization of civil society's potential to contribute to more comprehensive coordination efforts. Strengthening civil society's engagement in resource mobilization and active participation in committees could enhance its influence in shaping more inclusive and sustainable infrastructure planning and service delivery strategies

The findings that respondents are involved in planning, but only participate in committees, mobilize resources, or provide consultation, highlight a significant concentration of civil society engagement in the early stages of planning while neglecting other crucial phases of inter-jurisdictional coordination. This pattern suggests that while civil society plays an active role in shaping ideas, its influence may diminish when it comes to implementation and resource mobilization. Theoretically, this aligns with the concept of participatory governance, where civil society is recognized for contributing to policy development but may face institutional barriers or limited authority in other areas of governance, such as resource allocation and implementation

(Shunglu et al., 2022). This observation is particularly relevant to the Ethiopian context, where civil society organizations (CSOs) are often restricted in their capacity to engage in comprehensive governance processes due to regulatory limitations and political constraints (Anheier, Lang, & Toepler, 2019).

International literature offers a more nuanced perspective on civil society's role in urban governance. For example, studies in Latin America demonstrate that civil society can significantly impact inter-jurisdictional coordination, not only in planning but also in advocacy, resource mobilization, and implementation(de Mello-Théry et al., 2022). In these cases, well-established civil society organizations (CSOs) have been able to bridge the gap between government agencies and local communities, playing an essential role in the management of shared resources and regional development. In contrast, in many European cities, civil society's role extends significantly into resource mobilization and operational decision-making. Here, civil society organizations are often integrated into committees responsible for infrastructure planning and implementation (Lovan et al., 2017). The study area case, where civil society's engagement is largely limited to planning, underscored the need for structural and regulatory reforms to facilitate a broader role in inter-jurisdictional coordination.

4.4.2.3 The Role of Private Sector in Metropolitan Governance

The findings from document review and interviews indicate that the private sector plays a significant role in creating and maintaining service facilities and infrastructure as well as making investments. However, the focus group discussions and interviews conducted indicated that the private sector's role in the study area is not particularly prominent. This suggests that the private sector is crucial in providing the financial resources and expertise necessary for the development and upkeep of urban infrastructure. Metropolitan governance can leverage this partnership to address critical infrastructure gaps, especially in rapidly urbanizing regions. The strong involvement of the private sector in investment and infrastructure maintenance implies that public-private collaborations are essential for sustaining urban growth and meeting infrastructure demands. However, the lower percentages in advancing existing enterprises and resolving regional inefficiencies highlight that the private sector's role in promoting broader economic development and addressing systemic inefficiencies remains limited. While the private sector

plays a crucial role in infrastructure development, it could enhance its involvement in fostering economic growth, addressing regional disparities, and contributing to community development.

The findings that the private sector plays a significant role in creating and maintaining service facilities and infrastructure and in making investments reflect the critical function of private enterprises in urban development and service provision. These findings align with the theoretical framework of market-driven urban governance, which suggests that private sector involvement is essential for meeting the infrastructural and financial needs of metropolitan regions. Global literature has well-documented the growing recognition of public-private partnerships (PPPs) in metropolitan governance. In regions like Latin America, PPPs have been instrumental in driving infrastructure projects, with private firms bringing in capital, expertise, and efficiency in the provision of public services (Cruz & Marques, 2013; Garcia-Kilroy & Rudolph, 2017). This suggests that the private sector is well-positioned to continue playing a key role in study areas urbanization and infrastructure development, filling gaps that the government alone may struggle to address.

The lower levels of involvement in advancing existing enterprises and resolving inefficiencies suggest a more limited role for the private sector in fostering economic growth and addressing systemic inefficiencies in the region's economy. This is consistent with the theoretical perspective on governance that emphasizes the importance of balanced private-public sector roles (Saltman & Duran, 2015). According to literature from Europe and North America, successful metropolitan governance necessitates the active engagement of the private sector in fostering economic diversification and resolving inefficiencies that constrain regional economic competitiveness (Tasan-Kok et al., 2014). In contrast, the Ethiopian private sector’s focus on infrastructure and investment, without significant attention to enterprise development or economic restructuring, may hinder the region’s ability to fully capitalize on the potential for inclusive economic growth. Moreover, comparing these findings to the situation in more developed regions reveals the contrast in private sector roles. Furthermore, this difference highlights an area where the Ethiopian private sector could expand its involvement, fostering economic diversification and resolving systemic regional inefficiencies through greater emphasis on supporting small and medium-sized enterprises (SMEs) and promoting innovation.

4.4.2.4 Addressing Cross-Border Governance Issues in the Cities

The study identifies border conflict (31.4%), illegality (33.7%), and border cooperation (31.4%) as issues. Border conflict, illegality, and border cooperation were all named as important issues by the same number of people. This shows that inter jurisdictional coordination sees all three problems as equally important. This highlights the complexity of managing urban regions that span across multiple jurisdictions, where conflicting interests and illegal activities can hinder cooperation and effective governance. Border conflicts may delay infrastructure projects, disrupt service delivery, and create tensions between local governments, making it difficult to achieve coordinated urban development. At the same time, the recognition of border cooperation as a key issue indicates that there is an understanding of the need for collaborative approaches to overcome these challenges. The findings imply that fostering better cooperation across borders is essential for improving regional stability, ensuring smoother governance, and addressing the legal and logistical challenges that arise from cross-border development.

The findings underscored the complexity of managing urban regions that span multiple jurisdictions, with border conflict, illegality, and border cooperation perceived as equally significant challenges. These challenges align with the theoretical framework of urban governance, which recognizes that territorial disputes, informal economies, and lack of coordination across borders can hinder effective regional planning and governance(Da Cruz, Rode, & McQuarrie, 2019; Nelles, 2013). The concept of border conflicts in urban areas is not unique to the study area but is relevant to many developing countries, particularly those with rapidly expanding cities and limited institutional frameworks for managing cross-border issues. Border conflicts can arise due to competition over resources, jurisdictional disputes, and differing policy priorities between neighboring municipalities or regional governments (Yang & Li, 2013). Regional autonomy and ethnic federalism in Ethiopia often exacerbate such conflicts by creating tensions between different political entities (Bayu, 2021; Mengistu, 2015). These tensions can delay infrastructure projects and service provision, limiting the ability to implement integrated urban development strategies.

Similarly, the issue of illegality reflected in informal settlements, illegal land use, and unauthorized activities aligns with the broader governance literature on informality in urban contexts. The presence of illegal activities and informal settlements complicates governance by

creating areas outside of regulatory control and thus undermining the effectiveness of urban planning efforts. Studies in other African cities, such as Nairobi and Lagos, show that informal land markets and illegal construction practices can significantly impact metropolitan governance by increasing the complexity of infrastructure planning and resource allocation (Lamond et al., 2015; Turok, 2016). In this context, the study area faces similar challenges, and addressing illegality is critical for improving urban planning and governance.

On the other hand, the recognition of border cooperation as an equally important issue indicates an understanding of the potential benefits of coordinated governance across multiple jurisdictions. The theory of collaborative governance highlights that cooperation between neighboring jurisdictions can lead to more efficient service delivery, better resource management, and improved urban planning outcomes(Ansell & Torfing, 2015; Nelles, 2013). In Ethiopia, regional governments and municipalities often struggle with cross-border coordination due to a lack of institutional frameworks for collaboration. However, there are emerging examples of cross-border cooperation, such as joint infrastructure projects between Addis Ababa and its neighboring regions, which show that cooperation can reduce regional disparities and promote more equitable urban development(Ndoye, 2022; Worku & Adugna, 2024b). Other metropolitan regions globally have successfully implemented cross-border governance frameworks to address shared challenges, ranging from environmental management to transportation planning, and these initiatives align with their best practices.

In comparison, global case studies show that countries with strong institutional mechanisms for border cooperation such as Switzerland, with its control system can better manage cross-border urban challenges (Fricke, 2015; Solly, Berisha, & Cotella, 2018). This contrasts with the study area, where decentralized governance structures often lead to fragmented approaches. The literature suggests that establishing more robust (Mulugeta & Makonnen, 2017; Worku & Adugna, 2024a).

4.4.2.5 The Impact of Administrative Boundaries on Integrated Infrastructure Planning

Administrative boundaries significantly impact integrated infrastructure planning, according to the majority of respondents (60.7%), while (35.8%) believed they have no influence. This suggests that rigid administrative divisions can hinder the development of coordinated

infrastructure projects across regions, as each jurisdiction may prioritize its own needs and resources over collective goals. In the context of the study area, this finding is particularly relevant as the country's federal structure and regional boundaries can create challenges in aligning policies and infrastructure development efforts between neighboring regions and municipalities. On the other hand, some respondents believed that administrative boundaries have no influence on integrated planning, suggesting that effective coordination can still occur despite administrative divisions, provided there is political will, proper communication, and collaborative governance frameworks. However, the significant portion of respondents who see administrative boundaries as a barrier highlights the need for institutional reforms and mechanisms that facilitate cross-boundary collaboration in infrastructure planning. This underscored the importance of overcoming jurisdictional barriers to ensure that infrastructure development aligns with regional and urban growth

The finding fits with the idea of fragmented governance, which says that divisions of jurisdiction often lead to silos that make it harder to work together on urban planning and infrastructure development. Theories of urban governance, such as the "territorial trap"(Gualini, 2016; Shah, 2012), emphasize how political and administrative boundaries can limit the scope of urban planning and the effective management of shared resources. In metropolitan areas, especially those experiencing rapid growth, administrative boundaries often do not coincide with the functional areas required for integrated planning, such as transportation, and waste management. This is particularly evident in Ethiopia, where the decentralized system, underpinned by ethnic federalism, has created multiple administrative boundaries at various levels, often making it difficult to coordinate infrastructure projects that span across regions (Faguet, 2021; Mekonnen, 2018). In cities like Addis Ababa, infrastructure development frequently faces challenges due to competing regional interests and a lack of coordinated planning across these administrative borders.

In contrast, the respondents who believe that administrative boundaries have no influence on infrastructure planning reflect an alternative view rooted in the idea that strong governance frameworks and collaborative institutions can overcome the barriers posed by territorial divisions. This perspective aligns with the theory of collaborative governance, which emphasizes the importance of cooperation among local governments, stakeholders, and other actors,

regardless of administrative boundaries (Agger & Sørensen, 2018; Gollagher & Hartz-Karp, 2013). From this perspective, infrastructure planning can still be effective if governments are willing to engage in joint efforts and overcome institutional fragmentation. International examples, such as metropolitan governance models in cities like Toronto or Singapore, show that effective urban planning can occur across administrative boundaries if there is political commitment, strong institutional frameworks, and mechanisms for cross-jurisdictional collaboration (Blakely & Crommerlin, 2016). These models suggest that it is not the boundaries themselves that limit effective planning, but rather the lack of mechanisms to facilitate coordination and the absence of collaborative political will.

This study's findings thus highlight the need for reforms that facilitate cross-regional collaboration, such as joint governance committees or inter-regional planning bodies that can bridge administrative boundaries. The contrasting findings in this study emphasize that while administrative boundaries may pose challenges, there are opportunities to create collaborative mechanisms that allow for more integrated urban planning, ultimately supporting more sustainable and equitable infrastructure development across Ethiopia's urban regions. As shown in cities like Barcelona, metropolitan regions with multiple administrative divisions have overcome these barriers by establishing shared governance bodies and integrated planning strategies.

4.4.3 Financial Integration

4.4.3.1 The Source of Finance for Integrated Infrastructure Planning

Table 4.12: the source of finance for integrated infrastructure planning

No	Issues	Frequency	Percentage
1	Domestic investors	27	11
2	Public utilities	10	3.9
3	Dedicated government funds	201	81
4	Banks and other financial institutions	10	4.1
	Total	248	100

Source: survey, 2023

The results shown in Table 4.12 show that respondents consider dedicated government funds as the most significant source of financing for integrated infrastructure planning, and they support this option. This is indicative of a dependence on public funding as the primary driver of infrastructure development, particularly in situations where the private sector may lack the necessary capacity or inclination to invest. This is especially pertinent in the Ethiopian context, as the government plays a central role in the financing and implementation of significant infrastructure projects, including urban development, energy, and roads. While government funding is crucial, the challenge lies in allocating and managing these resources to optimize their impact.

In contrast, the relatively low percentages for domestic investors, public utilities, and banks and financial institutions indicate a restricted reliance on alternative or private sector sources of financing. This implies that there may be obstacles to attracting private sector investment in infrastructure, such as high-risk perceptions, regulatory challenges, or restricted access to capital markets. This finding suggests that a concerted effort to create a more favorable environment for the private sector to participate is necessary to improve financial integration and infrastructure development.

According to the theory of state-driven development, dedicated government funds are the most popular way to pay for integrated infrastructure planning. This makes sense in situations where public funding is a major source of infrastructure investment. This preference reflects a reliance on government resources, which is common in developing countries where financial markets and private sector involvement in large-scale infrastructure projects are often underdeveloped. The theory of state-centric urban governance suggests that in countries with limited access to international capital markets and domestic private investment, the government plays a central role in financing public infrastructure (Allain-Dupré, 2011; Lai, 2023). In Ethiopia, the government has historically been the primary source of funding for major infrastructure projects, such as roads, energy, and housing. While public funding remains essential, the challenge lies in the capacity of the government to mobilize and efficiently allocate these resources for large-scale, integrated infrastructure projects.

In contrast, the limited support for domestic investors and financial institutions reflects the barriers that hinder private sector participation in infrastructure development. Theories of

financial integration and public-private partnerships (PPPs) suggest that infrastructure financing can be more sustainable when private sector actors are involved, as they bring in capital, expertise, and innovation (Cheng et al., 2021; Ma et al., 2022). However, the relatively low percentage of respondents favoring private investors suggests that the institutional and financial environment in the study area does not yet fully facilitate private sector participation. Research indicates that high-risk perceptions, unclear regulatory frameworks, and restricted credit market access frequently hinder private sector participation in infrastructure development in Ethiopia (Debela, 2021; Megistu, 2013). The broader context of infrastructure finance in developing economies mirrors these challenges, emphasizing the need to address barriers to private sector involvement through policy reforms, improved access to finance, and stronger legal protections for investors (Laplane & Mazzucato, 2020).

The importance of state-owned enterprises in many developing economies, including Ethiopia, explains the minor preference for public utilities as a source of financing. In the Ethiopian context, public utilities have historically depended on government subsidies and investments for expansion and maintenance, particularly in areas where private sector participation is minimal. This finding highlights the need for greater efficiency and innovation within public utilities to address infrastructure challenges and improve service delivery.

Comparing these findings with global experiences, countries with more developed infrastructure financing systems often rely on a combination of public and private sources. In developed nations like the United States and Germany, infrastructure financing often combines government funding, public-private partnerships, and financial institutions to reduce the burden on the state and increase investment in long-term infrastructure projects (Bielenberg et al., 2016; de Mello & Sutherland, 2015). This contrasts with the study area context, where government funding remains the primary source and private sector participation is still limited. This highlights the importance of diversifying financing mechanisms, encouraging private sector involvement, and establishing a conducive policy environment to create a more balanced and sustainable approach to infrastructure financing in the study area.

4.4.3.2 Challenges and Opportunities in Collaborative Infrastructure Development

11.8% of respondents positively answered the question of whether cities collaborate to implement integrated infrastructure, while 82.35% answered negatively. This response suggests that sectoral coordination is nearly nonexistent. The low percentage of respondents affirming city collaboration on integrated infrastructure indicates significant gaps in cooperative planning and execution across urban areas. This suggests that cities may be operating in isolation rather than sharing resources, knowledge, and strategies that could enhance the efficiency, resilience, and sustainability of their infrastructure systems. The high rate of negative responses highlights potential inefficiencies and missed opportunities for coordinated urban development. This lack of collaboration could lead to duplicate efforts, inconsistent infrastructure standards, and unequal service levels across regions. The findings imply a need for policy adjustments and incentives to encourage cities to work together.

According to collaborative governance theory, cities that work together on shared infrastructure projects benefit from pooled resources, improved service delivery, and heightened resilience in the face of challenges such as climate change and rapid urbanization(Iaione, 2016; Kamara, 2017; Resetar et al., 2020). However, the study's findings indicate that Ethiopia faces significant obstacles in fostering this level of cooperation, as reflected in the high percentage of respondents reporting a lack of inter-city collaboration.

Comparative studies suggest that the absence of collaborative frameworks is more common in developing countries, where fragmented governance, limited funding, and capacity constraints hinder infrastructure integration. For instance, European cities commonly engage in regional cooperation, leading to streamlined infrastructure development and coordinated responses to environmental challenges(Böhme et al., 2011; Frantzeskaki et al., 2014). In the study area, these findings align with broader research on African urban governance, which highlights the structural challenges cities face in achieving sustainable growth. Issues like inadequate funding, limited technical expertise, and fragmented administrative systems significantly hinder cooperation on infrastructure projects in many Ethiopian cities (Girma et al., 2019; Woldesenbet, 2020). The lack of collaboration can lead to inefficient infrastructure investments, duplicative projects, and inconsistent standards across regions, limiting the ability of the cities to meet the demands of their growing populations.

By examining models of successful inter-city collaboration in other contexts, the cities might identify potential pathways for reform. For example, Singapore and Curitiba, demonstrate the positive impacts of integrated infrastructure planning driven by inter-agency and inter-municipal collaboration, supported by enabling policies and robust governance frameworks (Mitric, 2008). Drawing lessons from these cities, Ethiopia could consider implementing policy reforms that empower local governments, establish funding mechanisms for collaborative projects, and promote the development of infrastructure plans shared across urban regions. These adjustments would not only address local development needs more effectively but also contribute to Ethiopia's overarching goals for sustainable urbanization and resilience in the face of emerging global challenges.

4.4.3.3 Barriers to the Establishment of a Legal Framework

The reason for lack of a legal framework prevent the cities from coordinating is shown in table 4.13

Table 4.13: the reason for lack of a legal framework prevent the cities from coordinating

No	Issues	Frequency	Percentage
1	Funding and Resource Allocation Challenges	62	25.1
2	Absence of Shared Standards	153	61.8
3	Jurisdictional Conflicts	15	5.9
4	Uncertainty in Accountability	18	7.2
	total	248	100

Source: survey, 2023

The leaders and experts who participated in the interview stated that they are still preparing the legal framework and police measures. The absence of shared standards appears to be a primary barrier to inter-city coordination, with respondents attributing the lack of collaboration to this issue. Without a formal structure that defines roles, responsibilities, and processes for cooperation, cities may face difficulties aligning their policies, sharing resources, or developing joint initiatives. This absence of legal guidance can lead to inconsistencies in infrastructure standards and prevent cities from effectively addressing shared challenges. The data also reveals

that, without a legal framework, cities lack uniform regulations and protocols to guide their collaboration. This leads to inconsistencies in planning, decision-making, and implementation of initiatives, making coordination inefficient or unfeasible. A small percentage of respondents also mentioned this issue. Legal frameworks often establish mechanisms for sharing resources or securing joint funding. In their absence, cities struggle to pool financial or logistical resources, delaying or preventing coordinated efforts. Without clear legal guidelines, accountability for outcomes is ambiguous. Cities may hesitate to cooperate for fear of liability or unclear division of responsibility, resulting in fragmented or stalled efforts.

The absence of shared standards is a significant factor that prevents cities from coordinating effectively, as legal and regulatory structures are essential for guiding collaborative governance. According to collaborative governance theory, frameworks that establish clear roles, responsibilities, and protocols create a foundation for cooperation, as they reduce ambiguity and set shared expectations among stakeholders(Bridoux & Stoelhorst, 2022; Bryson et al., 2015). Without such structures, cities may face obstacles in aligning their policies, defining shared objectives, and coordinating efforts in infrastructure projects. In the study area, the respondents' emphasis on the lack of shared standards aligns with this theoretical understanding, implying that the cities in question lack the fundamental guidelines necessary for effective inter-city coordination. In contrast to many developed nations, cities in developing contexts often lack these structures. For instance, in European Union member states, shared standards encourage collaboration by mandating inter-regional coordination on infrastructure and environmental standards (Pietrangeli, 2016; Pina & Sicari, 2021). This gap in governance may explain why the cities have difficulty building shared initiatives and aligning on infrastructure goals, as seen in the study's findings.

Respondents cite the lack of funding and resource allocation challenges to inter-city collaboration in the cities as another barrier, which reflects the limited prioritization of cooperative infrastructure planning. Research on urban governance indicates that failure to recognize collaboration as a policy priority often results in inadequate funding and institutional support, making its sustainability challenging(Healey, 2017). This lack of prioritization reinforces isolated city planning efforts, potentially leading to inefficiencies, resource duplication, and varying standards of infrastructure quality across regions.

The study's findings also identify funding and resource allocation challenges as barriers to collaboration, potentially stemming from the ambiguity of accountability for outcomes in the absence of clear legal guidelines. Without accountability and assurances, cities may perceive inter-city partnerships as risky or as potentially compromising their individual interests, thereby limiting opportunities for effective collaboration. Lessons from other regions indicate that once frameworks are in place, they can significantly improve inter-city coordination by providing formal guidelines for roles, dispute resolution, and resource allocation(Miao, 2017; Vogel et al., 2010). Developing these frameworks could thus play a transformative role in enabling Ethiopian cities to work together, enhance infrastructure integration, and meet urbanization challenges more effectively.

4.4.4 Governance Challenges in Managing Infrastructure Integration

65.5% of respondents identified challenges in metropolitan governance, while 31% indicated that there were no challenges at all. The interviews, focus group discussions, and questionnaires completed by the respondents indicate that metropolitan governance presents challenges for city regions. The finding that respondents identified challenges in metropolitan governance suggests that there are significant obstacles in managing urban and regional development cohesively. This implies that issues such as fragmented authority, limited resources, or lack of coordination across city regions may be impacting the effectiveness of governance frameworks. Conversely, the respondents who did not perceive challenges in metropolitan governance indicate that there may be differing experiences or perceptions across regions. This could imply that while some areas struggle with governance coordination, others may have better frameworks or practices in place. Overall, the feedback from interviews, focus group discussions, and questionnaires underscores the complexity of metropolitan governance in city regions. The findings suggest a need for targeted reforms and strengthened inter-jurisdictional collaboration to address these challenges, as effective metropolitan governance is key to managing the unique demands of interconnected urban areas.

The finding that respondents identified challenges in metropolitan governance aligns with existing theories that highlight the complexities of governing interconnected urban areas. Metropolitan regions often encompass multiple jurisdictions, each with its own administrative boundaries, interests, and priorities, making unified governance difficult (Andersson, 2014;

Smith, 2023). Fragmented authority, competing political interests, and resource constraints often lead to coordination issues that impede effective policy implementation and infrastructure planning. The finding supports the theoretical basis that metropolitan governance requires collaborative frameworks to address these structural barriers effectively.

The presence of respondents who did not perceive challenges in metropolitan governance suggests a variance in perspectives and potentially reflects differences in institutional effectiveness or regional experiences. In some cases, stronger coordination mechanisms, shared goals, or collaborative leadership can mitigate the challenges of fragmented governance, as seen in cities with effective metropolitan councils or joint planning bodies. These positive experiences underscored that certain conditions such as established frameworks for inter-jurisdictional collaboration or incentivized partnerships can alleviate governance difficulties. The majority of respondents noted challenges in metropolitan governance, highlighting how the study area political and administrative structure may exacerbate issues of fragmentation and inefficiency in metropolitan governance. Scholars argue that in such contexts, establishing formal governance frameworks, such as metropolitan authorities or councils, could improve coordination (Butt et al., 2021). However, implementing such frameworks may require political will and commitment from multiple administrative levels, as well as an emphasis on shared regional goals to overcome deeply entrenched structural divides.

International comparisons show that metropolitan regions in other countries have addressed similar challenges by implementing governance structures that facilitate regional collaboration. For example, metropolitan planning organizations (MPOs) in the United States and similar bodies in European city-regions offer models for bringing together multiple jurisdictions to create unified plans for transportation, housing, and infrastructure(Herzog & Sohn, 2014; O'Brien, Pike, & Tomaney, 2019). Research has shown that these structures effectively align policies across boundaries in metropolitan governance. In summary, the findings emphasize the complexities of metropolitan governance in the study area, underscoring the need for governance reforms that prioritize inter-jurisdictional collaboration. International experiences demonstrate the potential benefits of establishing formal metropolitan authorities or collaborative frameworks to unify city-region planning efforts

4.4.4.1 The Major Governance Challenges in Managing Infrastructure Integration

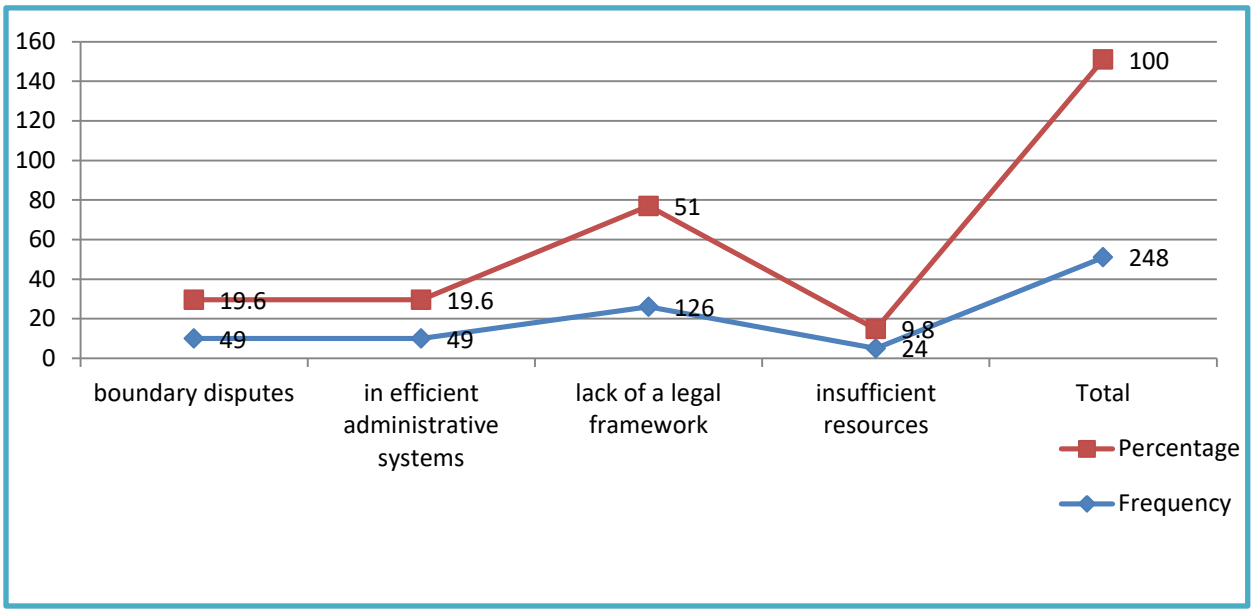

Fig.4.15: the Challenges of metropolitan governance

Source: Feld survey, 2024

The high percentage of respondents on Fig 4.16 identifying the lack of a legal framework as a major challenge imply that there is a critical need for clear laws and policies to support metropolitan governance. The equal proportion of respondents citing boundary disputes and inefficient administrative systems as challenges highlights additional barriers to cohesive governance. Boundary disputes can create jurisdictional conflicts that complicate resource allocation and policy execution, while inefficient administrative systems may slow down the coordination and responsiveness of metropolitan governance bodies. The respondents pointing to insufficient resources indicate that funding limitations also impede effective metropolitan governance. Limited financial resources can restrict the ability to invest in infrastructure, enforce policies, and support collaborative initiatives. This finding underscored the importance of securing adequate resources, possibly through government funding, partnerships, or alternative financing mechanisms, to enable sustainable and functional metropolitan governance structures.

The finding that respondents cited the lack of a legal framework as a primary challenge in metropolitan governance supports existing theories on the importance of formalized structures in urban governance. According to urban governance scholars, the absence of a defined legal structure can result in ad hoc, inconsistent policy approaches and hinder the establishment of

shared objectives across jurisdictions (Monstadt & Schmidt, 2019). A legal framework provides the authority for regional governance, delineates responsibilities, and establishes mechanisms for decision-making, which are critical for cohesive metropolitan governance (Gómez-Álvarez et al., 2017). In Ethiopia, where there is significant regional autonomy, the lack of a unifying legal framework for metropolitan governance means that city-regions struggle to implement coordinated planning or align priorities, leading to fragmented and often conflicting efforts in infrastructure development and service provision (Huchzermeyer et al., 2024).

An equal number of respondents said that boundary disputes and inefficient administrative systems were problems. This shows that there are more problems with running a metro area that are common in places with more than one jurisdiction. Boundary disputes create ambiguity and conflict over jurisdictional control, which can delay or prevent joint initiatives and resource sharing (Salminen, 2016). Inefficiencies within administrative systems, such as bureaucratic delays or redundant processes, further exacerbate the difficulty of coordinating across city-region boundaries. This fragmentation reinforces the need for the study area to establish clearer governance frameworks that can resolve boundary ambiguities and improve administrative coordination for better urban management.

The mention of insufficient resources by respondents as a hindrance to effective metropolitan governance aligns with theories that emphasize the importance of financial capacity for sustainable governance. Metropolitan regions require adequate resources to fund infrastructure, enforce policies, and provide services, yet many regions struggle with limited budgets and access to financial tools (Andres et al., 2014). This challenge is particularly relevant in Ethiopia, where budgetary constraints and limited private sector involvement often restrict metropolitan areas from accessing the funds needed to support urban development projects (Alem, 2021; Keller & Mukudi-Omwami, 2017). This finding suggests that strengthening metropolitan governance in the study area may require not only legal and administrative reforms but also strategies for mobilizing additional financial resources, such as public-private partnerships or international funding sources.

Internationally, metropolitan regions facing similar challenges have addressed these issues through regional governance models that foster cooperation and shared resources across jurisdictions. For instance, metropolitan planning organizations (MPOs) in the United States

provide a platform for cross-jurisdictional coordination, integrating legal, administrative, and financial resources to support regional initiatives(Weinreich & Skuzinski, 2021). Additionally, cities like London and Tokyo have used legislation to grant metropolitan authorities greater control over boundary disputes and resource allocation, ensuring that metropolitan governance is both efficient and aligned with regional goals (Gómez-Álvarez et al., 2017; Ohashi, Phelps, & Tomaney, 2022). Finally, the problems that people pointed out support the idea that for metropolitan governance to work well, there needs to be a consistent set of laws, clear lines of authority, streamlined government systems, and enough money. Applying these insights to the study area context, there is a clear need for governance reforms that address structural fragmentation and financial constraints.

4.4.4.2 The Role of the Federal Government in Managing the Governance Challenges

Table 4.14: the federal government's responsibilities to manage the challenges

No	Issues	Frequency	Percentage
1	Designing or formulating of policies and strategies	117	47
2	Providing supervision	56	23
3	Providing incentives	45	18
4	Allocating budgets	30	12
	Total	248	100

Source: Expertise survey, 2023

It was found that respondents shown in Table 4.14 want the federal government to be involved in making policies and strategies. This shows that clear goals and guidelines need to be set from the top down for metropolitan governance. This method has the potential to be particularly effective in ensuring that diverse regions collaborate to achieve national objectives that are cohesive. The respondents who identified federal supervision as a solution express a desire for more robust governance mechanisms to ensure accountability and adherence to established policies. Federal supervision could play a critical role in monitoring progress, addressing jurisdictional conflicts, and ensuring the effective implementation of metropolitan governance plans by regional authorities. This discovery implies that the federal government's oversight could facilitate the uniformity of governance practices across various metropolitan areas.

Respondents' endorsement of federal incentives suggests that cooperation among regions may necessitate motivation that transcends regulatory constraints. This discovery emphasizes the potential of incentives to encourage jurisdictions to collaborate and resolve gaps in collaboration in order to achieve shared objectives. Respondents' demand for federal budget allocations underscores the significance of financial support in facilitating effective governance. This underscored the fact that initiatives to enhance metropolitan governance may encounter challenges in gaining momentum or achieving long-term success in the absence of sufficient financial support.

The recommendation for federal government involvement in policy design and strategy formulation aligns with theories emphasizing the importance of multi-level governance structures in managing complex metropolitan regions. According to (Conteh, 2013; Hakulinen, 2023), multi-level governance frameworks allow for policy coherence across various jurisdictions, facilitating unified regional development goals while accommodating local autonomy. In Ethiopia, the lack of a coordinated policy framework often leads to fragmented efforts in metropolitan governance, as local governments operate with varying degrees of authority and resources. The finding that respondents view federal supervision as essential reflects a common approach in metropolitan governance, where higher-level authorities monitor and guide regional and local initiatives to ensure compliance and accountability. Research by Carlisle and Gruby (2019) and Stephan et al. (2019) on polycentric governance systems suggests that having a central authority oversee local efforts can help resolve conflicts, enforce regulations, and maintain consistency across diverse jurisdictions. This supervisory role could be particularly beneficial for fostering metropolitan governance in the study area, where political and administrative boundaries often hinder cooperative efforts in infrastructure and service coordination.

Federal incentives, as recommended by respondents, suggest the need for positive reinforcement mechanisms to motivate local governments and private entities to participate in metropolitan governance initiatives. Incentives play a significant role in aligning diverse stakeholders with broader goals, especially in complex metropolitan settings. Studies on metropolitan regions in the United States and Europe show that fiscal incentives and grants can encourage local governments to prioritize regional projects and partnerships (O'Brien & Pike, 2015; Vammalle &

Bambalaite, 2021). For the study area, introducing similar incentives could help alleviate local resistance to collaboration, promote resource pooling, and incentivize joint projects in transportation, housing, and infrastructure.

The importance of federal budget allocations, identified by respondents, aligns with the theory that financial resources are a fundamental driver of metropolitan governance capacity. Scholars have shown that without adequate financial support, metropolitan governance structures struggle to implement their mandates effectively, as insufficient funding limits both operational capacity and project feasibility (Simpson et al., 2019). Furthermore, federal funding could ensure that resource-constrained regions have the means to engage in collaborative efforts and develop essential infrastructure, strengthening overall governance capacity.

4.5 Strategic Tools for a Sustained Urban Infrastructure Integration System

4.5.1 The main challenges for infrastructural integration between Addis Ababa and Sheger Cities

The subsequent Table 4.15 addresses the interviewer's inquiry, "What are the current challenges in integrating physical infrastructure between Addis Ababa and Sheger?" We conducted KII to gather participants' perspectives on the current state of integrated infrastructure. The KII focused on the current challenges and potential alternative solutions for the integration of physical infrastructure.

Table 4.15- The current challenges in integrating physical infrastructure

Issues	Challenges	Alternatives
funding and financial constraints	Limited government budgets and competing priorities can make it challenging to secure sufficient funding for substantial integrated infrastructure initiatives.	We can alleviate the financial burden on the government by investigating public-private partnerships that capitalize on private sector investment and expertise.
land acquisition and compensation	Acquiring land for infrastructure projects often involves negotiating with landowners, which can lead to delays and increased costs due to compensation disputes.	Implementing fair and transparent land acquisition processes and offering attractive compensation packages can mitigate conflicts and accelerate land acquisition.
coordination and planning:	Coordinating among various government agencies, local authorities, and stakeholders can be complex, leading to fragmented efforts and inefficient use of resources.	Establishing a central coordinating body or task force dedicated to overseeing the integration project can improve coordination and streamline decision-making processes.

technical and engineering challenges	The geographical and topographical features between Addis Ababa and Sheger may pose technical challenges for construction, requiring advanced engineering solutions.	Investing in advanced engineering technologies and conducting thorough feasibility studies can help identify and address technical challenges early in the project.
environmental and social impact	infrastructure projects can have significant environmental and social impacts, including displacement of communities and disruption of ecosystems	Implementing comprehensive environmental and social impact assessments (esias) and engaging with affected communities can help mitigate negative impacts and ensure sustainable development.
resource availability and management	Limited availability of construction materials and skilled labor can slow down the progress of infrastructure projects.	Developing local supply chains and training programs for skilled labor can enhance resource availability and support the timely completion of projects.

Source: Interview survey, 2023; n =50

The findings for the current challenges in integrating physical infrastructure presented in Table 4.15 highlight the critical barriers to integrating physical infrastructure between the cities of the study area. These challenges and their proposed alternatives have significant implications. They underscored the multifaceted nature of urban infrastructure projects, which encompass economic, social, environmental, and technical dimensions. Funding and financial constraints, for instance, emphasize the importance of exploring innovative financing mechanisms such as public-private partnerships (PPPs). Urban planning literature widely recognizes this approach as a means of leveraging private investment to complement public resources, thereby ensuring the financial sustainability of large-scale infrastructure projects.

Similarly, issues related to land acquisition and compensation highlight the socio-political complexities of infrastructure development. Implementing transparent processes and fair compensation not only reduces delays but also fosters public trust and minimizes resistance from affected communities, which is essential for sustainable development. The inclusion of environmental and social impact assessments (ESIAs) aligns with global best practices in infrastructure development, ensuring that projects minimize harm to ecosystems and communities (Akwii et al., 2024; Kvam, 2018). This demonstrates a commitment to balancing development goals with environmental sustainability, a cornerstone of contemporary urban planning.

The results lie in their direct alignment with the study's goals of identifying and addressing the barriers to infrastructure integration between the cities. Each challenge identified corresponds to a tangible issue that impedes progress, and the proposed alternatives provide actionable solutions. For instance, the recommendation to establish a central coordinating body directly addresses the issue of fragmented efforts and inefficient resource use, which is a core obstacle in achieving integration. The systematic identification of challenges and solutions ensures that the study remains focused on practical outcomes. The proposed alternatives align with the study's objectives, which suggest that resolving these barriers can facilitate effective infrastructure integration, thereby enhancing regional connectivity and development.

The findings resonate with challenges observed in other countries, particularly in rapidly urbanizing regions. For example, studies in countries like India and South Africa have identified similar issues, including funding constraints, land acquisition disputes, and coordination challenges. In India, large-scale urban projects like the Delhi-Mumbai Industrial Corridor have relied heavily on PPPs to overcome financial barriers (Bhat, 2019; Halder, 2024; Kudtarkar, 2022). Similarly, fair compensation and public engagement have mitigated land acquisition challenges. In the European Union, cross-border infrastructure projects often require the establishment of centralized coordinating bodies to harmonize efforts across multiple jurisdictions (Joachim, 2018; Marshall, 2014; Medeiros et al., 2021). These parallels suggest that the findings are reflecting common obstacles in infrastructure integration, making the proposed solutions broadly applicable in similar contexts.

4.5.1.1 Challenges in traffic and mobility trends

Table 4.16:- Traffic Movement between Addis Ababa and Sheger by date

Day, Date & rush hours		Number of vehicles				Remark
		Mini-bus	Bus	Truck	Automobile	
Monday	7:00-:9:00 a.m.	420	95	80	650	High commuter traffic (workers, students)
	4:30-7:00 p.m.	380	90	100	700	Evening return flow to

						Sheger
Wednesday	7:00-:9:00 a.m.	400	85	70	620	Mid-week peak
	4:30-7:00 p.m.	390	88	90	680	Balanced inbound and outbound traffic
Friday	7:00-:9:00 a.m.	430	100	60	700	Start of weekend movement
	4:30-7:00 p.m.	450	110	80	800	Increased evening outflow
Saturday	7:00-:9:00 a.m.	300	60	90	500	Reduced work trips, more market trips
	4:30-7:00 p.m.	280	55	100	540	Leisure & market return flow
Sunday	7:00-:9:00 a.m.	200	50	70	400	Mostly non-work-related trips
	4:30-7:00 p.m.	220	45	80	450	Post-weekend return to Addis Ababa

Source: survey, 2024

Table 4.17:- Traffic congestion and mobility trends between Addis Ababa and Sheger cities.

Location	Peak Hour vehicles/hour	Off-Peak vehicles /hour	Traffic Congestion Level (1-10)	Travel Time (Peak Hours, mins)	Travel Time (Off-Peak Hours, mins)	Mode of Transport Usage (%)
Addis Ababa - City Center	4,500	2,000	9	40-45	15-20	Private Cars: 40%, Public Transit: 30%, Walking: 20%, Taxis: 10%
Addis Ababa - Outer Suburbs	3,200	1,800	7	35-40	18-22	Private Cars: 50%, Public Transit: 35%, Taxis: 15%
Sheger City - City Center	3,800	1,900	8	45-50	20-25	Private Cars: 45%, Public Transit: 30%, Taxis: 15%, Walking: 10%
Sheger City - Outer Areas	2,500	1,500	6	30-35	Dec-15	Private Cars: 55%, Public Transit: 25%, Taxis: 10%, Walking:

						10%
Addis Ababa to Sheger (Intercity)	2,800	1,700	7	55-60	30-35	Private Cars: 60%, Public Transit: 25%, Taxis: 10%, Buses: 5%

Source: survey, 2024

Note:- *The "Traffic Congestion Level (1-10)" is a rating scale used to indicate the severity of traffic congestion, with 1 representing minimal congestion (smooth traffic flow) and 10 representing severe congestion (extremely slow or standstill traffic). This scale helps quantify and compare congestion levels across different locations and times of day. 1-3: Low congestion. Traffic flows smoothly with minimal delays. 4-6: Moderate congestion. There may be some delays and slower traffic, especially in key areas, but movement is still possible. 7-8: High congestion. Traffic is slow, and there are noticeable delays. Vehicles may frequently come to a stop due to heavy traffic.9-10: Severe congestion. Traffic is extremely slow or at a standstill. Commutes are significantly delayed, and travel times are much longer than usual.*

The findings of the above in Table 4.16 & Table 4.17 indicates that the Traffic movement data from Addis Ababa and Sheger during peak hours (7:00–9:00 a.m. and 4:30–7:00 p.m.) shows significant congestion, especially on weekdays like Mondays and Fridays, driven by work-related travel, market activity, and social commitments. Both cities experience high volumes of mini-buses, trucks, buses, and private cars, contributing to severe road saturation, delays, and pollution. The absence of coordinated traffic systems and infrastructure planning exacerbates these issues, leading to inefficiencies in mobility and goods delivery (Cheng, Pang, & Pavlou, 2020; Faheem, Shorbagy, & Gabr, 2024).

This congestion highlights a lack of integration between transport systems and broader urban planning efforts. Unlike cities such as Singapore and Curitiba, which leverage smart technologies, BRT networks, and integrated zoning policies (Fryszman, Carstens, & Da Cunha, 2019; Haas, 2019), Addis Ababa and Sheger's fragmented governance structure and inconsistent transport policies hinder efficient mobility. The situation demonstrates how traffic congestion is both a consequence and a cause of poor infrastructure coordination, negatively impacting economic activity, service delivery, and environmental quality.

To address these challenges, the cities must implement integrated mobility frameworks, including shared traffic databases, harmonized regulations, and a regional transport authority, similar to models in Copenhagen or Singapore(Concas, Kummetha, & Staes, 2024; Joise et al., 2023). Public-private partnerships and data-driven planning tools are essential for developing responsive transport systems. Without such measures, Addis Ababa and Sheger risk continued duplication of infrastructure investments and worsening urban inequalities. Effective integration demands synchronized land-use planning, community involvement, and governance reform to align transportation with broader development goals.

4.5.1.2 The need in improvements of transportation system

In response to the inquiry, what enhancements would you like to see in transportation (roads, public transit, etc.)? Table 4.18 below presents the findings in more detail, along with discussions from the Focus Groups.

Table 4.18:- The need in improvements of transportation system

Roads and Highways	Public Transit	Environmental Considerations	Policy and Governance
Expanding and upgrading major roads and highways to accommodate increasing traffic volumes. This includes adding lanes, improving road surfaces, and ensuring proper signage and lighting.	Expanding the bus network to cover more areas, including suburban and peri-urban regions. Increasing the frequency of services and introducing dedicated bus lanes to improve reliability and speed.	Promoting green transportation options, such as electric buses and vehicles, to reduce emissions and improve air quality. Supporting the development of charging infrastructure for electric vehicles.	Encouraging public-private partnerships to leverage private investment and expertise in transportation projects.
Constructing bypasses and ring roads to divert through-traffic away from congested urban areas, reducing traffic jams and improving travel times.	Extending the Addis Ababa Light Rail Transit (LRT) system to cover more destinations, including key residential and commercial areas in	Integrating transportation planning with sustainable urban development to create walkable, transit-oriented communities that reduce the need	Involving communities in transportation planning to ensure that improvements meet the needs of residents and businesses.

	Sheger. This would provide a fast and reliable alternative to road transport.	for long commutes.	
Implementing regular maintenance programs to ensure roads remain in good condition, including pothole repairs, resurfacing, and drainage improvements.	Creating integrated transit systems that allow seamless transfers between buses, LRT, and other forms of public transport. Implementing unified ticketing systems and schedules to make public transit more user-friendly.		Securing adequate funding for transportation projects through government budgets, international aid, and innovative financing mechanisms

Source: FGD survey, 2023, n =90

The assessment of transportation infrastructure in the cities revealed significant disparities in road networks, public transit systems, and connectivity between the two cities. These underscored the need for targeted investments to improve connectivity and mobility in both cities. Rapid urbanization and industrialization have contributed to environmental degradation, posing risks to public health and ecosystem integrity. We need sustainable infrastructure integration strategies to mitigate these environmental risks and promote ecological resilience. The assessment of policy frameworks and governance structures highlighted gaps in coordination, stakeholder engagement, and decision-making processes related to infrastructure integration (Akhmouch & Clavreul, 2016; Di Vaio et al., 2021). Strengthening institutional capacities, enhancing multi-stakeholder collaboration, and streamlining regulatory frameworks are essential for effective infrastructure planning and implementation. Large-scale unbundling of infrastructure has resulted in the fragmentation of governance across sectors, spaces, and public and private domains. Because of this, it is important to improve transparency, accountability, and stakeholder participation in decision-making processes in order to improve policy outcomes, build public trust, and promote sustainable development.

The outlined transportation improvements highlight critical pathways for enhancing urban mobility and supporting sustainable development. These proposals underscored the importance of

comprehensive transportation planning in addressing urban challenges such as congestion, environmental degradation, and inadequate public transit. Expanding road networks and public transit systems reflects a growing recognition of their roles in promoting economic efficiency and improving quality of life. Promoting green transportation, such as electric buses and vehicles, aligns with global commitments to reduce greenhouse gas emissions and combat climate change. The integration of public transit systems further supports a modal shift away from private vehicle use, fostering sustainability and reducing urban air pollution (Chadalawada, 2024; Oeschger, Carroll, & Caulfield, 2020).

The recommendations are consistent with the study's objectives of identifying and addressing deficiencies in the transportation system. Suggestions such as expanding roads, improving transit coverage, and incorporating green options align with the goal of developing a comprehensive and efficient transportation network. These strategies also reflect an understanding of the current challenges, such as congestion and environmental concerns. By addressing these challenges, the strategies provide a robust framework for achieving the desired improvements. The recommendations align with best practices observed in other urban centers globally. Cities such as Curitiba in Brazil and Singapore have successfully implemented integrated transit systems and promoted public-private partnerships for infrastructure development (Suzuki, Cervero, & Iuchi, 2013). Similarly, the emphasis on electric transportation parallels initiatives in cities like Oslo and Amsterdam, which have championed green mobility solutions (Aagaard, 2018; Hirschhorn et al., 2020). By comparing these strategies to successful international case studies, the results demonstrate strong external validity. They highlight the universal applicability of integrated and sustainable transportation solutions.

4.5.1.3 The need in improvements of drainage, sewerage and waste management

In response to the inquiry, what improvements would you like to see in the areas of drainage, sewerage, and waste management? We have organized the response, or the results of the findings, in Table 4.19 below.

Table 4.19:- The need in improvements of drainage, sewerage and waste management

Drainage Systems	Sewerage Systems	Waste Management	Policy and Governance
Upgrading existing drainage infrastructure to handle increased rainfall and prevent flooding. This includes enlarging drainage channels, improving storm water management systems, and installing more effective drainage grates and culverts.	Expanding the sewerage network to cover underserved areas, ensuring that all households and businesses have access to proper sanitation facilities. This is essential for preventing waterborne diseases and improving public health.	Enhancing waste collection services to ensure regular and reliable collection of household, commercial, and industrial waste. This includes expanding coverage, increasing collection frequency, and using modern collection vehicles.	Strengthening regulations and enforcement mechanisms to ensure compliance with environmental and public
Implementing regular maintenance schedules to keep drainage systems clear of rubbish and functioning properly. This can help prevent blockages and reduce the risk of flooding	Upgrading sewage treatment facilities to handle increased capacity and meet higher environmental standards.	Upgrading waste disposal facilities, such as landfills and incineration plants, to meet higher environmental standards.	
Integrating green infrastructure solutions, such as rain gardens, permeable pavements, and green roofs, to absorb rainwater and reduce runoff. These solutions can also improve urban aesthetics and biodiversity.	Implementing measures to reduce leakages and overflows in the sewerage system. This includes regular inspections, maintenance, and timely repairs to prevent contamination of water sources and urban areas	Developing composting programs to manage organic waste, which can be converted into valuable compost for agriculture and landscaping? This reduces the volume of waste and supports sustainable agriculture practices.	
Developing comprehensive flood risk management plans that include early warning systems, flood barriers, and community preparedness programs to mitigate the impact of severe weather events	Exploring innovative sanitation solutions, such as decentralized treatment systems, and composting toilets, especially in areas where extending the sewer network may not be feasible.	: Implementing policies and initiatives to reduce plastic waste, such as banning single-use plastics, promoting reusable alternatives, and encouraging businesses to adopt sustainable packaging practices.	

Source: FGD survey, 2023, n =90

The recommendations for improving drainage, sewerage, and waste management systems are essential for creating sustainable and resilient urban environments. These improvements mitigate risks associated with flooding, waterborne diseases, and pollution, which are critical in urban planning and public health. Integrating green infrastructure like rain gardens and permeable pavements not only manages storm water effectively but also enhances urban biodiversity and aesthetics. Expanding the sewerage network and upgrading treatment facilities have direct implications for improving water quality and reducing the environmental footprint of urban wastewater. Similarly, better waste management practices, such as composting programs and upgraded disposal facilities, support sustainable development goals by reducing pollution, encouraging resource recycling, and promoting circular economy principles.

The proposed strategies align well with the study's goals of enhancing urban infrastructure and addressing existing deficiencies. Regular maintenance of drainage systems, expansion of sewerage networks, and improved waste collection services address specific challenges identified in the current infrastructure(Mguni, Herslund, & Jensen, 2016; Sobieraj, Bryx, & Metelski, 2022). The integration of innovative and green solutions further guarantees the sustainable achievement of these goals, thereby strengthening the internal validity of the findings. The strategies are consistent with global best practices observed in cities facing similar challenges. For instance, Singapore's adoption of green infrastructure solutions and advanced waste management systems demonstrates their feasibility and effectiveness (Kerdlap, Low, & Ramakrishna, 2019; Liu & Jensen, 2018). Cities like Rotterdam have implemented comprehensive flood risk management plans with early warning systems and community preparedness programs, providing a benchmark for addressing urban flooding (Brown, 2016; Chan et al., 2022). By aligning with these successful international models, the recommendations suggest they could yield comparable benefits in Addis Ababa and Sheger.

4.5.1.4 Challenges of Pollution

Table 4.20:- Pollution data of Addis Ababa and Sheger Cities

Pollution Indicator	Addis Ababa	Sheger City	Remarks
PM2.5 (µg/m³)	52	44	WHO recommends ≤15 µg/m³ (annual avg); both cities exceed safe limits
PM10 (µg/m³)	88	73	High due to dust, traffic, and unpaved

			roads
NO_2 (Nitrogen Dioxide)	42 ppb	35 ppb	Emissions mainly from vehicles and diesel generators
CO (Carbon Monoxide)	1.8 ppm	1.2 ppm	Higher in Addis due to denser traffic and fuel combustion
SO_2 (Sulfur Dioxide)	14 ppb	10 ppb	Often linked to industrial activities and poor fuel quality
Noise Pollution (dB)	78 dB (peak hours)	72 dB (peak hours)	Higher in transport corridors and construction zones
Solid Waste Generation	~0.7 kg/person/day	~0.55 kg/person/day	Collection coverage is higher in Addis than in Sheger
Wastewater Treatment (%)	~40% treated	~20% treated	Limited infrastructure in Sheger affects water and soil pollution levels
Air Quality Index (AQI)	145 (Moderate to Unhealthy)	120 (Moderate)	Fluctuates seasonally, worse during dry season and peak traffic periods

Source: survey, 2024

The findings in Table 4.20 reveal substantial environmental disparities between Addis Ababa and Sheger. Addis Ababa exhibits higher PM2.5 and PM10 levels due to intense traffic, industrial activity, and outdated vehicles, while Sheger's air quality, though currently better, is vulnerable to degradation from expanding transport infrastructure. Noise pollution is significantly higher in Addis Ababa, driven by congestion and construction, but Sheger is also seeing rising noise levels due to suburban growth. Waste generation in Addis (~0.7 kg/person/day) surpasses Sheger (~0.55 kg/person/day), and stark differences in waste collection and treatment capacity create cross-boundary pollution risks, particularly in shared waterways and landfills. Wastewater treatment also reflects inequality, with Addis Ababa treating 40% of its wastewater compared to Sheger's 20%, raising health and ecological concerns (Karadimitriou et al., 2021).

These disparities complicate integrated infrastructure planning. Without coordinated environmental regulation, the expansion of roads, freight corridors, or housing developments in Sheger could degrade its air quality and increase downstream pollution affecting Addis Ababa. Similar patterns in Delhi NCR and Lusaka-Kafue highlight how uncoordinated development leads to regional environmental degradation and necessitates regional management frameworks. Independent waste and wastewater systems further fragment service provision and increase risks

to share ecological resources, underscoring the need for unified planning mechanisms (Aleisa, 2024; Kushwaha, 2024).

The lack of joint environmental governance unlike successful models in London, Curitiba, and Paris prevents Addis and Sheger from addressing trans boundary pollution effectively. These global cities demonstrate that regional coordination on air quality, noise, and waste leads to more sustainable infrastructure development(Gavanas, 2024; Godfrey & Zhao, 2016; Mercier et al., 2019). Without similar frameworks, Addis Ababa and Sheger infrastructure projects risk exacerbating environmental degradation, health issues, and public dissatisfaction. Therefore, the establishment of a metropolitan environmental authority, harmonized pollution standards, and integrated environmental infrastructure planning should be prioritized for sustainable and equitable development.

4.5.1.5 Urban economics

Table 4.21:- Population Size, Growth Rate, and Demographic Characteristics of the cities

Category	Addis Ababa	Sheger City	Remarks
Population Size (2024 est.)	5,704,000	~1,400,000 – 1,600,000	Sheger estimate based on surrounding towns
Annual Growth Rate (%)	3.8%	4.5%	Sheger growing faster due to urban spillover
Age Distribution			
- 0–14 years	32%	35%	High dependency ratio
- 15–64 years (Working Age)	63%	60%	Majority in productive age group
- 65+ years	5%	5%	Aging population still small

Gender Distribution			
- Male	49%	50%	Nearly equal gender balance
- Female	51%	50%	Slight female majority in Addis
Average Household Income	ETB 5,000–15,000/month (varies widely)	ETB 3,000–10,000/month	Lower income average in Sheger
Employment Rate	65% (formal + informal combined)	60% (largely informal)	Informal economy dominant in both
Youth Unemployment (15–29)	~27%	~32%	Higher unemployment in peri-urban areas

Source: survey, 2024

The findings in Table 4.21 show that rapid population growth in both Addis Ababa and Sheger is straining infrastructure systems, especially along administrative borders where planning is uncoordinated. A youthful demographic, spatial income disparities and uneven service distribution further compound infrastructure challenges. Separate city administrations with distinct policies and planning processes result in fragmented infrastructure development, duplications, and service gaps (Kitchin & Moore-Cherry, 2021; Stokan & Deslatte, 2019). The lack of a joint planning mechanism undermines efforts to address cross-boundary demographic pressures.

The demographic and administrative fragmentation between Addis Ababa and Sheger undermines the effectiveness of infrastructure planning and investment. Without coordinated responses, population-driven demands will continue to outpace existing infrastructure, exacerbating urban inequality, informal settlement expansion, and environmental stress (Bai et al., 2017; Kandpal, 2024). Demographic-sensitive planning considering youth needs, spatial equity, and cross-border population flows—is essential for inclusive and sustainable development in the corridor.

International examples such as Seoul, Johannesburg, Lagos, Medellín, and London demonstrate that metropolitan-scale governance, integrated data systems, and inclusive planning can effectively manage urban demographic pressures (Keiner, 2016; Waters, 2016). These cities aligned governance structures with population need to create equitable, responsive infrastructure systems. Addis-Sheger should adopt similar strategies by establishing a joint planning authority, harmonizing infrastructure investments, and integrating demographic data into urban planning processes. Without such reforms, siloed responses will persist, leading to inefficient infrastructure outcomes and deepening regional disparities.

4.5.1.6 Zoning regulations

Table4.22:- Land use zoning regulations between Addis Ababa and Sheger cities,

Land Use Type	Key Regulations	Zoning Designations	Primary Areas Affected	Regulation Goals	Current Implementation (2025)
Residential	Limited height for buildings in residential zones	R1 - Low Density Residential, R2 - Medium Density Residential	Central urban areas, suburban growth zones	Promote adequate housing, protect residential character	Strict enforcement in central areas, relaxed in suburbs
	Setbacks and open space requirements	R3 - High Density Residential	Inner city and high-density residential districts	Ensure adequate green spaces and air circulation	Ongoing development of high-rise residential areas
Commercial	Floor area ratio (FAR) limits	C1 - Local Commercial, C2 - General Commercial	Commercial hubs, major intersections	Support business activity while controlling congestion	Expanding commercial zones near transportation hubs
	Mixed-use development allowances	C3 - Commercial Mixed-Use	Central Business District (CBD), transit corridors	Encourage mixed-use developments to reduce commuting	Ongoing development in CBD and key corridors
Industrial	Buffer zone requirements for heavy industry	I1 - Light Industrial, I2 - Heavy Industrial	Industrial zones on the outskirts of cities	Minimize environmental impact, create industrial	Large industrial zones established in outer areas

				clusters	
	Restrictions on industrial activities near residential areas	I3 - Industrial Park	Eastern and southern industrial zones in Sheger	Facilitate economic growth while ensuring residential safety	Strict zoning regulations near residential areas
Public and Recreational	Green space and park requirements	P1 - Parks and Green Spaces	Public parks, recreational areas in urban and suburban locations	Promote quality of life, preserve green areas	Ongoing development of parks in both cities
Mixed-Use Development	Integration of commercial, residential, and recreational spaces	MU1 - Mixed Use Development	Key commercial corridors, urban fringe areas	Create vibrant, walkable neighborhoods	New mixed-use zones under development, especially in Sheger

Source: survey, 2024

The land use zoning regulations in Addis Ababa and Sheger cities exhibit differences in zoning categories, enforcement, and planning priorities, particularly between central and peripheral areas. Both cities share similar residential and commercial designations (R1-R3, C1-C3), but enforcement practices vary, hindering integrated infrastructure planning for cross-boundary projects like roads and transit corridors. Mixed-use development (MU1 zones) along transit corridors is promoted, but inconsistent implementation leads to disconnected developments that do not align with infrastructure capacities, such as sewerage and transit systems. Additionally, the rapid industrial zoning expansion in Sheger, particularly in outer zones, contrasts with Addis Ababa's slower industrial growth, causing mismatched infrastructure development.

The fragmentation of zoning regulations between the two cities results in inefficiencies and service gaps, particularly in areas such as transportation, utilities, and green spaces. Lack of coordination in infrastructure planning and zoning leads to duplicated facilities, uneven infrastructure servicing, and logistical challenges. The inconsistent implementation of green space policies further exacerbates this issue, as Addis and Sheger have different approaches to

park development and integration into urban environments. This lack of cohesion affects the overall urban resilience, limiting opportunities for sustainable and integrated urban development.

To address these challenges, a unified metropolitan planning framework is necessary, similar to the coordinated strategies implemented in cities like Barcelona and Curitiba (Follador, 2017; Medeiros & van der Zwet, 2020). The regulatory fragmentation between Addis Ababa and Sheger is comparable to the challenges once faced by the Greater Toronto Area (GTA), which overcame zoning discrepancies through the Places to Grow Act(Collens, 2016; Taye, 2015). Similarly, Addis Ababa and Sheger would benefit from a joint metropolitan planning authority or legal framework that harmonizes zoning designations, regulation enforcement, and infrastructure investments. Without such alignment, the cities will continue to experience fragmented infrastructure systems, urban sprawl, and inefficiencies in integrated urban planning.

4.5.1.7 Infrastructure Investments

Table 4.23: - The infrastructure investments, progress, and key projects in both cities.

Infrastructure Type	Key Projects	Investment Amount (USD Millions)	Progress (as of 2025)	Primary Beneficiaries	Projected Completion Year
Roads	Addis Ababa Bypass Road	120	80% completed	Commuters, commercial transport	2026
	Addis Ababa-Sheger City Link Road	75	60% completed	Residents and freight transport	2027
	Road Expansion in Suburban Areas (Sheger)	50	50% completed	Peri-urban and rural residents	2026
Rail	Addis Ababa Light Rail Expansion	200	90% completed	Urban commuters, businesses	2025
	Sheger City Rail Network (New Line)	100	30% completed	Residents of Sheger, workers commuting	2028
Walkways	Pedestrian Pathways in Addis Ababa CBD	20	40% completed	Pedestrians, urban residents	2026
	Walkway Development in Sheger (Urban Areas)	10	20% completed	Local residents, students	2027

Public Transport Terminals	New Bus Stations in Addis Ababa	35	70% completed	Public transit users, commuters	2026
	Integrated Transport Hub in Sheger	25	40% completed	Sheger commuters, tourists	2028

Source: survey, 2024

The road, rail, and walkway infrastructure investments between Addis Ababa and Sheger show significant disparities in progress and coordination. While key projects like the Addis Ababa Bypass Road and the Addis Ababa Light Rail Expansion are nearing completion, Sheger lags behind in both rail and walkway development. This lack of coordination creates logistical inefficiencies and weakens regional economic integration. Additionally, public transport terminals in both cities suffer from disconnected service coverage and varying development timelines. Financial disparities, with Addis receiving significantly higher investment, further contribute to fragmented infrastructure outcomes.

The lack of regional coordination in infrastructure planning hampers the efficiency of transportation networks, leaving gaps in connectivity, particularly for peri-urban populations (Ayeni et al., 2025; García Fernández & Peek, 2023; Sheng, 2018). The absence of a unified planning and financing approach results in underutilized assets, incomplete infrastructure, and unequal service coverage. Without coordinated investment strategies and timelines, Addis Ababa and Sheger risk exacerbating urban disparities, undermining the potential for transit-oriented development, and failing to maximize economic synergy.

International models, such as Nairobi's metropolitan road coordination and Copenhagen's integrated rail system, highlight the benefits of regional infrastructure governance, synchronized timelines, and shared financing mechanisms. Addis Ababa and Sheger would greatly benefit from a regional infrastructure coordination body to align planning efforts, harmonize development schedules, and pool resources. By adopting an integrated approach, similar to successful cities like Singapore, the two cities can ensure equitable and efficient infrastructure investment, reduce congestion, and create a more cohesive urban system that promotes sustainable development.

4.5.1.8 The social and economic impacts expected from improved integration

Table 4.24 below presents and summarizes the findings from the conducted interviews regarding the expected social and economic impacts from improved integration.

Table 2.24:- The social and economic impacts expected from improved integration

Social Impacts	Economic Impacts	Environmental Impacts
Improved integration often means better access to services like healthcare, education, and social services for all community members. Increased availability of public amenities such as parks, recreational facilities, and cultural centers can improve living standards.	Improved infrastructure and connectivity can attract both domestic and foreign investments, boosting economic activities. Better integration can create opportunities for businesses to expand and tap into new markets, leading to job creation and economic diversification.	Better transportation links can reduce traffic congestion, leading to lower vehicle emissions and improved air quality. Enhanced public transportation systems can decrease the reliance on private vehicles, further reducing emissions.
Better integration leads to stronger relationships and trust within communities, reducing social tensions. collaborative development projects can strengthen community bonds and encourage civic participation	Construction and infrastructure: development projects related to integration will create jobs in construction, engineering, and related fields. Improved connectivity can stimulate growth in the service sector, including retail, hospitality, and transportation**.**	Integrated waste management systems can be more efficient, reducing pollution and improving recycling rates. Coordinated efforts can lead to better pollution control measures and cleaner environments.
Better infrastructure and investment can enhance the quality and accessibility of educational institutions, providing more opportunities for children and young adults.	Better transportation links can reduce travel time for commuters and goods, increasing productivity.	Improved planning can include more parks and green spaces, enhancing biodiversity and providing recreational areas for residents.
Improved infrastructure can facilitate the expansion and accessibility of healthcare services, leading to better health outcomes for residents. better integration can improve	Enhanced infrastructure and connectivity can increase the demand for residential and commercial properties, driving up property values. Integrated development can revitalize underutilized areas,	Coordinated water management strategies can ensure sustainable water use and better management of water resources. Energy efficiency: integration can lead to the implementation of energy-efficient systems and renewable energy

the efficiency of emergency services, ensuring quicker response times and better healthcare delivery	attracting investments and increasing property values.	projects.
integrating development plans can address disparities in infrastructure and services between different areas, promoting more equitable growth.	Improved infrastructure and amenities can attract more tourists, boosting the local economy through increased spending on accommodation, food, and entertainment.	

Source: Interview survey, 2023; n =50

The results of the findings outlined in Table 4.24 demonstrate the multidimensional benefits of improved integration. This underscored the interconnection between urban planning, economic development, and environmental sustainability. Improved access to services such as healthcare, education, and social amenities is vital for reducing inequalities and enhancing quality of life. From an economic perspective, better infrastructure and connectivity stimulate investment, create jobs, and increase productivity, driving sustainable growth (Diene, 2024; Mahmood et al., 2024; SB, Akbar, & Akmadani, 2024). Environmental impacts, such as reduced emissions and enhanced biodiversity, align with global sustainability goals, emphasizing the importance of eco-friendly practices in urban development (Grace, Iqbal, & Rabbi, 2023; Zhichao & Yashu, 2024). These results highlight the potential for integrated planning to create thriving, equitable, and sustainable urban environments.

The results are consistent with the study's goals of examining the broader implications of improved integration between the cities. The identified social impacts, such as improved access to healthcare and education, align with the study's objectives that better integration facilitates equitable service delivery. Similarly, economic impacts, including job creation and investment attraction, support the premise that enhanced infrastructure drives economic growth. The results are internally coherent, linking infrastructure development to specific outcomes in each domain. For instance, the study's context directly links enhanced transportation systems to reduced environmental emissions and increased economic productivity. The impacts align with global trends observed in integrated urban development. For instance, cities like Singapore and Amsterdam, known for their integrated

infrastructure, have demonstrated improved social equity, economic growth, and environmental sustainability (Lee et al., 2023; Veloso, Fonseca, & Ramos, 2024). The economic benefits, such as increased investment and job creation, mirror outcomes in countries that prioritize connectivity, such as South Korea's development of integrated smart cities (Arend, 2023). Environmental benefits, including reduced emissions and better waste management, are consistent with findings from European Union cities where integrated planning has significantly reduced urban carbon footprints (Harris et al., 2020; Taelman et al., 2018). These parallels affirm the external validity of the results and their applicability to other urban contexts worldwide.

4.5.2 Best strategies to integrate the physical infrastructure between the cities

4.5.2.1 Funding and implementing infrastructure projects

In response to the inquiry about strategies being considered for funding and executing infrastructure projects, Table 4.25 presents the interviewee's summary of the strategies they considered for funding and executing infrastructure projects between Addis Ababa and Sheger.

Table 4.25:- Strategies considered for funding and implementing infrastructure projects

Issues	Strategy	Implementation
public-private partnerships (PPPs)	Engage private sector partners to invest in and manage infrastructure projects. ppps can provide much-needed capital, expertise, and efficiency	developing clear legal and regulatory frameworks to support ppps, identify suitable projects, and create attractive investment conditions
multilateral and bilateral loans and grants	secure funding from international financial institutions such as the world bank, African development bank, and bilateral donors	preparing comprehensive project proposals, demonstrate the project's socio-economic benefits, and ensure compliance with donor requirements
government bonds and domestic financing	Issue government bonds to raise funds from domestic and international investors. utilize domestic financial institutions for project financing	strengthen financial markets, maintain sound fiscal policies, and offer attractive bond terms to investors
infrastructure funds and investment vehicles	establish dedicated infrastructure funds to pool resources from various investors, including sovereign wealth funds, pension funds, and insurance companies	create transparent and professionally managed funds, ensure robust governance structures, and offer competitive returns on investment

tax increment financing (TIF)	Use the anticipated increase in tax revenues from improved infrastructure to finance the project.	designate TIF districts, project future tax revenue increases, and issue bonds based on these projections to fund the infrastructure development
capacity building and institutional strengthening	enhance the capacity of government agencies and local institutions to plan, finance, and implement infrastructure projects effectively	provide training and technical assistance, strengthen procurement and project management processes, and promote good governance practices

Source: Interview survey, 2023; n =50

The strategies outlined in Table 4.25 offer a comprehensive framework for addressing funding and implementation challenges in infrastructure projects. These strategies align with principles of sustainable finance and governance, emphasizing the need to diversify funding sources and enhance institutional capacity. PPPs as a key strategy highlight their potential to bridge funding gaps and improve project efficiency. This is significant given global trends where PPPs have proven effective in accelerating infrastructure development. Similarly, the focus on multilateral loans, government bonds, and innovative mechanisms like Tax Increment Financing (TIF) demonstrates a nuanced understanding of leveraging both domestic and international financial resources. Institutional strengthening underscores the critical role of governance in ensuring that infrastructure projects are well-planned, transparently executed, and sustainably managed. These strategies collectively provide a roadmap for integrating financial innovation with sound management practices.

The strategies are consistent with the study's goals of addressing financial and institutional barriers to infrastructure development. For instance, the emphasis on PPPs and infrastructure funds directly addresses the issue of limited government budgets, aligning with the identified challenge of funding constraints (Bolomope et al., 2021; Cui et al., 2018; Trebilcock & Rosenstock, 2015). Similarly, the study's objectives, which emphasize the importance of effective governance for successful infrastructure integration, align with capacity-building measures. These strategies, which pair each issue with a clear and actionable implementation plan, strengthen the study's validity and reinforce its practical relevance. The proposed strategies align with the best practices observed in infrastructure projects globally. For example, countries like India and Brazil have widely adopted PPPs to develop transportation and energy infrastructure (Nataraj, 2007, 2014). Similarly, multilateral loans from institutions like the World

Bank and African Development Bank have supported numerous large-scale projects in Africa, ensuring socio-economic benefits (Abor et al., 2024; Serem, 2016). Government bonds have been instrumental in financing infrastructure in developed economies like the United States and Japan, demonstrating their applicability across various contexts (Mostaan & Ashuri, 2017; Ray, 2015). Cities like Chicago have effectively utilized TIF to revitalize urban areas and finance infrastructure projects (Malhotra, Mishra, & Vyas, 2022; Merriman, 2018). These parallels indicate that the strategies are applicable across different regions, making them robust and transferable to similar contexts with infrastructure development needs.

The study contributes to integrating traditional and innovative financing methods for infrastructure, emphasizing private sector participation and TIF. It provides a model for policymakers to optimize resource allocation and foster collaboration, which enhances the efficiency and sustainability of infrastructure projects. This contribution is valuable for both theoretical advancement and practical application in the field of infrastructure finance. The proposed strategies for funding and implementing integrated infrastructure projects have limitations, including potential risks associated with PPPs, the need for robust fiscal management and accurate revenue projections in low-income settings, the need to evaluate the social impact of funding mechanisms, and a lack of focus on long-term monitoring and evaluation. These issues require further exploration and development of performance metrics to ensure alignment with intended goals and objectives.

4.5.3 Policy instruments to improve urban connectivity and sustainability

To improve urban connectivity and sustainability between Addis Ababa and Sheger cities, several policy instruments can be implemented. These should focus on both short-term solutions and long-term sustainable strategies. Below are some key policy instruments that should be addressed:

1. Unified metropolitan planning authority: Establishing a joint metropolitan planning authority for Addis Ababa and Sheger would ensure that urban planning, infrastructure development, and land-use policies are harmonized across the two cities. This body would coordinate urban

projects, ensure consistency in planning, and oversee the integration of transport, utilities, and environmental standards.

2. Integrated transport master plan: Developing a comprehensive, unified transport master plan that links roads, rail systems, public transportation, and non-motorized transport (walkways and cycling paths) across both cities would improve connectivity and reduce congestion. This plan should align infrastructure projects, such as the Addis Ababa Bypass and the Sheger City Rail Network planned for future, to ensure smooth mobility and connectivity.
3. Investment in sustainable public transport: To reduce traffic congestion and improve environmental sustainability, policies should prioritize investments in sustainable public transport systems, such as bus rapid transit (BRT) systems, electric buses, and light rail expansions. Developing integrated transport hubs and ensuring interoperability between different modes of transport will provide seamless connectivity.
4. Green infrastructure and urban resilience policies: Promote the development of green spaces and environmentally friendly infrastructure, such as integrated stormwater systems, green roofs, and urban parks. Policies should incentivize the inclusion of green infrastructure in new developments to reduce the urban heat island effect, manage flood risks, and improve biodiversity.
5. Cross-border zoning and land-use regulations: Establish a regional zoning framework that aligns land-use regulations between the two cities to prevent fragmented urban growth. Policies should encourage mixed-use developments along transit corridors and promote sustainable urbanization that reduces urban sprawl while improving access to essential services like healthcare, education, and recreational areas.
6. Public-Private Partnerships (PPPs): Foster collaborations between the public and private sectors to fund and implement infrastructure projects. This could include financing transportation networks, renewable energy initiatives, and affordable housing projects. These partnerships can bring in additional capital, expertise, and innovative solutions to urban challenges.
7. Sustainability-focused incentives and regulations: Implement incentives for developers and businesses that adopt eco-friendly technologies, such as energy-efficient buildings, renewable energy systems, and waste-recycling initiatives. Regulations that set standards for

energy consumption, waste management, and carbon emissions will promote sustainability in urban development.

8. Integrated data and monitoring systems: Develop centralized data systems that allow both cities to monitor and manage urban services in real-time. These systems would track transportation patterns, air quality, water use, waste management, and energy consumption, allowing for informed decision-making and responsive urban management.
9. Community engagement and social inclusion policies: Ensure that urban development projects are inclusive and benefit all communities, especially marginalized groups. Policies should include community engagement strategies to ensure that citizens' needs are reflected in infrastructure plans. Efforts should also focus on improving access to affordable housing, healthcare, and education, particularly in peri-urban areas.
10. Climate change adaptation and mitigation strategies: Develop and implement policies that align urban development with climate change adaptation and mitigation strategies. These could include promoting green building standards, renewable energy use, and energy-efficient infrastructure, while also ensuring that the cities are resilient to climate impacts such as flooding and heat waves.

CHAPTER V: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

5.1.1 The Practices of an Integrated Infrastructure Planning

The study concludes that the practice of integrated infrastructure planning between Addis Ababa and Sheger cities is currently limited and remains predominantly fragmented across sectors and administrative jurisdictions. Although the two cities are increasingly interconnected through urban expansion, population growth, transportation flows, wastewater generation, drainage systems, and solid waste management, infrastructure planning have not developed a sufficiently integrated framework to respond to these interdependencies.

In the sewerage sector, the study concludes that existing infrastructure and planning arrangements are inadequate to provide integrated wastewater management across the two cities.

The continued reliance on decentralized sanitation systems and the limited coverage of integrated sewerage networks demonstrate the need for coordinated planning of wastewater collection, treatment, and disposal. The study therefore establishes that sewerage infrastructure planning needs to be aligned with urban expansion and coordinated across administrative boundaries.

For drainage infrastructure, the study concludes that planning remain fragmented, with no sufficiently coordinated approach to stormwater management between Addis Ababa and Sheger. Since drainage systems are influenced by wider catchment areas and urban land-use changes, planning within individual administrative boundaries cannot adequately address intercity drainage and flooding problems.

Regarding solid waste management, the study concludes that the two cities lack a sufficiently integrated approach to waste management planning. The absence of a unified solid waste management framework and inadequate disposal infrastructure constrain the ability of the cities to respond collectively to increasing waste generation. Integrated planning is therefore required for waste collection, transportation, disposal, treatment, and environmental management.

In transportation, the study concludes that Addis Ababa and Sheger are increasingly functionally connected, but their transportation systems remain insufficiently integrated. Differences in infrastructure development, inadequate supporting facilities, congestion, and limited coordination of intercity transportation constrain effective mobility between the two cities.

Overall, the study concludes that existing practices demonstrate some forms of interaction and cooperation, but these have not yet developed into a comprehensive system of integrated infrastructure planning. The major requirement is therefore to move from individual sectoral and administrative planning toward coordinated infrastructure planning that recognizes the cities as a functionally interconnected urban region.

5.1.2 The Challenges of Integrated Urban Infrastructure Planning

The study concludes that integrated infrastructure planning between Addis Ababa and Sheger is constrained by a combination of institutional, legal, financial, technical, and infrastructural

challenges. These challenges are interrelated and collectively affect the capacity of the two cities to plan and implement infrastructure in a coordinated manner.

The absence or inadequacy of appropriate legal and institutional frameworks is one of the principal challenges. Existing institutional arrangements do not provide sufficiently clear mechanisms for joint planning, decision-making, implementation, and monitoring of infrastructure that serves both cities. Boundary-related issues and differences in administrative responsibilities further complicate coordination.

Financial and resource constraints also constitute important barriers. Limited financial resources, inadequate infrastructure investment, and shortages of technical and human capacity affect the ability of the cities to expand and upgrade infrastructure in accordance with rapidly increasing demand. These constraints are particularly significant in sewerage, drainage, solid waste management, and transportation.

The study further concludes that sectoral fragmentation contributes to inefficient infrastructure planning. Infrastructure sectors are often planned separately despite their physical and functional interdependencies. Such fragmentation can result in limited information sharing, inefficient resource allocation, duplication of efforts, and infrastructure decisions that do not adequately consider their impacts on other sectors or neighboring jurisdictions.

Rapid urbanization, continued population growth and physical expansion represent an additional challenge that increase demand for transportation, wastewater management, drainage, and solid waste services. The study therefore concludes that infrastructure planning needs to be anticipatory and based on current as well as projected urban development rather than responding only to existing infrastructure deficiencies.

5.1.3 Urban Governance for Sustainable Infrastructure

The study concludes that effective urban governance is fundamental to achieving integrated infrastructure planning between Addis Ababa and Sheger. The current institutional arrangements provide insufficient mechanisms for managing infrastructure systems whose spatial and functional impacts extend across administrative boundaries.

The study identified limited formal coordination mechanisms among relevant institutions as a major governance concern. The absence of a clearly established institutional arrangement for coordinating common infrastructure reduces the effectiveness of joint planning and creates uncertainty concerning institutional responsibilities and accountability.

The findings also indicate that financial integration remains highly dependent on public-sector resources. While government financing remains essential for infrastructure development, the study concludes that reliance on public financing alone may not be sufficient to meet the growing infrastructure requirements of the two cities. More diversified financing mechanisms are therefore required.

The study further concludes that effective metropolitan governance requires clear responsibilities, appropriate legal frameworks, institutional accountability, stakeholder participation, and mechanisms for resolving intercity issues such as infrastructure financing, land, municipal boundaries, compensation, and service provision.

Accordingly, integrated infrastructure planning between Addis Ababa and Sheger requires governance arrangements that extend beyond individual city administrations and provide an appropriate platform for intercity coordination. Such governance should support joint priority setting, infrastructure investment decisions, implementation, monitoring, and evaluation.

5.1.4 Strategic Tools for a Sustained Urban Infrastructure Integration System

The study concludes that achieving sustained infrastructure integration requires the adoption of appropriate strategic, institutional, financial, technical, and planning tools. Integrated infrastructure planning should be supported by long-term strategies that connect infrastructure investment with population growth, land-use development, environmental sustainability, and future service requirements.

From a financial perspective, diversified financing mechanisms, including public-private partnerships and other innovative infrastructure financing approaches, can complement

government resources. However, such mechanisms require transparent financial management, appropriate regulation, accountability, and effective institutional capacity.

From a technical perspective, the study concludes that the use of GIS**,** spatial analysis, infrastructure mapping, demand forecasting, and integrated infrastructure databases can strengthen evidence-based planning. These tools can assist decision-makers in identifying infrastructure gaps, understanding spatial relationships, forecasting future demand, and prioritizing investment across Addis Ababa and Sheger.

Environmental and social considerations should also be incorporated into infrastructure planning. Infrastructure development should contribute to environmental protection, public health, accessibility, social equity, and resilience to future risks. Consequently, environmental and social assessment should form an integral part of infrastructure planning and project implementation.

The study further concludes that stakeholder participation and institutional capacity development are necessary for sustaining infrastructure integration. Government institutions, private-sector actors, communities, and other relevant stakeholders need appropriate opportunities to participate in planning and decision-making. Strengthening technical and institutional capacity will also improve the ability of responsible institutions to implement and manage integrated infrastructure systems.

In general, based on the findings across the four thematic areas, the study concludes that integrated infrastructure planning between Addis Ababa and Sheger cities remains inadequate relative to the degree of spatial and functional interdependence between them. The major problem is not only the physical shortage of infrastructure but also the absence of sufficiently coordinated institutional, legal, financial, and planning arrangements for managing infrastructure as an interconnected urban system.

The study therefore concludes that the sustainable development of the Addis Ababa–Sheger urban region requires a transition from fragmented sectoral and jurisdictional planning toward coordinated, integrated, and future-oriented infrastructure planning. Such an approach should combine joint institutional coordination, appropriate legal frameworks, diversified financing, technical planning tools, stakeholder participation, and long-term infrastructure strategies.

5. 2 Recommendations

Based on the findings of the study and the identified research gaps concerning integrated infrastructure planning between Addis Ababa and Sheger City, the following recommendations are proposed. The recommendations are intended to provide practical directions for improving institutional coordination, infrastructure planning, financing, spatial integration, stakeholder participation, environmental sustainability, and monitoring of infrastructure development across the two cities.

5.2.1 Establish a Formal Intercity Integrated Infrastructure Planning and Coordination Mechanism

The existing administrative separation makes it difficult to plan and manage infrastructure systems that extend beyond individual municipal boundaries. Therefore, the responsible regional and city-level authorities should establish a permanent coordination platform or joint planning mechanism involving the relevant infrastructure institutions of both cities.

The mechanism should have clearly defined responsibilities for joint planning, information sharing, infrastructure prioritization, project coordination, implementation monitoring, and resolution of intercity infrastructure issues. It should particularly focus on infrastructure systems that are spatially and functionally interconnected, including transportation, sewerage, drainage, and solid waste management.

5.2.2 Develop a Joint Integrated Infrastructure Development Plan

Addis Ababa and Sheger City should prepare a joint integrated infrastructure development plan that recognizes the two cities as a functionally interconnected urban area. The plan should move beyond individual sectoral plans and establish common priorities for infrastructure development.

The joint plan should include existing infrastructure conditions, projected infrastructure demand, spatial development patterns, infrastructure gaps, priority investment areas, implementation responsibilities, financing requirements, and mechanisms for intercity coordination. It should

also establish short-, medium-, and long-term infrastructure development priorities based on projected population growth and urban expansion.

Particular attention should be given to infrastructure systems whose impacts extend across administrative boundaries. Joint planning should therefore be undertaken for transportation corridors, sewerage systems, drainage catchments, solid waste disposal facilities, and other infrastructure with intercity implications.

5.2.3 Strengthen Policy and Legal Frameworks for Intercity Collaboration

The responsible government authorities should develop and strengthen clear legal and policy provisions governing intercity infrastructure collaboration. The absence of clearly defined institutional responsibilities and coordination mechanisms can create uncertainty concerning planning authority, financing, implementation, maintenance, and accountability.

The legal framework should clearly define the responsibilities of the cities administrations and relevant sector institutions in the planning of shared infrastructure. It should also provide mechanisms for addressing issues related to municipal boundaries, land, compensation, cost sharing, infrastructure maintenance, and dispute resolution.

5.2.4 Improve Sectoral Integration of Infrastructure Planning

The study recommends strengthening coordination among the institutions responsible for transportation, sewerage, drainage, and solid waste management. These sectors should not be planned independently because they are physically and functionally interconnected. A cross-sectoral planning process should therefore be established in which relevant institutions jointly review major infrastructure proposals before implementation.

5.2.5 Establish Integrated Sewerage Planning

Addis Ababa and Sheger should develop a coordinated sewerage and wastewater management strategy that responds to current and projected urban growth. Sewerage planning should consider the spatial distribution of population, existing sewer networks, wastewater generation, treatment capacity, and future urban expansion.

Where infrastructure systems or wastewater flows cross administrative boundaries, the two cities should jointly determine appropriate locations, capacities, and responsibilities for sewerage infrastructure and treatment facilities. Expansion of sewerage systems should be linked with land-use planning so that new urban development does not occur without adequate sanitation infrastructure.

5.2.6 Develop a Joint Stormwater and Drainage planning Framework

The two cities should prepare a coordinated stormwater and drainage master plan based on drainage catchments rather than administrative boundaries alone. Since stormwater flows can move across municipal boundaries, drainage planning should consider the wider hydrological system.

The joint framework should identify flood-prone areas, existing drainage deficiencies, major drainage corridors, required infrastructure improvements, and appropriate maintenance responsibilities. Future road and urban development projects should incorporate drainage infrastructure from the initial planning stage rather than treating drainage as a secondary component of infrastructure development.

5.2.7 Establish an Integrated Solid Waste Management Strategy

The responsible authorities should prepare and implement a joint solid waste management strategy for Addis Ababa and Sheger City. The strategy should address waste generation, collection, transportation, transfer stations, treatment, recycling, and final disposal as components of one integrated system.

Particular attention should be given to the development and appropriate management of adequate solid waste disposal facilities. The two cities should assess the future demand for disposal and treatment facilities and jointly determine suitable locations and financing arrangements. Opportunities for waste reduction, recycling, resource recovery, and private-sector participation should also be incorporated into the strategy.

5.2.8 Strengthen Intercity Transportation Integration

Transportation planning should be undertaken at the scale of the functional urban region, rather than being limited to individual city boundaries. Addis Ababa and Sheger should coordinate the development of major intercity roads, public transport routes, bus terminals, parking facilities, and other supporting infrastructure.

An integrated public transportation system should be promoted to improve accessibility and reduce congestion and unnecessary duplication of services. Transport demand generated by current and future urban expansion should be incorporated into infrastructure investment decisions. The authorities should also establish mechanisms for coordinating road maintenance and transportation services along major intercity corridors.

5.2.9 Diversify Infrastructure Financing Mechanisms

The study recommends reducing excessive dependence on government financing by developing diversified and sustainable infrastructure financing mechanisms. In addition to public budgets, the two cities should explore appropriate forms of public-private partnership, infrastructure funds, development financing, and other innovative financing mechanisms.

For jointly implemented projects, clear arrangements should be established regarding cost sharing, revenue generation, operation, maintenance, and financial accountability. Financial mechanisms should be transparent and based on clearly defined responsibilities and agreed investment priorities.

5.2.10 Strengthen Stakeholder and Community Participation

The identified research gap concerning community involvement indicates the need for greater participation of communities, civil society organizations, private-sector actors, professional institutions, and other stakeholders in infrastructure planning.

Participation should occur not only during project implementation but also during needs identification, priority setting, planning, monitoring, and evaluation. Public consultation mechanisms should be institutionalized so that local knowledge and community concerns can

inform infrastructure decisions. This would improve the social acceptability, transparency, and sustainability of infrastructure projects.

5.2.11 Integrate Environmental Sustainability and Climate Resilience

Environmental and sustainability considerations should be incorporated into all stages of integrated infrastructure planning. Infrastructure projects should be assessed in terms of their potential environmental and social impacts and their ability to respond to future risks.

Particular attention should be given to wastewater pollution, solid waste disposal, flooding, land degradation, and the environmental impacts of urban expansion. Drainage and stormwater planning should incorporate climate and flood resilience, while sewerage and solid waste systems should prioritize protection of water resources and public health.

5.2.12 Strengthen Geographic and Spatial Planning

The study recommends greater use of geographic and spatial analysis to support integrated infrastructure planning. GIS-based infrastructure inventories should be developed for Addis Ababa and Sheger to identify the location, capacity, condition, and service coverage of major infrastructure systems.

A shared spatial database would allow the responsible institutions to identify infrastructure gaps and overlaps, analyze spatial relationships, forecast future requirements, and prioritize investment. Infrastructure planning should also be linked with land-use planning and urban expansion patterns to ensure that infrastructure development guides and supports sustainable spatial growth.

5.2.13 Establish an Integrated Infrastructure Information and Data-Sharing System

The two cities should establish a common infrastructure information and data-sharing platform. Relevant institutions should regularly exchange updated information on infrastructure networks, projects, investment plans, service coverage, demand, and infrastructure conditions.

The platform should establish common data standards and procedures for updating and sharing information. Improved data availability would support evidence-based decision-making and reduce duplication in infrastructure planning.

5.2.14 Strengthen Institutional and Technical Capacity

Finally, the study recommends strengthening the institutional and technical capacity of organizations responsible for infrastructure planning. Training should focus on integrated planning, metropolitan governance, GIS and spatial analysis, infrastructure modeling, environmental assessment, financing mechanisms, and stakeholder engagement.

Capacity development should be supported by adequate staffing, technical resources, institutional coordination, and knowledge-sharing mechanisms. Building institutional capacity is essential because integrated infrastructure planning requires not only appropriate policies and plans but also the ability to implement and maintain them effectively.

Overall, the study recommends that Addis Ababa and Sheger City move from fragmented, sector-based, and administratively bounded infrastructure planning toward coordinated, spatially integrated, financially sustainable, and participatory infrastructure planning. The successful implementation of these recommendations would strengthen institutional cooperation, improve infrastructure service delivery, reduce duplication and inefficiencies, and provide a stronger foundation for sustainable development of the interconnected urban region.

5.3. Further Research

By addressing the following recommendations and future research, the integration of infrastructure between Addis Ababa and Sheger can be better managed to achieve sustainable development and enhance the overall quality of life for residents in both cities.

- Governance and Institutional Collaboration:

Focus on the impact of inter-municipal coordination, institutional collaboration models, administrative boundaries, and metropolitan governance structures on effective service delivery and urban management.

- Community and Stakeholder Engagement:

Explore strategies for community involvement, behavioral dynamics, public-private partnerships, and comparative studies across cities to enhance participatory planning and inclusive infrastructure development.

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Annexes

Annex 1 **Code: 1**

Survey questionnaires developed for data collection

This questionnaire is prepared by Geremew Worku a Ph.D. candidate in Urban and Regional Planning, Addis Ababa University, who is currently working on the dissertation titled "Practices and Challenges of Integrated Infrastructure Planning between Addis Ababa and Oromia Special Zone Surrounding Finfinnee. This questionnaire is prepared for data gathering purposes for Ph.D. study and thus I ask you kindly to help me in filling the questionnaires.

Dear respondent, this questionnaire is prepared to collect data for the above - stated Ph.D. study. Thus, I would like to thank you in advance for your willingness to fill this questionnaire paper; In filling out the questionnaire try to be very honest, free, and open; because your responses to each and every question will have a high contribution for the validity and reality of this study as a whole. Moreover, I would like to promise that the data will only be used for academic purposes and will not be passed to any third party. The name of respondents will not be disclosed or used in the process of documenting the study. It is only for the researcher's validity.

General questions about the profile of the Experts

Adress: - City/Town ----------S/City/Town ----------Kebele ----------

Name ---------- Age ---------- Gender ---------- Educational background ---------- Profession ---------- Organization ---------- Responsibility ----------

For Plan Institute Experts

Instruction:

In the attached questionnaire you are expected to **answer all the questions by: circling the appropriate choice**. Your **choice might be one, more than one and all.** And the other which **needs explanation; please write on the given space**. If there are questions which you are unwilling or unable to answer, skip them and continue with the remaining questions.

Part I

1. For how many long have you been working in this Organization? A) 0-5 years, b) 6-10 years c) 11-15 years d) 16 and above
2. How do your organizations work with Addis Ababa Planning and development commission? ----------
3. If not, why? a) lack of finance b) lack of capable professionals c) lack of legal frame work d) if others, specify ----------
4. Who is responsible for an integrated infrastructure planning? ----------
5. What the integration looks like? a) Strong b) weak
6. How do you collaborating with other stake holders to plan these infrastructures in the study areas? --------
7. What is the model/ structure of this integration? a) formal, b) informal,
8. If your answer is informal; Why do you lag still now, to make formal structure?----------
9. If yes, what are the benefits? ----------
10. Does the town have strong institutional integration with your similar sector of the town? a) Yes b) No,
11. If yes, what is that integration? ----------
12. Can you consider urban – urban or rural – urban linkage when you plan? a) Yes, b) No,

13. If yes, how? ----------
14. If no, why? ----------
15. What are future considerations do you have in your planning? ----------

Part IV

1. If yes, what are they? a) Council b) Mayors committee c) team of professionals d) ad hock committee e) Newly established institutions
2. Are there informal Metropolitan area's governance (formally or informally commonly established coordination mechanism (e.g., sharing of data, resource sharing? a) Yes b) No,
3. If yes, what are the incentives for this informal activity? a) providing logistics b) transportation c) salary d) if others, specify ----------
4. What are the Metropolitan area's governance (formally or informally commonly established) body responsibilities? a) managing the infrastructure b) coordinating project c) fund raising for projects d) maintain the infrastructure e) preparing integrated infrastructure plan.
5. If yes, what are these challenges? a) lack legitimacy/legal frame work b) administrative c) inadequate resources d) land disputes
6. What is the national government role to cooperate? a) supervising b) giving incentives c) formulating policy and strategies d) allocating budget e) giving technical support d) if others, specify ----------
7. How civil society and other stake holders are included in inter-jurisdictional coordination processes? a) participate in planning b) have a part in established committee c) involve advisory work d) fund raising e) consultation
8. What roles they can play in infrastructure design and delivery? a) involve in consultation b) participate in planning c) fund raising d) if others, specify ----------

9. What roles do the private sectors play in infrastructure design and delivery? a) develop and maintain infrastructure and services b) promote and expand existing businesses c) address inefficiencies in the local economy d) promote human capital development e) encourage community development f) attract investment
10. What are the sources of financing for integration? a) Domestic investors b) Public utilities c) Dedicated Government Funds d) term loans e) Banks and financial institutions f) Foreign investors
11. Do the towns have integrated infrastructure planning process with other sectors, towns? a) Yes b) No,
12. If no, why? a) lack of attention b) no legal frame work c) no policy support d) hesitation of each other
13. What the integration looks like? a) Strong b) weak
14. What is the model/ structure of this integration? a) formal, b) informal,
15. What are the challenges of urban governance? a) conflict b) Migration c) fail to provide adequate access to services d) in equalities
16. What are the problems for border integration? a) expansion b) dispute c) illegality
17. What is the initial for this? a) boundary b) spatial conflict c) illegal settlement d) if others specify --------
18. How the two Regions are going to financing, operating and maintaining the infrastructure? a) by Ad hoc Committee b) by establishing formal Institution
19. Is there a metropolitan governance practice in the study area? a) Yes, b) No,

20. What are the most important functions of metropolitan regions? a) Decision-making and control function b) Innovation and competition function c) Gateway function d) if others specify ----------

Code: 2

For Water and Sanitation Authority Experts

Instruction:

In the attached questionnaire you are expected to **answer all the questions by: circling the appropriate choice**. Your **choice might be one, more than one and all.** And the other which **needs explanation; please write on the given space**. If there are questions which you are unwilling or unable to answer, skip them and continue with the remaining questions.

Part I

1. For how many long have you been working in this Organization? A) 0-5 years, b) 6-10 years c) 11-15 years d) 16 and above
2. Do you have a plan for liquid waste dumping site with the surrounding towns? a) Yes b) No,
3. If not, why? a) lack of agreement b) boundary dispute c) lack of composition mechanism d) lack of legal frame work
4. Who should take the responsibility to coordinate? a) Mayors committee b) new established institute c) not assigned

Part II

1. How many wastes water treatment plant you have in the city? ----------
2. Where you found them? ----------
3. If it is found in the surrounding towns, how do you cooperate with them? a) compensate each other b) using commonly c) giving incentives d) un known
4. Is the institutional mandate support you to work with others? a) Yes, b) No,

5. If no, what is a problem? a) lack of legal frame work b) lack of city region experience c) I do not know d) if others specify ----------

Part III

1. What are the challenges to avoid liquid waste problems in the city? a) lack of financial resources b) lack of skilled human power c) geographical land scape d) lack of coordination among stake holders
2. What are the major technical, institutional, and financial challenges that are facing to sewerage? a) lack of cooperation b) geographical land scape c) lack of resources d) lack of technology e) lack of clear policy direction
6. How the growth of urbanization affects the sewerage system? a) increase demand b) increasing volume of waste c) need adequate finance d) acquire new technology and innovation
7. Are there legislations, regulations and strategies that enable and facilitate the achievement of integration? a) Yes, b) No
3. How do you compensate them, a) in kind, b) in money?
4. What are the major problems concerning sewerage? ----------
5. And what are their known and possible causes? ----------

Part IV

1. Are there current formal areas of Metropolitan area's governance (formally or informally commonly established coordination? a) Yes b) No,

2. If yes, what are they? a) Council b) Mayors committee c) team of professionals d) ad hock committee e) Newly established institutions
3. Are there informal Metropolitan area's governance (formally or informally commonly established coordination mechanism (e.g., sharing of data, resource sharing? a) Yes b) No,
4. If yes, what are the incentives for this informal activity? a) providing logistics b) transportation c) salary d) if others, specify ----------
5. What are the Metropolitan area's governance (formally or informally commonly established) body responsibilities? a) managing the infrastructure b) coordinating project c) fund raising for projects d) maintain the infrastructure e) preparing integrated infrastructure plan.
6. Are there challenges that Metropolitan area's governance encounter? a) Yes b) No
7. If your yes, what are these challenges? a) lack legitimacy/legal frame work b) administrative c) inadequate resources d) land disputes
8. What is the national government role to cooperate? a) supervising b) giving incentives c) formulating policy and strategies d) allocating budget e) giving technical support d) if others, specify ----------
9. How civil society and other stake holders are included in inter-jurisdictional coordination processes? a) participate in planning b) have a part in established committee c) involve advisory work d) fund raising e) consultation
10. What roles they can play in infrastructure design and delivery? a) involve in consultation b) participate in planning c) fund raising d) if others, specify ----------
11. What roles do the private sectors play in infrastructure design and delivery? a) develop and maintain infrastructure and services b) promote and expand existing businesses c) address

inefficiencies in the local economy d) promote human capital development e) encourage community development f) attract investment

12. What are the sources of financing for integration? a) Domestic investors b) Public utilities c) Dedicated Government Funds d) term loans e) Banks and financial institutions f) Foreign investors
13. Does the town have integrated infrastructure planning process with other sectors, city? a) Yes b) No,
14. If no, why? a) lack of attention b) no legal frame work c)no policy support d) hesitation of each other
15. What the integration looks like? a) Strong b) weak
16. What is the model/ structure of this integration? a) formal, b) informal,
17. Do you believe the towm can benefit from the integrated infrastructure planning? a) Yes b) No,
18. What are the challenges of urban governance? a) *conflict* b) *Migration* c) fail to provide adequate access to services d) in equalities
19. Is there Institutional Collaboration between Addis Ababa and the town? a) Yes b) No,
20. Dose the infrastructures being enough to serve the people of the metropolitan regions? a) Yes b) No,
21. What are the problems for border integration? a) expansion b) dispute c) illegality
22. What is the initial for this? a) boundary b) spatial conflict c) illegal settlement d) if others specify --------
23. How the two Regions are going to financing, operating and maintaining the infrastructure? a) by Ad hoc Committee b) by establishing formal Institution

24. Do you think the integrated infrastructure planning have impacts on administrative boundary? a) Yes, b) No,

25. What are the most important functions of metropolitan regions? a)Decision-making and control function b)Innovation and competition function c)Gateway function d) if others specify ----------

Code: 3

For Municipality Experts

Instruction:

In the attached questionnaire you are expected to answer all the questions by: circling the appropriate choice. Your choice might be one, more than one and all. And the other which needs explanation; please write on the given space. If there are questions which you are unwilling or unable to answer, skip them and continue with the remaining questions.

Part I

1. For how many long have you been working in this Organization? A) 0-5 years, b) 6-10 years c) 11-15 years d) 16 and above

2. Is there a common solid waste dumping site? a) Yes b) No

3. if not, state the reasons a) lack of integrated planning b) lack of agreement c) lack of compensation mechanisms d) administrative issues

5. Do you need new disposal site? a) Yes, b) No,

6. If yes, how do you get it? a) by expropriation b) by compensation c) I do not know

7. How do you integrate it with the city of the study areas? a) prepared common disposal land b) by planning expansion areas c) compensation

8. Did you have long term plan in coordination with the city? a) Yes, b) No,

9. If yes, for how long? ----------

10. In your previous plans did you prepare spatial plans in coordination with the city? a) Yes b) No,

11. What is the impact of urban growth on the services? a) increased volume of waste b) need high investment cost c) need sophisticated technology d) need skilled human resource

12. How does the town cooperate with similar stakeholders in the city? a) by working together b) by sharing resources c) by planning together d) exchanging professionals e) by establishing common institute

13. Are the solid wastes dumping sites imposing negative impacts on the surrounding towns or downstream towns? a) Yes b) No.

14. If, yes state the impacts a) health problem b)affect the beauty of the city c) if others specify---
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15. How do you cooperate with other stake holders to keep the transfer site and damping site? a) by discussion b) compensation c) by incentives d)if others specify ----------
---

16. How many solid waste disposal sites are in the city? ----------

17. Where are you found them? ----------

18. If it is found in the city, how you cooperate with it? ----------

Part II

1. Are solid waste management areas being well planned? a) Yes b) No,

2. If not, why? a) lack of strategy b) lack of common agenda c) un known

3. What is the source of finance for the collection of solid waste in the study area? a) treasure budget b) loan c) municipal fund d) special saving

4. What are the challenges of integrated solid waste management planning in the study areas? a) inadequate funding of waste management agencies b) poor urban planning and low level of awareness among households on waste management c)lack of coordination d)lack of legal frame work e) if others specify ------

5. How many of the wastes are collected? ----------,

6. And how many of it is taken to the disposal areas? ----------

7. What hinders you to collect wastes in full capacity? a) lack of trucks b) lack of resources c) lack of access d) if others specify----------

8. How many disposal areas you have in the study areas? ----------

9. How many wastes are produced in kg per year in the study areas? ----------

10. How many of the wastes are collected? ----------,

11. And how many of them are taken to the disposal areas? ----------

Part III

1. What are the challenges of solid waste collection in the study areas? a) Resource b) lack of accessibility c) lack of awareness d) shortage of transfer site.

2. What is the challenge of the current solid waste disposal site? a) lack of accessibility b) inadequate space c) lack of compatibility d) if others specify ----------

3. What are the challenges of integrated solid waste management planning in the study areas? a) Inadequate funding of waste management agencies b) poor urban planning and low level of awareness among households on waste management c) lack of coordination d) lack of legal

4. What are the problems to prepare common land fill site for the study areas? a) Hesitate each other on administrative boundary b) lack of policy direction c) lack of agreement on compensation mechanism d) lack of accessibility,

5. What are the challenges of managing wastes in the study areas? a) inadequate finance b) lack of skilled human power c) lack of machinery d) population growth d) if others specify ----------

Code: 4

For Road Authority Experts

Instruction:

In the attached questionnaire you are expected to answer all the questions by: circling the appropriate choice. Your choice might be one, more than one and all. And the other which needs explanation; please write on the given space. If there are questions which you are unwilling or unable to answer, skip them and continue with the remaining questions.

Part I

1. For how many long have you been working in this Organization? A) 0-5 years, b) 6-10 years c) 11-15 years d) 16 and above
2. Is there a common urban storm water drainage master plan with the surrounding towns? a) Yes b) No,
3. Are there strategies to protect flood from downstream? a) Yes, b) No,

4. Does the town plan storm water drainage master plan through integration with the surrounding towns? a) Yes b) No,

5. Dose the town storm water management considers the downstream towns? Example, the negative impacts it could create on the surrounding towns? a) Yes, b) No,

6. If not, why? a) absence of responsible body b) lack of policy direction c) lack of finance d) lack of integrated plan

7. How does the town cooperate with the surrounding towns to plan integrated drainage management? a) by working together b) by sharing resources c) by planning together d) by exchanging professionals e) by establishing common institute

8. Does the town have a drainage plan, which is incorporated in master plan? a) Yes, b) No,

9. What is the existing condition of a road and urban storm water drainage network infrastructure? a) not integrated b) not well-planned c) deteriorated d) unfair distribution

10. What is the existing spatial integration in drainage infrastructure between the city and the surrounding towns? a) not integrated b)unfair distribution c) if others, specify ----------
---

11. What are the main responsibilities of your Authority in terms of drainage and storm water management? a) designing/ planning b) constructing c) maintaining d) operating

12. Does the town city consider the surrounding towns and suburbs when designing drainage system? a) Yes, b) No,

13. Are there any efforts made to introduce integrated approach for physical infrastructure development within the surrounding towns? a) Yes, b) No,

14. Does your institution have future objectives for institutional coordination? a) Yes, b) No,

15. Are there rules or regulations or any legal conditions which suggest institutional integration among stockholders? a) Yes, b) No,

16. What is the existing condition of a road and urban storm water drainage network infrastructure in the study areas? a) not integrated b)unfair distribution c) if others, specify -
---

17. What is the impact of urban growth on the services? a) increased volume of waste b) need high investment cost c) need sophisticated technology

Part II

1. Is there a common drainage route in the study areas? a) Yes b) No,

2. If yes, where they are found? ----------

3. Are there strategies that protect flood from downstream? a) Yes, b) No,

4. How many kilometers drainage lines are provided in the town along road sides? ----------

5. Dose it considers the problem it creates on the city? a) Yes, b) No,

1. How the town cooperates with the surrounding towns to plan integrated drainage management system? a) by working together b) by sharing resources c) by planning together d) by exchanging professionals e) by establishing common institute

6. Does the town city have a drainage plan, which is incorporated in master plan? a) Yes, b) No,

7. Dose all the roads linking the city to the town is provided with drainage? a) Yes, b) No,

Part III

1. How the existing drainage does is enough to serve the people of the study areas? a) sufficient b) fair c) not sufficient d) if others, specify ----------

2. What are the problems to provide the drainage line along a road side in collaboration? a) inadequate resource b) lack of skilled human power c) inadequate machinery d) if others, specify ----------

3. How the increasing number of populations to be challenge for integrated planning the system? a) demand more drainage lines b) demand more skilled human power c) demand more finance d) if others, specify ----------

Code: 5

For Transport office Experts

Instruction:

In the attached questionnaire you are expected to answer all the questions by: circling the appropriate choice. Your choice might be one, more than one and all. And the other which needs explanation; please write on the given space. If there are questions which you are unwilling or unable to answer, skip them and continue with the remaining questions.

Part I

1. For how many long have you been working in this Organization? A) 0-5 years, b) 6-10 years c) 11-15 years d) 16 and above

2. Are there any rules or regulations or legal conditions which suggest institutional integration among other stockholders? a) Yes, b) No,

3. Does the town has an integrated infrastructure planning process with other stakeholders and towns? a) Yes b) No,

4. If not, why? a) lack of attention b) no legal frame work c) no policy support d) hesitation of each other

5. Does the town have a common integrated project through integrated finance? a) Yes, b) No,

6. Where is the source of your finance? a) Treasure budget b) loan c) municipal fund d) special saving

7. Is there an institution that manages the integrated transport infrastructures in the study areas? a) Yes, b) No,

8. Is the geographical location of the towns hindering the linkage/ integration with Addis Ababa? a) Yes, b) No,

9. Is the institutional mandate support your organization to work with others? a) Yes, b) No,

10. How do you evaluate the trends of coordination among the infrastructure provider sectors? a) strong b) weak c) not known

11. Is there strong coordination with other similar institutions in the study areas? a) Yes b) No,

1. If not, why? a) lack of integrated planning b) lack of agreement c) Administrative issues

12. Does the town have integrated transport planning that links Addis Ababa and the surrounding towns? a) Yes, b) No,

13. Did you identify the proposed routes that link the town to the city? a) Yes, b) No,

14. How many bus stations are there in the city/towns? ----------

15. How many parking areas are there in the city? ----------,

16. How many of them are built up? ----------

17. How many of them are un built? ----------

18. How many of them are suitable for commuters in terms of location? ----------

19. Are there sufficient transport facilities such as public transportation, roads, parking and bus stations that integrate the city and the surrounding towns? a) Yes, b) No,

20. How do you evaluate the existing condition of infrastructure? a) good b) weak c) fair

21. What are possible factors influencing spatial integration? a) Cross border committing b) ethnic composition c) administrative systems d) political systems e) language barriers f) physical accessibility g) inter - organizational relationships h) economic disparities j) all. K) if others specify ----------

22. What is the impact of population growth on integrated infrastructure planning? a) Increase demand of infrastructure b) demand well managed infrastructure c) cooperate governance e) high finance, f) all

Part II

1. Do you reach your destination on time? a) Yes, b) No,
2. Do you get transportation easily? a) Yes, b) No,
3. Do you think there are problems in infrastructures planning and design in the study areas? a) Yes, b) No,
4. Does the town have integrated transport planning that links Addis Ababa and the surrounding towns? a) Yes, b) No,
5. Do you have a comprehensive integrated transport planning which is integrated land use? a) Yes, b) No,
6. Do you have integrated transport planning that links Addis Ababa with the surrounding towns? a) Yes, b) No,
7. Do you have a comprehensive integrated transport planning which is integrated with land use? a) Yes, b) No,
8. Does the town have a transport policy? a) Yes, b) No,
9. Does the city have common integrated transportation - related project financed through collaboration? a) Yes, b) No,
10. How the two Regions are going to finance, operate and maintaining transport infrastructure? a) by Ad hoc Committee b) by establishing a formal Institution

11. What do you think about the source of finance for implementing and maintaining integrated infrastructure? a) from both towns and city treasure b) from different aids c) from national government

12. Is there an institution to manage these infrastructures? a) Yes, b) No,

Part III

1. What are the challenges for the commuters coming from the surrounding towns? a) lack of accessibility b) traffic congestion c) inadequate transport facilities d) lack of integrated transport planning
2. Are there sufficient professionals to prepare integrated infrastructure plan? a) Yes, b) No,
3. How do you cooperate with the city professionals to prepare this plan? ----------
4. Do you think there are problems in infrastructures planning and design in in the study areas? a) Yes, b) No,
5. If the answer is yes; what are those problems? a) technology b) skill c) finance d) rules and regulations e) standards f) if others specify
6. Does the problem is a direct relationship to lack of integrated infrastructure planning and implementation? a) Yes, b) No,
7. What are the challenges of integrated infrastructure management in the study area? a) technology b) skill c)finance d)rules and regulations e)standards f) if others specify ---------
8. What are the challenges of integrated infrastructure planning? a) governance b) finance c) lack of strong institution d) lack of skilled human power e) lack of inventory f) if others specify ----------
9. What is the impact of population growth on integrated infrastructure planning? a) Increase demand for infrastructure b) demand well - managed infrastructure c) cooperate governance e) high finance, f) all
10. How do you evaluate the impacts of urbanization on integrated infrastructure planning? a) increased volume of transport b) need high investment cost c) need sophisticated technology
11. What are the main problems of integrated transport planning in the study areas? a) inadequate funding of transport management agencies b) poor urban planning and low level

of awareness among users c) lack of coordination d) lack of legal frame work e) if others specify

12. Are there sufficient professionals to prepare an integrated infrastructure plan? a) Yes, b) No,

13. How do you are cooperated with the towns' - professionals to prepare this plan? a) by working together b) by sharing resources c) by planning together d) by exchanging professionals e) by establishing a common institute

Part IV

1. Are there current formal areas of Metropolitan area's governance (formally or informally commonly established coordination? a) Yes b) No,
2. If yes, what are they? a) Council b) Mayors committee c) team of professionals d) ad hock committee e) Newly established institutions
3. Are there informal Metropolitan area's governance (formally or informally commonly established coordination mechanism (e.g., sharing of data, resource sharing? a) Yes b) No,
4. If yes, what are the incentives for this informal activity? a) providing logistics b) transportation c) salary d) if others, specify ----------
5. What are the Metropolitan area's governance (formally or informally commonly established) body responsibilities? a) managing the infrastructure b) coordinating project c) fund raising for projects d) maintain the infrastructure e) preparing integrated infrastructure plan.
6. Are there challenges that Metropolitan area's governance encounter? a) Yes b) No
7. If your yes, what are these challenges? a) lack legitimacy/legal frame work b) administrative c) inadequate resources d) land disputes
8. Is there legal frame work to coordinate with each other? a) Yes b) No
9. What is the national government role to cooperate? a) supervising b) giving incentives c) formulating policy and strategies d) allocating budget e) giving technical support d) if others, specify ----------
10. Does the service delivery is considered as part of this coordination in the study area? a) Yes b) No

11. How civil society and other stake holders are included in inter-jurisdictional coordination processes? a) participate in planning b) have a part in established committee c) involve advisory work d) fund raising e) consultation

12. What roles they can play in infrastructure design and delivery? a) involve in consultation b) participate in planning c) fund raising d) if others, specify ----------

13. What roles do the private sectors play in infrastructure design and delivery? a) develop and maintain infrastructure and services b) promote and expand existing businesses c) address inefficiencies in the local economy d) promote human capital development e) encourage community development f) attract investment

14. What are the sources of financing for integration? a) Domestic investors b) Public utilities c) Dedicated Government Funds d) term loans e) Banks and financial institutions f) Foreign investors

15. Does the town have integrated infrastructure planning process with other sectors, city? a) Yes b) No,

16. If no, why? a) lack of attention b) no legal frame work c)no policy support d) hesitation of each other

17. What the integration looks like? a) Strong b) weak

18. Is there any structure that facilitates the integration? a) Yes b) No,

19. What is the model/ structure of this integration? a) formal, b) informal,

20. Do you believe the towm can benefit from the integrated infrastructure planning? a) Yes b) No,

21. What are the challenges of urban governance? a) conflict b) Migration c) fail to provide adequate access to services d) in equalities

22. Is there Institutional Collaboration between Addis Ababa and the town? a) Yes b) No,

23. Is there any problem if Addis Ababa and the surrounding towns integrated in infrastructure planning and management? a) Yes b) No,

24. Dose the infrastructures being enough to serve the people of the metropolitan regions? a) Yes b) No,

25. What are the problems for border integration? a) expansion b) dispute c) illegality

26. Are there conflicts between the town and the city? a) Yes b) No,

27. What is the initial for this? a) Boundary b) spatial conflict c) illegal settlement d) if others specify ---

28. How the two Regions are going to financing, operating and maintaining the infrastructure? a) by Ad hoc Committee b) by establishing formal Institution

29. Do you think the integrated infrastructure planning have impacts on administrative boundary? a) Yes, b) No,

30. Is there a metropolitan governance practice in the study area? a) Yes, b) No,

31. What are the most important functions of metropolitan regions? a) Decision-making and control function b)Innovation and competition function c)Gateway function d) if others specify ----------

Annex 2 Published and submitted Articles

1. Published Arcticles

1.1 G. Worku, D. Adugna (2025). Two studied metropolitan cities in Ethiopia and their current integrated infrastructure plan to enhance resilience and sustainability, Environmental and Sustainability Indicators, https://doi.org/10.1016/j.indic.2025.100668

1.2 G. Worku, D. Adugna (2026). Urban governance for sustainable integrated infrastructure in the metropolitan areas of Addis Ababa and Sheger, Ethiopia, Cities & Health, DOI: 10.1080/23748834.2026.2692662

1.3 G. Worku, D. Adugna (2025). The Practices of an Integrated Infrastructure Planning in Ethiopian Metropolitan Cities, the Case of Addis Ababa and Sheger Cities, American Journal of Applied Scientific Research, https://doi.org/10.11648/j.ajasr.20251101.14,

1.4 G. Worku, D. Adugna (2025). The Challenges of Integrated Infrastructure Planning Between the Metropolitan Cities of Ethiopia, the Case of Addis Ababa and Sheger Sheger Cities, American Journal of Applied Scientific Research, https://doi.org/10.11648/j.ajasr.20251101.16

2. Accepted:

2.1 G. Worku, D. Adugna (2026). Integrated Infrastructure Planning for Drainage & Sewerage Management: A Comparative Study of Addis Ababa and Sheger

3. under revision: (returned to Journal after minor revision)-

3.1 G. Worku, D. Adugna (2026). Strategic tools for a sustained physical infrastructure integration system between Addis Ababa and Sheger metropolitan cities

4. G. Worku, D. Adugna (2026). **Other 4 Articles are under revision**

Environmental and Sustainability Indicators 26 (2025) 100668

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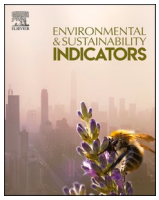

Two studied metropolitan cities in Ethiopia and their current integrated infrastructure plan to enhance resilience and sustainability☆

Geremew Worku *, Dagnachew Adugna

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Infrastructure planning

ABSTRACT

As urbanization accelerates globally, cities face increasing challenges related to infrastructure development, especially in metropolitan areas central to economic and social activities. The main objective of this study is to assess the effectiveness of the current integrated infrastructure planning in in Addis Ababa and three selected sub cities of Sheger (Burayu, Galan, and Furi), focusing on their potential to improve urban sustainability and resilience. The study employed a mixed-methods approach, utilizing both descriptive and explanatory research designs. We used a purposive sampling method to get a sample that represents the group well. This included 69 respondents, 15 key interviews, and 90 focus group discussions (FGDs). We processed, coded, classified, and input the data into Microsoft Excel for analysis. The study identifies significant gaps in current planning approaches, notably the tendency to treat urban systems in isolation. It underscores the critical roles of governance, stakeholder collaboration, and efficient resource allocation in overcoming these challenges. The research looks at Addis Ababa and Sheger to find ways to improve city infrastructure. It identifies strategies, challenges, and opportunities to make the cities stronger and more sustainable. Key findings indicate substantial gaps in governance, lack of institutional collaboration, critical gap in the regulatory frameworks, Proper drainage system, gap in waste management, inefficiencies in the transportation system, poor accessibility, absence of an integrated transport plan between the cities, and lack of existing institution managing the common transport infrastructure. These insights provide actionable recommendations for city administrations, policymakers and urban planners.

1. Introduction

As urbanization accelerates across the globe, cities face mounting challenges related to infrastructure development, particularly in metropolitan areas that are central to economic and social activities(Li et al., 2019; McGranahan, 2016). In Ethiopia, the growing population and rapid urban expansion have placed significant pressure on the infrastructure systems of major cities, leading to the need for integrated planning approaches that enhance resilience and sustainability(Abraha et al., 2022). Likewise, Addis Ababa and Sheger cities face unique challenges, including a lack of innovative solutions tailored to local contexts, limited financial resources, and insufficient coordination among stakeholders, despite the global progress in integrated infrastructure management. These challenges underscore the significance of examining the integrated infrastructure plans of major urban centers to identify pathways for development.

Despite the significant progress in infrastructure development in these cities, there are persistent gaps in the integration of various urban systems, which has led to inefficiencies in transportation, waste management, drainage, and utility services(Jacobsen et al., 2024; Yilma, 2014). Current issues such as traffic congestion, insufficient drainage networks, and inadequate waste management systems underscored the imperative necessity for a cohesive planning approach(Alemneh and Adugna, 2024). These deficiencies exacerbate vulnerabilities to climate

☆ With case studies from two significant Ethiopian cities, "Evidence from Two Studied Metropolitan Cities in Ethiopia" offers a targeted analysis of how integrated infrastructure management might enhance the resilience and environmental sustainability of urban areas. A coordinated strategy is necessary to improve resilience and sustainability, as evidenced by the research of integrated urban infrastructure management in two Ethiopian metropolitan centers. The study provides useful advice and insights that help guide the creation of strong and long-lasting urban infrastructure, which will benefit present and future generations, by utilizing empirical evidence.

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change, economic pressures, and growth in population and increasing pressures on energy infrastructure, water supply systems, and transportation networks. An integrated system takes into account the interconnectedness of various urban components, in contrast to conventional approaches that treat each sector in isolation to address these challenges. For instance, in order to guarantee accessibility and efficiency, transportation planning should be consistent with land use policies(Gil et al., 2011; Zito and Salvo, 2011). An integrated approach to urban development not only addresses immediate challenges but also promotes long-term sustainability and resilience, thereby ensuring that these cities are better prepared to meet the demands of a swiftly expanding population and changing climate conditions (Carter et al., 2015; Ramirez Lopez and Grijalba Castro, 2020; Sharifi and Yamagata, 2018).

Urban resilience and sustainability have become central themes in contemporary urban planning, particularly in rapidly urbanizing cities. The concept of urban resilience refers to a city's capacity to withstand and recover from environmental, social, and economic shocks while maintaining essential functions and structures ((Agboola and Tunay, 2023)). Sustainability, on the other hand, encompasses long-term strategies that balance economic growth, social equity, and environmental protection. In the context of Addis Ababa and Sheger, a comparative analysis of their resilience and sustainability efforts is crucial to understanding how governance, infrastructure, and community engagement shape urban development.

The increasing integration of Information and Communication Technology (ICT) in urban management has significantly influenced resilience strategies. According to Agboola and Tunay (2023), ICT plays a pivotal role in enhancing urban resilience by facilitating real-time data collection, improving disaster response mechanisms, and optimizing resource allocation. Smart city technologies, such as Geographic Information Systems (GIS) and sensor networks, enable authorities to monitor urban infrastructure effectively and predict potential disruptions. In the study area, using digital tools to monitor floods, manage traffic, and develop sustainable infrastructure can help them withstand climate issues and economic challenges.

(Agboola et al., 2023)emphasize the importance of human social capital in strengthening urban resilience, particularly in post-COVID-19 recovery efforts. Their research underscores that community networks, participatory governance, and inclusive policies contribute to a city's ability to recover from crises. In rapidly urbanizing cities like Addis Ababa and Sheger, fostering strong social capital through community-driven initiatives, collaborative urban planning, and public participation in decision-making processes can significantly improve resilience and sustainability. Strategies such as participatory disaster risk reduction and inclusive governance frameworks can bridge gaps in policy implementation and enhance community-driven resilience efforts.

A critical aspect of urban resilience and sustainability is the spatial organization of land use (Agboola et al., 2018). explore how GIS-based land use analysis provides insights into urban morphology, infrastructure distribution, and environmental vulnerabilities. Their study demonstrates how GIS mapping can help identify areas prone to flooding, inefficient land use patterns, and potential locations for sustainable infrastructure development. In Addis Ababa and Sheger, using GIS-based spatial analysis in urban planning can improve decision-making. This helps make sure new developments are environmentally sustainable and strong against challenges. Such an approach can support better zoning regulations, green infrastructure planning, and flood risk assessment. For Addis Ababa and Sheger, incorporating digital technologies, fostering community engagement, and utilizing GIS tools can strengthen their urban planning frameworks. Addressing the identified gaps in governance and infrastructure through these strategies can contribute to more resilient and sustainable urban environments.

The main objective of this study is to assess the effectiveness of the current integrated infrastructure planning in the study area, with an emphasis on their potential to improve urban sustainability and resilience by examining their policies, challenges, and practices. Based on this objective, the study seeks to answer key questions: (1) How do Addis Ababa and Sheger integrate infrastructure planning to address urban resilience and sustainability? (2) What are the major challenges and gaps in the current infrastructure strategies? Can we draw lessons to enhance future urban planning in Ethiopia and other developing regions?

This study contributes to the existing body of knowledge in urban sustainability and infrastructure planning by focusing on two key metropolitan cities in Ethiopia Addis Ababa and Sheger. While much of the literature on urban resilience and sustainability has focused on global cities in developed countries, this study offers a novel perspective by examining the specific context of rapidly urbanizing cities in a developing country. It fills a gap in understanding how integrated infrastructure planning can be effectively applied to enhance urban resilience and sustainability in such environments.

The study's unique contribution lies in its comparative analysis of an established city (Addis Ababa) and a newly developing metropolitan area (Sheger). By focusing on these two cities, the research highlights how integrated infrastructure planning can be adapted to different stages of urban development. The study also explores how local governance, policy implementation, and urban planning strategies are shaped by the distinct challenges these cities face. Furthermore, this study advances the existing literature by offering empirical insights into the challenges and successes of infrastructure integration in Ethiopian cities, providing actionable recommendations for policymakers and urban planners. By drawing lessons from the Ethiopian experience, this research can also inform urban development strategies in other similar developing regions, making it a valuable contribution to the global discussion on sustainable urbanization.

The scope of this study focuses on Addis Ababa and Sheger because they are important cities in Ethiopia working on plans to improve their infrastructure for better resilience and sustainability. Addis Ababa, the capital city and economic hub of the country, faces various urban challenges, including rapid population growth, traffic congestion, and increasing vulnerability to climate change. In contrast, Sheger, a newly emerging metropolitan area, is undergoing extensive infrastructural development aimed at improving urban resilience and sustainability. Despite differences in scale and development, both cities face common challenges in infrastructure planning, climate adaptation, and sustainable governance.

2. Materials and method

2.1. Study area

The study was conducted between the metropolitan cities, Addis Ababa and Sheger city. Addis Ababa, the capital city of Ethiopia, has experienced rapid urbanization and population growth in recent decades (Arsiso et al., 2018; Beshir and Song, 2021; Larsen et al., 2019). The city serves as the political, economic, and cultural center of the country, attracting migrants from rural areas and contributing significantly to Ethiopia's GDP (Dorosh and Thurlow, 2014). The urban development challenges in Addis Ababa include rapid population growth, inadequate infrastructure, informal settlements, and traffic congestion (Abagissa, 2019; Kitila et al., 2023).

The Sheger Metropolitan area is an emerging urban region that encircles Addis Ababa and its surrounding areas, experiencing substantial population inflow and urban expansion (Ages; Analytica, 2023). As part of Ethiopia's development plans, Sheger Metropolitan area aims to accommodate the growing population, attract investments, and improve infrastructure to support economic growth and urban livability (Asante, 2021).

Addis Ababa has been investing in infrastructure development projects, including transportation networks, water supply systems, waste

management facilities, and energy supply and its infrastructure (SEIFE, 2019; Yilema and Gianoli, 2018). These initiatives are crucial for addressing urban challenges, enhancing livability, and supporting economic activities in the city(Zhang et al., 2023).

The Sheger Metropolitan area faces challenges such as inadequate infrastructure to meet the demands of a growing population, urban sprawl, environmental degradation, and limited access to basic services in some areas (Debele and Negussie, 2023). Addressing these challenges requires integrated planning and sustainable development strategies.

Addis Ababa plays an essential role in Ethiopia's economy, hosting major industries, financial institutions, government offices, and international organizations (Kloosterboer, 2019). The city's economic activities contribute significantly to job creation, investment opportunities, and regional development. Fig. 1 show the study areas.

2.2. Research design and approaches

This study explores the current integrated infrastructure plan to enhance resilience and sustainability in Ethiopian metropolitan cities using descriptive and explanatory research designs. We employ a mixed-methods approach that integrates both quantitative and qualitative data. The study uses a convenient sampling strategy, focusing on urban officials, urban planners, and community representatives. We gathered data through interviews, focus group discussions, surveys, and field observations. We scrutinize qualitative narratives using thematic analysis and statistical techniques. The research adheres to ethical guidelines

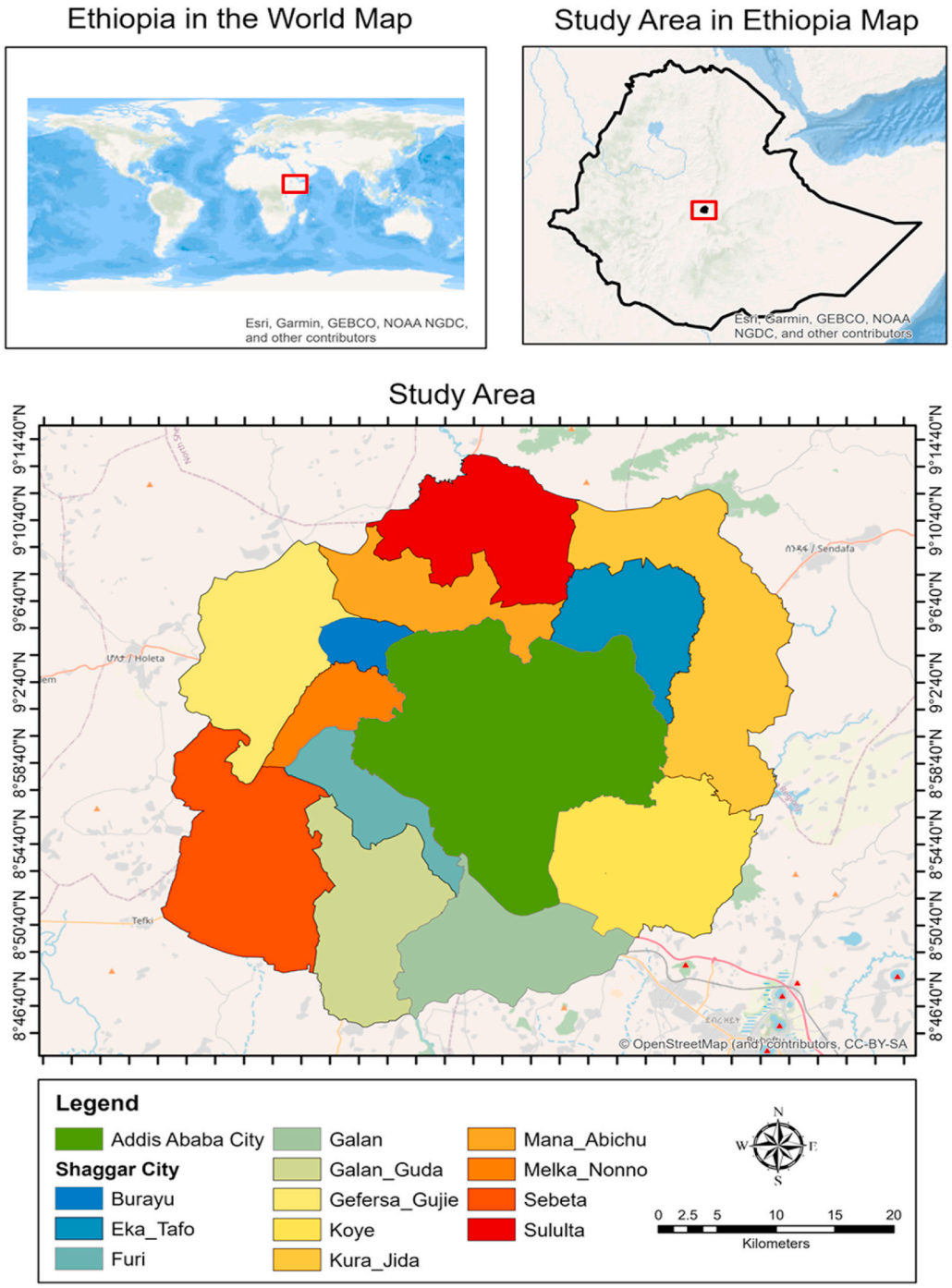

Fig. 1. Location map of the study area.

and cultural considerations.

2.3. Data types and sources

The data sources for this study consisted of both primary and secondary data, including quantitative and qualitative data from Addis Ababa and Sheger City (Burayu, Galan, and Furi). We collected the primary data using a diverse array of methodologies and instruments, such as questionnaires, focal group discussions (FGDs), and structured and semi-structured key informant interviews (KII) with community representatives, professionals, and city officials. Furthermore, we conducted field observations to enhance the integrity of the data and to obtain additional insights. We acquired secondary data from books, review articles, research findings, and both published and unpublished reports to supplement and assess the primary sources.

2.4. Sampling techniques and sample size determination

The human resource report from Addis Ababa, as well as the subcities of Burrayu, Galan, and Furi within Sheger City, indicates that there are 580 experts or professionals pertinent to the research topic. Fig. 2 demonstrates the selection of 69 experts across five urban infrastructure domains in Addis Ababa. We selected the experts using a convenience sampling method. The researchers concentrated their efforts on specialized specialists in transportation, roadway infrastructure, waste management systems, as well as drainage and sewage systems. We facilitated focus group discussions (FGDs) involving a total of 90 participants. We conducted interviews with fifteen participants in order to obtain a variety of perspectives for qualitative data. The study ensured fair representation from different groups and cities, increasing the trustworthiness of the findings while maintaining strict research standards. Table 1 display the number of Focus Group Discussions (FGDs) conducted in Addis Ababa and selected sub cities in Sheger City.

The number of respondents/participants from different sectors is shown on Fig. 2

2.5. Data collection methods

The research utilized a combination of quantitative and qualitative data collection methodologies, including closed-ended and open-ended questionnaires, to address various topics in infrastructure sectors. We gathered secondary data from various sources such as periodicals, books, journals, and reports. Subsequently, we devised a variety of inquiries for expert perspectives, focus group discussions, and key informant interviews, following a comprehensive examination of the study area and adherence to the objectives. The study involved 20 graduate students from various universities, who conducted data collection over a two-month period. We conducted the investigation in two phases. The initial stage consisted of the preliminary data collection and pre-survey preparation. Before the full-scale administration, we verified that the queries were substantively significant, logical, and appropriate. In conclusion, in total, we disseminated questionnaires to 69 experts, and we were able to collect 100 % of them.

Table 1
Number of FGDs conducted in Addis Ababa and in selected sub cities in Sheger city.

No	Sub city	No. of FGD	Participant per FGD	Total number of participants
1	Addis Ababa city	2	10	20
2	Sabata/Furi sub city	1	9	9
3	Gelan sub city	1	8	8
4	Burayu sub city	1	10	10
	Total	6	–	47

Source(s): FGDs survey, March 2023

2.5.1. Expert perspectives

In order to acquire primary and secondary data for both quantitative and qualitative analysis, we elected to implement a field survey. The questionnaire surveys were the most critical component of the fieldwork that occurred during the summer of 2023. This study implemented the "formal standardized questionnaire method" in conjunction with other data collection methodologies. The primary objective of the expert survey was to acquire a deeper understanding of the planning of integrated infrastructure. We distributed survey questionnaires to 69 purposefully selected and pertinent professionals in the five sectors of the study area. With the help of the data collectors, we made significant efforts to ensure accurate completion and return of all questionnaires. The questionnaires consist of both open-ended and closed-ended queries in order to collect additional information regarding the knowledge gap. As part of a retrospective data-gathering strategy, we were collecting current information. Selected professionals with expertise in urban infrastructure planning comprised the cohort. In order to expedite the process of contacting respondents, researchers implemented convenience and snowballing sampling methods after determining the total number of respondents.

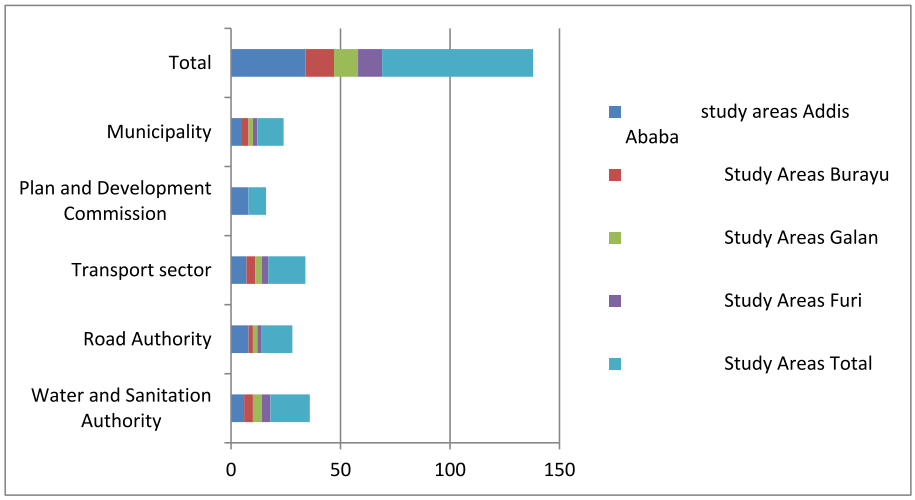

Fig. 2. The number of respondents/participants from different sectors.

2.5.2. Focal group discussions

The study used the FGDs to investigate various aspects of the challenges in integrated urban infrastructures, including experiences, attitudes, practices, and even testimonies. also utilized focus group discussions (FGDs). The study areas hosted both homogeneous and heterogeneous FGDs. Homogeneous FGDs involved different groups of people to represent a diverse cross-section of government officials, urban planners, engineers, and community representatives from the two metropolitan cities. Stakeholders were participated in heterogeneous FGDs. We utilized 9 groups, each with 10 participants, as seen in Table 1 to foster an open exchange of ideas, which is particularly beneficial for exploring complex issues related to infrastructure development and integration. Additionally.

2.5.3. Key informant interviews

This study collected data on integrated infrastructure planning through structured and semi-structured interviews. In order to guarantee precision and detail, we conducted the interviews on-site and in the office, with the participant's consent, and recorded them using an audio recorder. We conducted interviews with 15 professional, officials, and community representatives to gain insight into the obstacles associated with integrated infrastructure planning in the study area. In the study area, we conducted interviews that averaged 35 min in duration. We conducted interviews to scrutinize the city's policies, strategies, legal frameworks, challenges, and coping mechanisms.

2.5.4. Field observations

The researcher utilized a methodology similar to, which involved extensive participant observation. The researcher conducted these observations using a camera and short notes to investigate and assess existing integrated infrastructure planning problems that arise from inadequate integration, planning, and management were investigated and evaluated through the use of a camera and concise notes. We were able to provide a visual representation of the identified challenges as a result.

2.5.5. Documents

In order to generate information regarding infrastructure development trends, reports, legal and policy frameworks, and other critical data, this investigation implemented secondary data. Consequently, we collected secondary data from a diverse array of sources, including academic periodicals, books, proclamations, government policy documents, published and unpublished documents, and statistical data. We collected secondary data from a variety of sources, including the structural plan of Addis Ababa, the federal urban planning institute, the Addis Ababa transport policy document, the Addis Ababa draft sanitation plan, the Addis Ababa draft drainage plan, the Shegere draft structural plan, and the urban planning implementation manual.

Table 2
Wastewater management strategies.

No	Issues	Frequency	Percentages (%)
1	people wanted their own treatment systems	3	5
2	wanted shared access to a central treatment plant	35	50
3	wanted new satellite treatment facilities to be built	17	25
4	wanted their own treatment systems	14	20
	Total	69	100

Source(s): FGDs survey, March 2023

3. Results and discussion

3.1. Sewerage management systems

3.1.1. Wastewater management strategies

The findings highlighted in Table 2 indicate a significant inclination toward decentralized approaches, such as satellite treatment facilities and recycling, which together account for 75 % of the responses. This indicates a preference for strategies that balance scalability and sustainability. The lower preference for independent systems (5 %) reflects an awareness of the inefficiency of isolated solutions in addressing collective wastewater challenges.

The findings align with the study's goals of identifying feasible and preferred wastewater management strategies. The prominence of satellite treatment facilities (50 %) and recycling/reuse (25 %) aligns with the objectives that cities would prioritize flexible, localized solutions over centralized or independent models. This validates the research framework, which anticipated a shift toward sustainable and collaborative wastewater management practices. The low percentage favoring independent systems (6.3 %) further supports the study's assumptions about the inefficiency of fragmented approaches. When compared to similar studies in other countries, these findings exhibit both consistency and unique regional characteristics(Jeuland et al., 2023; Musiyarira, 2011). Globally, people increasingly recognize satellite treatment facilities as a scalable and adaptable solution, which aligns with the 50 % preference in this study(Reymond et al., 2018; Webber et al., 2022). Recycling and reuse initiatives, accounting for 25 %, are also gaining traction in water-scarce regions, suggesting that this study reflects a broader trend toward sustainability. However, the fact that satellite systems are used so much compared to share centralized access (20 %) could be because of local factors, like political or logistical issues that are different from those in countries where centralized systems are more common(Bakchan and White, 2024; Molle and Closas, 2020).

This study explores urban wastewater management strategies in relation to existing infrastructure, focusing on localized, sustainable approaches. It offers a method for evaluating stakeholder preferences and identifying optimal practices. However, it has limitations, including subjective preferences and a lack of consideration for economic, regulatory, or environmental constraints. Future research should include cost-benefit analyses, environmental impact assessments, and comparative studies across different socio-economic conditions.

3.1.2. Institutional barriers to collaboration

The survey finding that only 14.3 % of respondents believe the institutional mandate allows cooperation with equivalent institutions, while 85.7 % believe it does not, highlighted a significant systemic barrier to collaborative efforts. This result underscored the restrictive nature of institutional mandates and their impact on inter-institutional collaboration. The lack of cooperation is likely to hinder knowledge sharing, resource pooling, and coordinated actions, all of which are critical for addressing complex, cross-disciplinary challenges(Ahsan, 2024; Yemets, 2019). This finding signals the need for structural reforms to institutional frameworks to promote collaborative governance.

The results align with the study's objective of examining institutional constraints on cooperation. The overwhelming response indicating a lack of cooperative mandates validates the objectives that structural barriers within institutions significantly limit collaborative potential (Arakpogun et al., 2020; Harris-Lovett et al., 2018). These findings highlight the consistency between the data and the research framework, affirming the internal validity of the study. The clear majority response also strengthens confidence in the reliability of the survey design. When compared to similar studies globally, these findings reveal both parallels and distinctions. In many countries, institutional mandates often limit collaboration due to jurisdictional conflicts or rigid governance structures(Ananda and Proctor, 2013; Margerum, 2011). For instance, studies on inter-agency cooperation in disaster management frequently

cite similar constraints. However, the high percentage (85.7 %) indicating a lack of collaborative mandates in this study may reflect unique local governance issues that are more pronounced than in other regions. These results contribute to a broader understanding of how institutional frameworks influence collaboration across different contexts.

This study highlights the role of institutional mandates in fostering collaboration and provides a framework for assessing their impact on cooperation. It offers valuable insights for policymakers and institutional leaders. Despite its contributions, the study has limitations. The reliance on survey data from a limited group of respondents may not fully capture the diversity of perspectives on institutional mandates. Additionally, the study does not delve into the specific reasons why mandates are restrictive, such as legislative, cultural, or operational factors. Future research should use qualitative methods, comparative studies across regions, and longitudinal research to understand the underlying causes of restrictive mandates and the impact of policy reforms on inter-institutional collaboration.

3.1.3. Absence of regulatory frameworks for collaboration

The finding that only 28.6 % of professionals confirmed the existence of procedures, regulations, or legal conditions for collaborative initiatives, while the majority (71.4 %) indicated their absence, highlights a critical gap in the regulatory frameworks needed to support collaboration. This indicates systemic weaknesses that hinder the facilitation of cooperative efforts. The absence of such frameworks limits the ability of institutions to engage in multi-stakeholder initiatives effectively, which are crucial for addressing complex, cross-sectoral challenges(Arbeiter and Bucar, 2021; Ayala-Orozco et al., 2018). This result underscores the importance of developing comprehensive regulatory frameworks to enable and enhance collaborative endeavors.

The results align with the study's goal of identifying barriers to collaboration. The significant majority (71.4 %) reporting a lack of frameworks validates the hypothesis that regulatory and procedural gaps are among the key impediments to collaboration. The internal consistency of these findings with the study objectives indicates that the survey methodology was effective in capturing the core issues. The balance between the minority who acknowledged existing frameworks (28.6 %) and the majority who did not reflects a nuanced perspective, suggesting that while some structures exist, they may be insufficient or inaccessible to many stakeholders. When compared to similar studies in other countries, these findings reflect a broader trend in regions where institutional frameworks are underdeveloped or fragmented. Globally, the lack of supportive legal and procedural conditions is frequently cited as a barrier to collaboration, particularly in developing or transitioning economies(Burch, 2010; Mangla et al., 2018). However, the relatively high percentage of respondents (71.4 %) indicating the absence of frameworks in this study may reflect specific local governance challenges. In contrast, countries with mature governance systems often report higher levels of established frameworks but face challenges related to their enforcement or adaptability(Abbott and Snidal, 2021; Anderies et al., 2013). These comparisons highlight the need for tailored approaches to framework development that consider regional socio-political and economic contexts.

This study explores the role of regulatory frameworks in fostering collaboration, quantifies deficiencies, and advances discussions on governance and cooperation. It emphasizes the need for legal and procedural reforms to create collaborative environments. However, the study has limitations, including potential bias and lack of specific reasons for absence. Future research should include detailed policy analyses, case studies, and longitudinal assessments to understand best practices and framework impact.

3.1.4. Shared waste management solutions

The results indicate that 50.1 % of respondents are willing to jointly use waste disposal facilities with surrounding cities, while 38.9 % prefer offering incentives, and 11.14 % remain uncertain. These findings suggest that the majority of respondents recognize the value of collaborative resource utilization in addressing waste management challenges. Joint usage indicates an inclination toward cooperative approaches that optimize infrastructure and minimize redundancy. The preference for offering incentives reflects an understanding of the importance of fostering participation among stakeholders, even if direct collaboration is not feasible. However, the uncertainty among 11.14 % highlights a potential gap in awareness or confidence regarding the benefits of cooperation.

The findings align with the study's goal of exploring willingness to cooperate among stakeholders for waste disposal solutions(Lu et al., 2015; Zhang et al., 2024). The significant majority (50.1 %) indicating a preference for joint usage validates the objectives that collaborative strategies are widely seen as beneficial in managing shared resources(Ji et al., 2021). The substantial proportion opting for incentives (38.9 %) also reflects the complexity of achieving cooperation, where financial or logistical encouragement may be necessary to overcome resistance. The smaller percentage of uncertain respondents (11.14 %) suggests that while the majorities are decisive, there remains a need for clarity or additional information to address hesitations. These results demonstrate consistency with the study's objectives. Comparisons with studies from other countries reveal both similarities and contextual differences. Globally, the joint use of waste management facilities is a widely accepted strategy for optimizing costs and improving efficiency, aligning with the 50.1 % preference in this study. Countries with decentralized governance structures commonly employ incentive-based approaches, as reflected in 38.9 % of responses, to foster collaboration between jurisdictions. However, the relatively high proportion of respondents in this study favoring incentives may point to specific local challenges, such as political distrust or competition among cities that necessitate additional encouragement. 11.14 % expressed uncertainty, underscoring the need to address these factors for effective collaboration.

The study explores stakeholder dynamics in waste management cooperation by quantifying preferences for joint usage and incentive-based collaboration. It provides a framework for assessing attitudes towards cooperative strategies and highlights the need for targeted interventions to bridge gaps in confidence and awareness. However, the study has limitations, including potential bias and lack of exploration of reasons behind preferences and barriers to cooperation. Future research should include qualitative methods and longitudinal studies, such as focus groups or interviews, to provide deeper insights into the motivations and concerns influencing stakeholder decisions.

3.2. Drainage management system

3.2.1. Challenges in consensus building for citywide integrated drainage planning

The finding that only 30.4 % of respondents provided positive feedback on a citywide integrated drainage plan, while 69.6 % expressed negative responses, highlights a significant challenge in achieving consensus on urban drainage strategies. This disparity underscores a potential lack of awareness, trust, or perceived feasibility regarding such plans among stakeholders. Integrated drainage plans are critical for addressing urban flooding, waterlogging, and efficient water management(Green et al., 2021; Zhao and Yue, 2023). The low positive response rate may reflect concerns about implementation challenges, insufficient stakeholder engagement, or gaps in the proposed plan's design. These results emphasize the importance of fostering inclusive participation and transparency to build support for integrated urban drainage systems.

The findings align with the study's objective of evaluating stakeholder perspectives on urban infrastructure planning. The significant majority (69.6 %) expressing negative responses supports the objectives that integrated drainage planning faces substantial resistance, possibly due to technical, financial, or political barriers. The lower proportion of

positive responses (30.4 %) validates the assumption that stakeholders are not uniformly convinced of the plan's benefits. These results are consistent with the study's goals, demonstrating that the methodology effectively captured the underlying attitudes and concerns related to integrate drainage planning. When compared to similar studies globally, these findings are consistent with trends in urban drainage management, particularly in regions where integrated planning initiatives are in their promising stages(Mguni, 2015; Zhou et al., 2024). Internationally, resistance to integrated drainage plans often stems from stakeholder anxieties about costs, disruption during implementation, and unclear benefits(Oladunjoye et al., 2020; Oluwayemi, 2021). However, the high percentage of negative responses (69.6 %) in this study may reflect unique local challenges, such as insufficient communication of the plan's objectives or a history of failed infrastructure projects. Studies from more developed contexts typically show higher acceptance rates, highlighting the need for tailored approaches to stakeholder engagement and education in this region(Sherman and Ford, 2014).

This study explores stakeholder dynamics in urban infrastructure planning, particularly integrated drainage systems. It highlights the importance of diverse perspectives and the need for targeted strategies to address concerns. However, the study has limitations, including a lack of in-depth qualitative feedback and specific reasons for resistance. Future research should use qualitative methods, compare studies across different regions, and track changes in stakeholder attitudes after targeted engagement efforts.

3.2.2. Assessment of drainage infrastructure on intercity road networks

The results indicate that 39.1 % of respondents confirmed the presence of drainage lines on roads connecting the two cities, while the majority (60.9 %) reported their absence. This finding highlights a critical infrastructure gap that could exacerbate issues such as flooding, road damage, and waterlogging, particularly during heavy rainfall. Proper drainage is essential for ensuring the durability of road networks and maintaining smooth connectivity between urban centers. The absence of drainage lines along most connecting roads suggests significant vulnerabilities in urban and inter-urban infrastructure planning (Kanai and Schindler, 2019). These findings underscore the need for targeted investments in drainage infrastructure to enhance road resilience and improve regional mobility.

The findings align with the study's objective of assessing the adequacy of drainage infrastructure in urban and inter-urban settings. The significant majority (60.9 %) reporting an absence of drainage lines legalizes the objective that gaps in drainage infrastructure are widespread (Kanai and Schindler, 2019). The minority response (39.1 %) highlights variability, suggesting that while some roads are adequately equipped, the problem is not uniformly addressed. This balance indicates that the practice was effective in capturing diverse stakeholder perceptions and providing an accurate assessment of the current state of drainage infrastructure. When compared to studies from other countries, in Sub Saharan Africa, these findings reflect common challenges faced by regions with underdeveloped infrastructure(Calderón and Servén, 2010; Dang and Pheng, 2015). Universally, the absence of drainage lines on roads is a frequent issue in rapidly urbanizing areas, where planning often lags behind urban growth. However, the relatively high proportion of roads without drainage lines (60.9 %) in this study suggests more severe deficiencies compared to regions with established drainage networks. In countries with better infrastructure management, drainage coverage is significantly higher, underscoring the need for region-specific strategies to address these gaps. This comparison highlights the importance of benchmarking against international best practices to identify feasible solutions.

This study explores the role of drainage infrastructure in urban planning and provides a framework for assessing coverage. It emphasizes the need to integrate drainage planning into infrastructure projects for sustainable urban development. However, its limitations include its reliance on respondent perceptions and its failure to examine causes such as funding constraints or technical challenges. Future research should include field surveys, technical evaluations, and longitudinal studies to better understand and address drainage infrastructure gaps.

3.3. Solid waste management system

3.3.1. Challenges in integrated solid waste management planning

The results revealed on Fig. 3 emphasize the multifaceted nature of challenges in solid waste management, where both systemic issues (e.g., urban planning) and organizational barriers (e.g., cooperation and legal frameworks) are interrelated. The predominance of urban planning and awareness challenges suggests the need for comprehensive educational and policy interventions(Watson, 2011); while the lesser emphasis on resource allocation highlights that addressing operational inefficiencies may hold more immediate promise than solely increasing budgets (Schick, 2014).

The results align with the study's objectives of identifying barriers to effective waste management planning. The distribution of challenges indicates consistency with the addressing solid waste management requires a multi-pronged approach, balancing structural, policy, and behavioral considerations(Das and Panda, 2024; John and Ajibade, 2024). For instance, the significant proportion (42 %) emphasizing poor planning and awareness supports the goal of evaluating strategic gaps in city-wide initiatives, while the relatively high recognition of legal frameworks (21 %) validates the assumption that regulatory deficiencies remain a key bottleneck. These findings underscore the reliability of capturing diverse stakeholder perspectives on the issue. When compared to studies conducted in other countries like Nigeria, these findings resonate with global challenges in integrated solid waste management (Abdulfatah, 2023; Mbah and Nzeadibe, 2017). Poor urban planning and low awareness often emerge as primary obstacles in developing and transitioning economies, where rapid urbanization outpaces infrastructural and behavioral adaptations. Similarly, legal and cooperative gaps are commonly cited as barriers in regions where governance structures are fragmented or underdeveloped(Nelles, 2013; Shackleton et al., 2015). However, the comparatively lower emphasis on resource allocation (18 %) in this study contrasts with findings from countries where financial constraints dominate the discussion, suggesting that operational or strategic inefficiencies may play a more critical role in this context. These comparisons highlight the importance of tailoring solutions to local conditions while drawing on international best practices.

This study contributes to the theoretical understanding of integrated waste management by highlighting the interconnected nature of systemic, regulatory, and behavioral challenges. It provides a framework for prioritizing interventions and emphasizes the need for a balanced approach combining policy reform, capacity building, and public engagement. However, the study has limitations, including limited stakeholder responses and a lack of causal relationships. Future research should include larger sample sizes, stratified sampling, longitudinal studies, comparative analyses, and qualitative methods.

3.3.2. Financing solid waste collection: analysis of diverse funding sources

These results highlighted in Table 3 indicate the significant role of local and governmental financing in sustaining solid waste management (SWM) systems. The predominance of municipal funds and government treasury contributions (80 % combined) underscores the dependency on institutional support, while the smaller proportions from aid and public contributions suggest limited external or community-based financing (Diokno-Sicat et al., 2020; Gómez and Atun, 2013). These patterns have implications for the sustainability of SWM systems, as over-reliance on government and municipal resources may hinder adaptability and innovation in the long term. The results are consistent with the study's goal of identifying the financial foundations for SWM systems in the area. The significant share of municipal funds (22 %) supports the local governments bear a substantial burden in financing waste collection

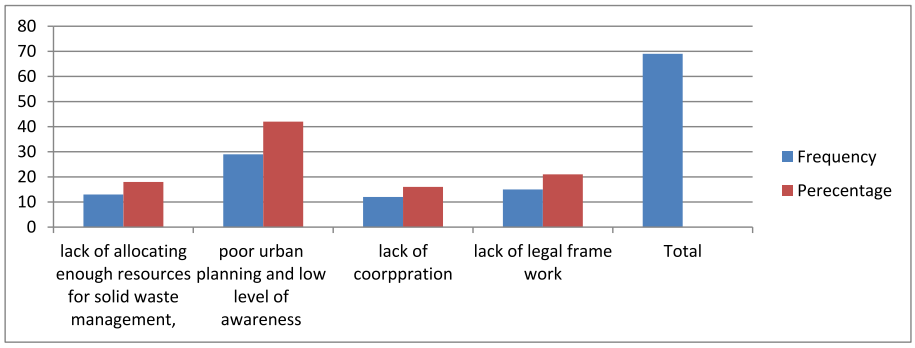

Fig. 3. Challenges in integrated solid waste management planning.

Table 3
Financing solid waste collection.

No	Issues	Frequency	Percentages (%)
1	from municipal funds	15	22
2	from the government treasury (resume budget)	40	58
3	from aid	3	4
4	from public contributions, and various savings	11	16
	Total	69	100

Source(s): Expertise survey, May 2023

efforts. The prominence of government treasury support (58 %) aligns with the assumption that state-level involvement is critical in supplementing local efforts(Talukdar, 2023). Meanwhile, the relatively low percentages from public contributions and savings (16 %) and from aid (4 %) suggest a gap in community engagement or alternative financing mechanisms, highlighting areas for improvement. These findings validate the study's focus on financial sustainability as a core challenge in SWM planning. Comparing these findings to similar studies in other countries reveals parallels and differences. Globally, municipal and government funds are often the primary sources of financing for SWM, particularly in low- and middle-income countries(Aparcana, 2017; Massoud et al., 2021). However, countries with more advanced systems frequently exhibit higher proportions of community contributions or private-sector involvement. The low reliance on aid (12 %) in this study contrasts with regions heavily dependent on international funding, suggesting a relatively higher degree of financial independence (Michalena and Hills, 2018; Pérez Niño and Le Billon, 2014). This comparison underscores the need to explore innovative financing mechanisms, such as public-private partnerships, to diversify and stabilize funding sources for SWM systems.

This study contributes to and explores the financial dynamics of solid waste management systems, focusing on institutional financing. It provides a framework for assessing financial sources and suggests diversifying financing mechanisms to reduce reliance on government and municipal resources. However, the study has limitations, including reliance on quantitative survey responses and lack of exploration of sustainability and efficiency. Future research should include qualitative methods, comparative studies, and pilot programs.

3.3.3. Challenges in waste transportation: addressing gaps in urban waste management systems

The findings indicate that while 96 % of waste generated in the cities is collected, only 83 % is transported to disposal sites, leaving a significant gap in waste management. The primary hindrances to full-capacity collection are a lack of trucks (50 %), lack of resources (22 %), and lack of accessibility (28 %). these results highlight logistical and infrastructural deficiencies that undermine the effectiveness of waste collection systems. The shortage of trucks, as the most cited issue, points to systemic operational limitations, while the lack of resources underscores financial constraints. Accessibility challenges reflect urban planning inefficiencies, such as inadequate road infrastructure or poorly located waste disposal sites(Breukelman et al., 2019; Hardoy et al., 2013). These findings emphasize the importance of integrated planning and investment to improve waste management capacity, reduce environmental impacts, and promote public health.

The results align with the study's goal of identifying barriers to effective waste collection and disposal. The disparity between waste collection (96 %) and transportation to disposal sites (83 %) validates the objectives that inefficiencies exist within the system, particularly in the logistics and allocation of resources. The identification of specific hindrances trucks, resources, and accessibility demonstrates the study's success in pinpointing operational challenges(Sanchez-Diaz et al., 2020). This internal consistency underscores the reliability of the data collection methods in addressing the study's objectives. The findings resonate with waste management challenges reported in similar studies globally. In many developing and transitioning urban areas, logistical constraints such as inadequate vehicle fleets and financial limitations are common barriers(Sahu et al., 2022; Schachenhofer et al., 2023). Regions where urban expansion outpaces infrastructure development also frequently observe accessibility issues. However, the relatively high waste collection rate (96 %) reported in this study exceeds the averages of some regions with similar socio-economic contexts, suggesting strengths in initial collection efforts. The lower transportation rate to disposal sites (83 %) is consistent with global findings, emphasizing the need for improved logistics(Kwakye et al., 2024; Mak et al., 2019). These comparisons demonstrate that while the study area faces typical challenges, its collection efficiency provides a foundation for further improvements.

This study focuses on the broader discourse on optimizing waste management systems by identifying logistical and operational constraints. It provides a roadmap for addressing waste collection and transportation gaps, emphasizing the importance of targeted investments in vehicle fleets, financial planning, and infrastructure. However, the study has limitations, such as potential biases and a lack of exploration of the systemic reasons behind issues. Future research should include field assessments, comparative studies across cities, and longitudinal studies to assess the effectiveness of interventions.

3.4. Transportation system

3.4.1. Timeliness of transportation facilities

The results indicate that 64.4 % of respondents reported that transportation facilities do not arrive on time, while 34.6 % noted that they do. This suggests significant inefficiencies in the transportation system that could impact the overall effectiveness of waste management. The late arrival of transportation vehicles may lead to delays in waste collection and disposal, potentially resulting in environmental pollution,

public health risks, and logistical bottlenecks(Sahu et al., 2022). The findings underscore the importance of timely transportation in maintaining an efficient and sustainable waste management system. Addressing these delays could lead to improved waste collection and disposal processes, enhancing both operational efficiency and public satisfaction.

The results align with the study's objectives of investigating the operational effectiveness of transportation and related facilities in the waste management system. By revealing that more than 60 % of respondents observe delays in transportation, the study successfully identifies a critical weakness in the system. This supports the objectives that timely transportation is a challenge, corroborating the expectation that logistical inefficiencies exist within the waste management system (Multaharju et al., 2017; Rejeb et al., 2021). The large discrepancy between on-time and delayed transportation highlights an operational gap, validating the study's focus on improving transportation infrastructure to ensure timely waste collection and disposal. The findings are consistent with global studies on waste management that highlight transportation inefficiencies as a common challenge(Ferronato and Torretta, 2019). Urban centers often attribute delays in waste collection and transportation to insufficient fleet management, traffic congestion, and poor infrastructure(Beliën et al., 2014; Holguín-Veras et al., 2020). For instance, studies in both developing and developed cities have pointed to transportation delays as significant barriers to effective waste management. The findings from other regions that report similar logistical issues align with the 64.4 % of respondents who indicated late arrivals. However, the relatively higher proportion of on-time arrivals (34.6 %) in this study might be an anomaly compared to other studies, where such timely transportation is less common(Hale et al., 2016). This suggests that, despite the challenges, certain parts of the system may function well, and we should concentrate our efforts on enhancing the less efficient areas.

This study highlights the importance of transportation efficiency in waste management, revealing that delays in transportation hinder consistent and effective waste services. It emphasizes the need for direct respondent feedback to assess operational inefficiencies and provides valuable empirical data for improving transportation planning and fleet management. However, the study's limitations include reliance on self-reported data, potential bias, and not examining root causes of delays. Future research should consider a mixed-methods approach, investigate environmental, economic, and social impacts, and compare results with other cities or regions.

3.4.2. Assessing transportation accessibility

Only 26.9 % of respondents reported good accessibility for transportation from the origin to the destination, whereas 73.1 % reported poor accessibility. The finding that 73.1 % of respondents reported a lack of accessible transportation from origin to destination or back highlights a significant gap in transportation infrastructure or service availability. This disparity suggests that the majority of the population faces considerable difficulties in reaching their destinations efficiently, which could have cascading effects on economic productivity, education, healthcare access, and overall quality of life. It underscores the urgent need to improve transportation networks to ensure inclusivity and convenience for all users. Limited accessibility could also exacerbate social inequalities, particularly affecting vulnerable populations such as those in rural or underserved areas, individuals with disabilities, and lower-income groups(Oviedo, 2021). These populations often rely heavily on public or affordable transport options, and their exclusion from accessible systems could deepen existing disparities. Furthermore, the inefficiency in transportation may discourage investment and development in certain regions, thereby limiting economic opportunities(Jouanjean, Gachassin, & te Velde, 2022; Pojani and Stead, 2015). Addressing these accessibility issues requires comprehensive planning, resource allocation, and innovative solutions, such as expanding transportation infrastructure, optimizing routes, and enhancing the affordability and reliability of services. Improved accessibility can significantly contribute to sustainable development and social equity, benefiting both individuals and the broader community.

The results are consistent with the study's goals of investigating the operational challenges in waste management, particularly in relation to transportation accessibility. The large proportion of respondents (73.1 %) who reported difficulties in this area validates the objectives that accessibility issues contribute to delays in transportation. These findings are internally valid as they directly address one of the key factors identified in the study transportation accessibility as a limitation in the system. The high percentage of respondents indicating poor accessibility further supports the assumption that logistical inefficiencies, such as poor road infrastructure or urban congestion, are significant barriers to effective transportation(Cheng and Chen, 2015; Rietveld and Bruinsma, 2012). This consistency bolsters the validity of the research design and the dependability of the data in achieving the study's goals. The results align with global trends identified in other studies on waste management. Many cities worldwide commonly cite poor road infrastructure and access constraints as significant barriers to effective waste transportation(Sultana et al., 2019). Studies from other developing regions, for example, have identified poor accessibility as a primary factor in delays and inefficiencies in waste management. Research in urban areas, where infrastructure development has not kept pace with rapid urbanization, is consistent with these findings. The issues raised by the respondents in this study echo similar problems seen in other cities globally, suggesting that poor accessibility is a widespread challenge in the field of waste management. However, further comparison with cities that have successfully addressed these issues (through improved road networks, better traffic management, or more efficient waste transportation systems) could provide insights into potential solutions and best practices.

The study highlights the importance of considering infrastructure and logistics when designing and implementing waste management systems, particularly in urban settings. It provides new insights into the role of accessibility in waste collection and transportation efficiency. However, the study has limitations, such as reliance on questionnaire responses and lack of objective data on road conditions and traffic patterns. Future research should collect more granular data on specific barriers to transportation accessibility, examine the effectiveness of potential solutions, compare cities with successful accessibility challenges, and explore the long-term impacts of infrastructure improvements on waste management efficiency.

3.4.3. Urban connectivity challenges: the need for integrated transport planning

The finding that 73.4 % of respondents reported the absence of an integrated transport plan between the cities is crucial, as it points to a significant gap in urban planning and regional connectivity. The lack of an integrated transport plan may result in inefficiencies, such as increased travel times, higher transportation costs, and potential disruptions in service delivery. It may also exacerbate issues like traffic congestion, environmental pollution, and limited mobility for residents of both cities. The results suggest that the absence of a well-coordinated transport system will impede waste management and other municipal services, including healthcare and emergency response, which heavily depend on timely and efficient transportation. Furthermore, the lack of an integrated transport network indicates a missed opportunity for enhancing regional development and fostering economic growth through improved accessibility between urban and suburban areas.

The results are internally valid in terms of addressing the studies suggested that there may be challenges related to transportation infrastructure between Addis Ababa and Sheger. The objectives of fragmented transportation systems between the cities, likely to hinder effective critical services, finds support in the majority of respondents reporting the absence of an integrated transport plan(Holden, 2012; Suzuki et al., 2013). This data validates the assumption that lack of

coordination in transport planning could be a barrier to both operational efficiency and economic development in the region. Moreover, since the question directly asked respondents about the existence of such a transport plan, the results provide clear evidence regarding the current state of transport planning between the two cities. These findings resonate with broader trends in urban planning and transport infrastructure seen in other developing countries. Various cities where fragmented or non-integrated transportation networks across municipalities limit regional cooperation and impede efficient service delivery face similar challenges(Rode, 2016). Studies from regions such as Southeast Asia, Sub-Saharan Africa, and Latin America often point to the lack of integrated transport planning as a major constraint on urban development (Porter, 2008). For example, research in cities like Nairobi and Lagos highlights the negative impacts of disconnected transportation systems on waste management, economic mobility, and public health(Otuoze, 2021). By comparing these global patterns with the findings of this study, it becomes evident that the issues of fragmented transport systems are not unique to Addis Ababa and Sheger but rather part of a larger pattern observed in rapidly growing urban areas facing similar infrastructural challenges.

The study underscores the significance of transportation infrastructure in urban and regional planning, emphasizing the absence of an integrated transport plan connecting Addis Ababa and Sheger. This lack of integration undermines regional economies and urban sustainability. The study also highlights the need for effective public service delivery, such as waste management and emergency response. However, it acknowledges limitations, such as relying on subjective data and not exploring specific barriers to integration. Future research should focus on identifying underlying reasons for the lack of integration, such as governance issues, resource allocation, and stakeholder coordination. Longitudinal studies could also provide insights into the evolution of integrated transport systems.

3.4.4. Financing integrated transportation infrastructure

The results reveal that a significant portion of respondents (50.6 %) view their local treasuries as the primary source of financing for an integrated transportation infrastructure between the two cities, followed by grants (45 %), and a smaller proportion (4.4 %) view federal government subsidies as a viable funding option. These findings are important because they suggest a potential reliance on local financial resources for large-scale infrastructure projects, which can be both strength and a limitation. From a scientific standpoint, this reliance on local treasuries indicates that local governments may prioritize and control transport infrastructure projects, potentially leading to more tailored solutions for their specific needs. However, it also raises questions about the adequacy of local budgets for such significant infrastructure developments. The limited reliance on federal government subsidies could imply that local governments may face challenges in securing sufficient funds without external financial support, potentially hindering the timely and effective development of an integrated transport system.

The results are internally valid as they address the study's objectives regarding potential sources of financing for the construction and maintenance of an integrated transport infrastructure. The question specifically targeted potential funding avenues, and the answers obtained reflect the perceptions of the respondents regarding available financial resources. Although the significant role of grants challenges the expectation that local governments will be solely responsible for funding urban infrastructure, the high reliance on local treasuries (Beecher, 2021; Oosthuizen and Thornhill, 2017). This result is consistent with the study's goal of understanding the financial mechanisms that support the development of integrated urban infrastructure (Oosthuizen and Thornhill, 2017). The finding also highlights a gap in the reliance on federal subsidies, which may suggest limited national governmental involvement in regional transportation development. These results are externally valid when compared to similar studies conducted in other countries, particularly in developing or rapidly urbanizing regions(Oosthuizen and Thornhill, 2017). Local governments in many countries are primarily responsible for financing infrastructure, especially in areas where national funds are either insufficient or diverted to other priorities. For example, in African cities such as Nairobi or Lagos, local governments often rely on municipal funds and external grants for infrastructure development, with limited support from the national government(Graham, 2016; Turok, 2016). Studies from Southeast Asia have underscored the crucial role of international development agencies in financing large infrastructure projects, especially when local budgets face constraints(Renwick, 2016). This external comparison underscores the importance of grants and external financial support, which can alleviate some of the burdens on local treasuries. The lower reliance on federal subsidies in this study is consistent with trends in other developing countries, where decentralization of funding responsibilities means that local governments often have to explore a variety of funding sources, including grants, private sector partnerships, and municipal bonds.

The study highlights the financial challenges and opportunities faced by local governments in developing integrated transport systems. Successful infrastructure projects often require a mix of local, federal, and external funding sources, especially in resource-constrained environments. The study also provides a nuanced understanding of the financial sources prioritized by local governments, which can inform policy and planning decisions. However, the study lacks specific details about the funding available through each source, and does not explore the sufficiency of funds or allocation to transportation projects. Future research could focus on administrative and political challenges faced by local governments in securing funding and assess the long-term financial sustainability of integrated transportation systems funded primarily by local treasuries.

3.4.5. The absence of an institution managing common transport systems

The finding that 77 % of respondents reported no existing institution managing the common transport infrastructure is significant because it highlights a critical gap in urban infrastructure governance. In scientific terms, this implies a lack of institutional oversight or central coordination in managing shared transportation systems between the cities. The absence of a dedicated institution may lead to inefficiencies, disjointed planning, and a lack of accountability, which can hinder the development of an integrated transportation network. In the context of urban planning and infrastructure, this result suggests a need for a formalized management body that can coordinate the design, implementation, and operation of transportation systems across multiple cities. This finding also has broader implications for governance, as a lack of management structures may contribute to the fragmentation of services, increase costs, and reduce service quality.

From a policy perspective, this gap indicates that there might be significant challenges in ensuring that the transportation system is maintained, adequately funded, and effectively expanded over time. If no central institution exists to manage these functions, each city may independently operate its transportation services, which could lead to inconsistencies in service quality, standards, and the ability to make coordinated regional investments. The lack of institutional management underscores the importance of integrated governance structures for achieving sustainable urban transport systems(Bouraima et al., 2023).

The internal validity of the findings is solid, as the results directly address the study's regarding the existence of an institution managing the common transport infrastructure. The question was clear, and the responses were straightforward, indicating a lack of formal institutions in place for managing transport across cities. The study's goal of understanding the governance challenges facing integrated transport systems aligns well with the research objectives, confirming the need to establish management structures as a critical element. By focusing on the existence of such an institution, the study identifies a crucial gap that hinders the effective operation and integration of transportation

infrastructure. The relatively high percentage of respondents indicating the absence of such institutions underscores a common issue in the early stages of infrastructure development and integration, which is consistent with the study's goals of exploring challenges to creating a unified transport system. The results align with trends observed in similar studies from other regions, particularly in rapidly urbanizing areas or in cities experiencing significant infrastructure growth. For instance, research in cities like Nairobi and Lagos, where multiple municipal governments struggle to manage shared infrastructure effectively, often identifies the absence of a centralized body for managing transportation networks as a major barrier to integrated systems(Agunbiade and Olajide, 2016; Cartwright et al., 2018). Similarly, studies in Latin America, particularly in cities with high levels of congestion and fragmented governance (such as São Paulo), have revealed that the lack of an institution coordinating regional transport is a critical issue(Lane, 2017; Schabas, 2012). In these cities, the absence of institutional management frequently results in inefficiencies, as localities operate independently and make decisions without considering a regional perspective. This result is consistent with findings from other developing countries, where fragmented governance structures often hamper large-scale infrastructure projects. The external comparison reinforces the relevance of the study's findings and highlights a common governance challenge across cities with ambitious urban development plans.

The study highlights the importance of institutional integration and governance frameworks in managing shared transport infrastructure. It suggests that even with technical solutions and funding, urban transport systems may not reach their full potential without an effective management body. This highlights the role of governance in sustainable urban development. The study also highlights the need for further research on the institutional frameworks required for effective management of integrated transport systems. It also suggests that future research could explore the reasons behind the absence of a managing institution, such as political challenges, funding shortages, or bureaucratic inefficiencies. It also suggests that understanding the political, legal, and financial feasibility of setting up a managing institution could be crucial for future transport integration projects.

4. Conclusion and recommendations

4.1. Conclusion

The findings on wastewater management strategies reveal a strong preference for decentralized solutions, such as satellite treatment facilities and recycling, which collectively make up 75 % of responses. This suggests that respondents are inclined toward strategies that balance scalability and sustainability, with an emphasis on decentralized options. However, the minimal preference for independent systems (5 %) highlights recognition of the inefficiencies of isolated solutions. These insights underscore the need for localized yet coordinated strategies for wastewater management, which could be crucial in the Ethiopian context given the urbanization challenges and limited resources. Additionally, the findings emphasize the necessity of structural reforms to institutional frameworks to enable inter-institutional collaboration, as a significant majority (85.7 %) cited the lack of collaboration due to restrictive institutional mandates. Developing robust regulatory frameworks to foster collaborative efforts and multi-stakeholder engagement is paramount in overcoming these barriers and achieving more efficient urban management.

The findings on financing solid waste collection illustrate a dependence on municipal funds and government treasury, accounting for 80 % of the responses, while alternatives like aid and public contributions are less frequently considered. Despite 96 % of waste being collected, 83 % is transported to disposal sites, pointing to logistical and infrastructural deficiencies, primarily caused by a lack of trucks, insufficient resources, and accessibility issues. These findings highlight the need for increased investments in waste management infrastructure to close the gap between waste collection and transportation. Furthermore, the inefficiencies in the transportation system, including late arrivals and poor accessibility, highlight the importance of improving service timeliness and infrastructure planning. A comprehensive approach involving both local and federal resources could help address these barriers, ensuring smoother waste management operations.

The findings related to transportation and integrated drainage systems reveal significant gaps in infrastructure planning and regional connectivity. The absence of drainage lines on most connecting roads (60.9 %) highlights vulnerabilities in urban and inter-urban infrastructure, which could lead to flooding, road damage, and waterlogging. Similarly, the lack of an integrated transport plan (73.4 %) between cities suggests inefficiencies that could disrupt waste management and other municipal services. The findings imply that strategic investments in both drainage and transportation infrastructure are necessary to improve regional resilience and connectivity.

The findings related to the governance and institutional frameworks show a significant lack of coordinated efforts, with only 28.6 % of respondents confirming the existence of procedures or regulations for collaboration. The absence of an institution managing common transport infrastructure (77 %) further illustrates the challenges of fragmented governance in addressing complex regional issues. This highlights a critical gap in urban infrastructure governance and the need for establishing clear institutional frameworks to ensure coordinated management. Without formalized management bodies or collaboration mechanisms, urban development efforts risk being inefficient and unsustainable. Thus, strengthening institutional coordination and establishing dedicated management structures could greatly improve urban governance and infrastructure planning in Ethiopian city-regions.

In conclusion, the findings across these areas wastewater management, solid waste collection, transportation, and institutional governance highlight the critical gaps in infrastructure, governance, and collaboration. These gaps emphasize the need for strategic investments in both physical infrastructure and institutional frameworks to promote more efficient and sustainable urban development. A shift toward more collaborative, decentralized approaches, combined with targeted regulatory reforms and institutional capacity building, is essential for overcoming the current challenges. Furthermore, addressing gaps in transportation, drainage, and waste management could significantly improve the quality of life and urban resilience in Ethiopian city-regions. The findings also suggest that a comprehensive, integrated approach involving local governments, the private sector, and other stakeholders will be key to creating a more effective and equitable urban governance system.

4.2. Recommendations

Based on the findings of this study, the following lessons could be suggested to inform future policy-making and implementation practice in property expropriation:

- Governments should consider reforming institutional mandates to foster collaboration across agencies and introducing cross-jurisdictional cooperation agreements and shared goals.
- Policymakers should focus on creating regulations that support multi-stakeholder engagement and cross-institutional cooperation in wastewater and drainage management.
- The city Administrations should allocate finance to waste management operations, with a focus on improving logistical capabilities and ensuring the availability of critical resources.
- The concerned body should design integrated transport plans and establish a regional transport authority with clearly defined goals, timelines, and performance metrics to guide the development of a cohesive and efficient regional transport network.

- Conduct further research to understand the political, financial, and logistical challenges of integrated infrastructure management, ensuring the institution is sustainable and effective.

CRediT authorship contribution statement

Geremew Worku: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Dagnachew Adugna:** Writing – review & editing, Visualization, Validation, Supervision, Methodology, Investigation, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Urban governance for sustainable integrated infrastructure in the metropolitan areas of Addis Ababa and Sheger, Ethiopia

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ABSTRACT

Urban governance plays a critical role in enabling sustainable and integrated infrastructure in rapidly growing metropolitan regions. This research investigates the governance issues impacting infrastructure planning and service delivery in the Addis Ababa and Sheger metropolitan region of Ethiopia. Employing a mixed-methods approach, data were gathered from 46 participants through surveys, 15 In-Depth Interviews, and 47 in focus group discussions with community representatives, experts and graduate students. The results indicate that over 75% of stakeholders identify a lack of effective metropolitan governance mechanisms, leading to disjointed infrastructure provision in sectors such as transport, water, and waste management. Major challenges include misaligned institutional responsibilities, inadequate cross-jurisdictional coordination, administrative inefficiencies, and political complexities stemming from Ethiopia's federal and chartered city structures. Despite these obstacles, informal collaboration and federal support are seen as potential enablers of integrated planning. The study reveals that establishing legally mandated metropolitan coordination frameworks, joint spatial planning tools, shared infrastructure financing, and corridor-level governance mechanisms can improve infrastructure integration and service delivery. These findings contribute theoretically enhancing the understanding of metropolitan governance in complex federal settings and practically providing actionable recommendations to reinforce institutional coordination, align cross-boundary infrastructure planning, and foster sustainable urban development of Ethiopia's growing metropolitan regions.

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Metropolitan governance; Addis Ababa; Sheger city; governance model; cross – border integration; integrated infrastructure planning

Introduction

Governance plays a critical role in shaping the development, sustainability, and efficiency of urban infrastructure, particularly in rapidly urbanizing regions such as Ethiopia. Metropolitan areas, such as Addis Ababa and Sheger, face growing demands for coordinated infrastructure planning to ensure equitable service delivery and sustainable urban growth. In this context, integrated urban infrastructure planning encompasses both cross-sectoral coordination, including transport, water supply, drainage, and solid waste management, and cross-jurisdictional cooperation between Addis Ababa and Sheger City, which extents multiple administrative boundaries (Debele and Negussie 2023, Alemneh and Adugna 2024). The effective integration of these sectors is essential to address challenges arising from rapid population growth, resource scarcity, and increasing urban demand for services, while minimizing inefficiencies, duplication, and environmental degradation (Giles-Corti *et al.* 2016, Pieterse *et al.* 2018, Worku and Adugna 2025).

Despite its recognized importance, the governance paradigm in the Addis Ababa – Sheger metropolitan region remains fragmented and outdated. Addis Ababa, as a federal city, and Sheger City, under the Oromia regional government, operate within distinct administrative and regulatory frameworks, creating overlapping responsibilities, unclear authority, and coordination gaps across infrastructure sectors (Alemneh and Adugna 2024). Transport networks, water supply systems, and waste management services are managed independently, often without aligned planning frameworks or joint investment strategies (Meyer and Auriacombe 2019, Mohamed *et al.* 2020). These institutional and sectoral divisions hamper the alignment of policies, investment decisions, and operational priorities, leading to inequitable service coverage, infrastructure inefficiencies, and missed opportunities for regional development.

Urban expansion along major corridors, including Addis – Sebeta – Gelan – Dukem axis, the Addis – Adama expressway, western expansion to

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Ambo and northern growth toward Sululta, further complicates governance. Population growth, industrial development, and infrastructure demand in peri-urban areas increase the need for coordinated planning. Rapid urbanization has also intensified pressures on land markets, accelerated condominium housing and informal settlement development, and heightened competition over shared resources, such as water, transport corridors, and waste disposal sites. In this context, the absence of a metropolitan-scale governance framework forces the ability of local administrations to respond effectively to cross-jurisdictional infrastructure challenges, reinforcing fragmented and sectoral decision-making.

The existing literature on Ethiopian urban infrastructure planning primarily addresses sector-specific issues and often neglects the systemic governance mechanisms that enable or hinder integration across sectors and jurisdictions (Ayana 2014, Yimenu 2021). Empirical research is particularly scarce on how institutional arrangements, administrative practices, and political dynamics interact to shape cross-sectoral and cross-jurisdictional infrastructure planning. This research gap limits policymakers' ability to design governance structures capable of coordinating investments, harmonizing service delivery, and managing metropolitan-scale infrastructure sustainably.

This study contributes by empirically examining the governance of integrated infrastructure in the Addis Ababa and Sheger metropolitan region, posing insights into both institutional practices and practical barriers. It identifies operational, administrative, and political constraints to coordination and proposes context-specific strategies to strengthen metropolitan governance, such as formal coordinating councils, joint planning instruments, and shared financing mechanisms. Although the findings provide actionable recommendations, the study is limited by its reliance on a convenience sampling of sectoral experts, which may affect statistical generalizability, and by the focus on three primary infrastructure sectors, potentially omitting other relevant services.

This study aims to (1) assess current metropolitan infrastructure coordination practices across transport, drainage and sewage, and waste management; (2) identify barriers to effective cross-sectoral and cross-jurisdictional planning; and (3) develop strategic recommendations to enhance metropolitan governance. By addressing these gaps, this study contributes a comprehensive rationale for practical interventions and institutional reforms to improve integrated infrastructure planning and sustainable urban development in one of Ethiopia's fastest-growing metropolitan regions.

The significance of this research lies in its potential to inform policy and practice. As the study area continues to urbanize, the need for robust governance frameworks becomes increasingly urgent. By examining the current governance paradigm, this study provides a foundation for designing more effective and inclusive policies that align with Ethiopia's broader urbanization goals. Additionally, the findings offer valuable lessons for other rapidly urbanizing regions facing similar governance challenges, making the study relevant beyond the Ethiopian context.

Conceptual framework

Integrated infrastructure planning in rapidly urbanizing metropolitan regions requires coordinated governance that transcends administrative boundaries, aligns sectoral priorities, and addresses cross-jurisdictional challenges (Morandell 2025). In the Addis Ababa and Sheger metropolitan region, urban systems including transport, water supply, drainage, and waste management networks serve populations across multiple municipalities; however, governance responsibilities remain fragmented. This study employs a conceptual framework that combines metropolitan governance, multi-level governance, functional urban regions, and corridor-led urbanization to analyze how institutional arrangements, spatial dynamics, and the political economy influence integrated infrastructure planning.

Metropolitan governance provides the primary lens, emphasizing institutional mechanisms that enable multiple local governments to coordinate infrastructure planning, financing, and service delivery (Boschken 2017, Slack 2019). In the Addis and Sheger region, the absence of formal metropolitan institutions has historically limited integrated planning, producing fragmented infrastructure systems, inefficiencies, and uneven service coverage across the transport, water, and waste sectors.

Multi- level governance highlights how authority is distributed across national, regional, and municipal institutions. Ethiopia's federal system complicates metropolitan coordination: Addis Ababa, as a chartered city, exercises autonomous planning authority, whereas Sheger City falls under the Oromia regional administration. This multi-layered structure creates overlapping mandates, divergent funding mechanisms, and competing priorities, necessitating negotiations among institutions and constraining effective cross-jurisdictional infrastructure integration.

Functional urban regions capture the spatial reality, in which urban systems often extend beyond formal administrative boundaries (Sýkora and Mulíček 2009). Commuting patterns, economic interactions, and infrastructure connectivity link Addis Ababa to surrounding centers, such as Sebeta, Gelan, Dukem, and Sululta, forming a metropolitan region whose functional integration is not matched by governance

structures. Fragmented institutional responsibility for these integrated networks leads to coordination failures and suboptimal infrastructure investments.

Corridor-led urbanization further shapes spatial and infrastructural dynamics. Growth along major axes, stimulates industrial expansion, residential development, and transport demand, creating concentrated pressure on metropolitan infrastructure. Without coordinated planning, these corridors exacerbate sectoral fragmentation, thereby highlighting the need for unified governance mechanisms.

Finally, the framework incorporates the political economy of Ethiopia's federal system, recognizing that institutional incentives, intergovernmental competition, and resource allocation shape cooperation and rivalry among metropolitan actors. Empirical realities, such as Addis Ababa's dependence on Oromia reservoirs, shared transport corridors like the Light Rail Transit – Anbessa – Sheger network, waste disposal at Sendafa, and fragmented building standards across Sheger sub-cities, illustrate how governance structures directly impact infrastructure integration.

By linking theory to practice, this framework enables a comprehensive analysis of institutional arrangements, spatial development, and sectoral coordination, providing a foundation for evidence-based policy interventions and actionable recommendations to achieve a sustainable, integrated metropolitan infrastructure in the Addis – Sheger region.

Materials and method

Study area

Addis Ababa, Ethiopia's capital, was founded by Emperor Menelik II in 1889 (Pankhurst 1961, Ejigu 2014). and initially developed organically without formal planning, shaped by the rugged topography (Shafiei 2013, Murray 2017). Formal urban planning, influenced by Western models, emerged after the Italian occupation in 1935. Today, Addis Ababa is a self-governing chartered city and a federal special region, hosting international organizations, embassies, the African Union, and the Economic Commission for Africa (Givental 2017, Boakye 2019). With an estimated population of five million approximately 25% of Ethiopia's urban population (Demissie 2013), the city experiences rapid growth fueled largely by rural-urban migration (Monstadt and Schmidt 2019), accounting for 40% of its annual 2%–4% growth rate, creating both economic opportunities and infrastructural challenges.

Sheger City, established on 22 October 2022, surrounds Addis Ababa as a satellite urban development model, aiming to promote economic growth and regional influence. Its administration comprises 12 sub-cities, 36 districts, and 40 rural kebeles, providing governance and service coordination across the emerging metropolitan region. Figure 1 illustrates the geographical location of the study area, including Addis Ababa and the selected subcities of Sheger City used in this research.

Research design and approaches

The study adopts a mixed-methods research design in order to capture both the quantitative and qualitative dimensions of metropolitan infrastructure governance. Examining governance dynamics requires combining statistical data with insights from institutional actors involved in planning and service delivery

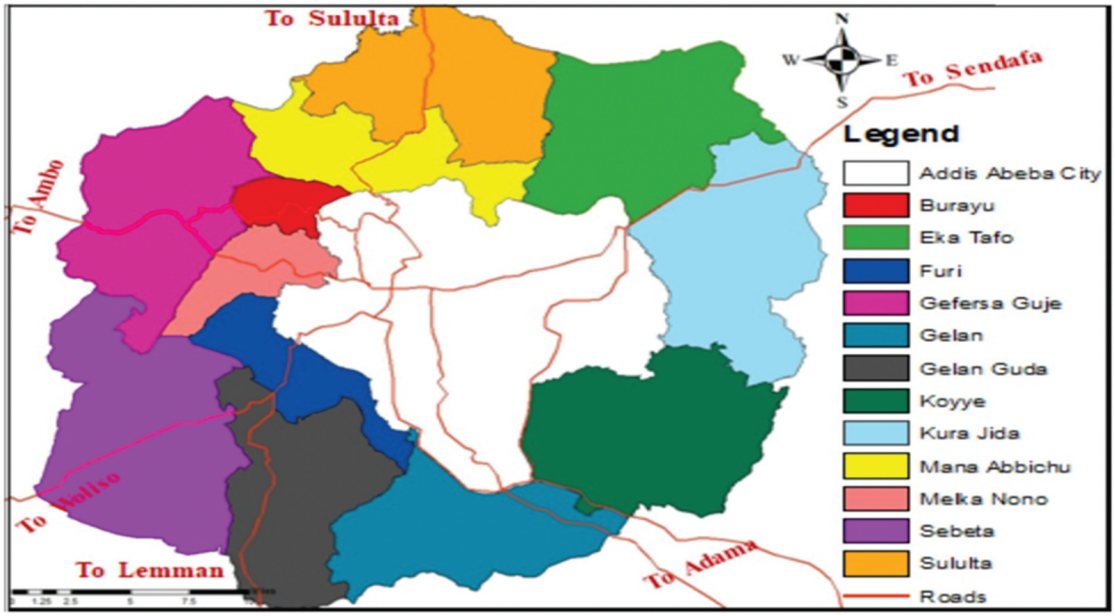

Figure 1. Location map of the study area (Ethiopia Mapping Agency, 2021).

processes. Expert respondents and graduate students were selected as key participants because they possess professional knowledge of urban planning systems, infrastructure management institutions, and policy implementation practices and represent emerging professionals engaged in research and perspectives practice related to metropolitan development within the metropolitan region. Their experience, understanding the technical and institutional dimensions provides valuable insights into institutional coordination challenges and governance constraints affecting integrated infrastructure planning.

Focus group discussions were conducted to capture collective perspectives on metropolitan governance challenges. Participants included professionals involved in infrastructure planning, municipal administration, and policy development. Demographic characteristics such as professional background, institutional affiliation, and years of experience were considered in order to ensure diverse perspectives in the discussions. Qualitative data obtained from interviews and focus group discussions were analyzed using thematic analysis. This analytical approach involved systematic coding of qualitative responses, identification of recurring themes related to governance coordination, and interpretation of patterns associated with institutional cooperation, policy constraints, and infrastructure planning challenges.

Data types and sources

This study has extensively employed both primary and secondary data, including both quantitative and qualitative data from Addis Ababa and Sheger City (Burayu subcity, Galan subcity, and Furi subcity), which served as the data sources. We gathered the primary data using a variety of methodologies and tools, such as questionnaires, focal group discussions, and structured and semi-structured interviews with community representatives, professionals, and city officials. In addition, we conducted field observations to improve the quality of the data and to acquire supplementary insights. In order to supplement and evaluate the primary sources, we obtained secondary data from books, review articles, research findings, and both published and unpublished reports.

Sampling techniques and sample size determination

This study employed a convenience sampling approach to select 46 specialists actively engaged in urban infrastructure planning and management in Addis Ababa and in the Burayu, Galan, and Furi sub-cities of Sheger City. According to human resource reports from the respective administrations, approximately 580 professionals are involved in infrastructure-related sectors; however, the research specifically targeted experts working in transportation and road networks, solid waste management, and drainage and sewage systems because of their direct relevance to integrated infrastructure planning. Given the specialized expertise required and the practical difficulty of accessing professionals directly engaged in planning activities, a non-probability sampling method was considered the most feasible way to obtain informed perspectives grounded in institutional practice. In total, 46 experts participated in the survey. To deepen the analysis and capture diverse viewpoints, the study also conducted 15 in-depth interviews with professionals, government officials, and community representatives. In addition, six focus group discussions were organized across four study areas, involving a total of 47 participants (see Tables 1 and 2). Although convenience sampling limits the statistical generalizability of the findings, the inclusion of participants from multiple institutions and sectors, together with interviews, focus group discussions,

Table 1. Number of focus group discussions conducted in Addis Ababa and in selected sub cities in Sheger city.

Number	Sub city	Number of focus group discussions	Participant per focus group discussions	Total number of participants
1	Addis Ababa city	2	10	20
2	Sabata/Furi sub city	1	9	9
3	Gelan sub city	1	8	8
4	Burayu sub city	1	10	10
	Total	6	–	47

Source: Focus group discussions survey, March, 2023.

Table 2. A total of participants contributed to the study.

S/N	Data collection method	No. of participants	Description
1	Structured Surveys	46	Participants rated governance coordination, institutional effectiveness, and infrastructure integration,
2	In-Depth Interviews	15	Semi-structured interviews with senior experts and municipal officials explored institutional arrangements, policy gaps, and coordination challenges.
3	Focus Group Discussions	47	Six Focal group discussions facilitated discussions among mixed groups of community representatives, experts and graduate students to explore collective perspectives on cross-jurisdictional infrastructure governance.

Source(s): Expertise survey, 2025.

document reviews, and field observations, strengthened the study through methodological triangulation and helped ensure a balanced understanding of infrastructure planning practices in the study area.

Data collection methods

The research utilized a combination of quantitative and qualitative data collection methodologies, including closed-ended and open-ended questionnaires, to address various topics in infrastructure sectors. We gathered secondary data from various sources such as periodicals, books, journals, and reports. It is imperative to possess a comprehensive understanding of the survey area and its inhabitants prior to employing any formal questionnaire procedure (Czaja *et al.* 2014). Subsequently, we devised a variety of inquiries for expert perspectives, focus group discussions, and key informant interviews, following a comprehensive examination of the study area and adherence to the objectives. The study involved 20 graduate students from various universities, who conducted data collection over a two-month period. We conducted the investigation in two phases. The initial stage consisted of the preliminary data collection and pre-survey preparation. Before the full-scale administration, we verified that the queries were substantively significant, logical, and appropriate. In conclusion, in total, we disseminated questionnaires to 46 experts, and we were able to collect 100% of them.

Data analysis

This study employed both quantitative and qualitative data analysis methods to examine perceptions of governance effectiveness and infrastructure integration. Survey data were analyzed using descriptive statistics frequencies, percentages, and mean values to summarize participant responses, whereas correlation analysis was used to explore relationships between participant characteristics, such as institutional affiliation and years of experience, and their perceptions of governance coordination.

Additionally, qualitative data obtained from in-depth interviews and focus group discussions were analyzed using a thematic analysis approach. This involved a systematic process of familiarizing with the transcripts, coding key ideas and concepts using NVivo software, grouping related codes into broader themes such as governance coordination, institutional fragmentation, sectoral challenges, and political influences, and interpreting these themes in relation to metropolitan governance theory, multi-level governance, and corridor-led urbanization to connect the empirical findings with the study's conceptual framework.

Results and discussion

Institutional integration

'Metropolitan governance' denotes the frameworks that enable multiple municipalities and potentially other levels of government to collaborate in the provision of services and decision-making within a metropolitan area. It encompasses mechanisms for the coordination of policies, the management of common resources and infrastructure, and the resolution of shared challenges, including transportation, housing, and economic development (Luo and Shen 2009, Iaione 2016). In the Addis Ababa metropolitan region, infrastructure integration challenges are closely linked to institutional fragmentation. Different sectors, including transportation, water supply, waste management, and urban planning, are managed by separate agencies operating under different administrative authorities. This fragmented institutional landscape complicates coordination between Addis Ababa and Sheger cities.

Political dynamics also influence cooperation between metropolitan institutions. Because Addis Ababa operates as a chartered city, while Sheger City is governed under the Oromia Region, coordination may involve negotiations between regional and municipal authorities with different governance priorities. These institutional incentives may sometimes encourage competition rather than collaboration in infrastructure planning. Sectoral fragmentation is particularly evident in areas such as transportation planning, water resource management, and waste disposal infrastructure. Differences in regulatory frameworks, planning standards, and resource allocation mechanisms often create barriers to the development of an integrated infrastructure across metropolitan jurisdictions.

Formal metropolitan governance in integrated infrastructure planning

Experts from both cities participated in the questionnaire regardless of their institutional affiliation within the metropolitan region. The survey results indicate that only 17.6% of respondents acknowledged the existence of formal metropolitan governance mechanisms responsible for coordinating integrated infrastructure planning between Addis Ababa and Sheger, while 78.4% of experts reported that no such formal structure currently exists. These responses indicate that there is substantial governance gap in the coordination of regional infrastructure systems. The absence of a formal metropolitan body limits the capacity of the two cities to jointly plan and manage cross-boundary infrastructure, such as transportation networks, drainage and sewerage systems, and solid waste management. In practice, this situation often results in

fragmented planning, duplication of investments, and missed opportunities for integrated service delivery across the rapidly expanding metropolitan region.

As seen from interviews and focus group discussions further illuminate the practical consequences behind these survey results. Several respondents emphasized that infrastructure projects frequently stop or change design once they reach administrative borders. As one urban planner from Addis Ababa explained during an interview, *'Infrastructure planning is usually prepared within each city's administrative mandate. When a road or drainage line reaches the boundary with Sheger City, coordination becomes complicated because there is no joint planning platform'*. Participants in the focus group discussions resonated similar concerns, noting that institutions often operate within their own jurisdictions and budgets, which limits opportunities for integrated decision-making. A participant from the Burayu sub-city explained, *'Even when the infrastructure systems are physically connected, the planning and budgeting processes remain separate. Each administration prioritizes its own projects first'*. These qualitative insights reinforce the quantitative findings and demonstrate how institutional fragmentation affects day-to-day planning practices.

According to urban governance theory, these findings reflect what scholars describe as fragmented governance, in which multiple administrative jurisdictions manage interconnected urban systems without a coordinating framework (Finka and Kluvánková 2015). Such fragmentation is closely associated with the concept of the 'territorial trick', which assumes that governance and planning must remain confined within fixed administrative boundaries, even when urban systems function at a broader metropolitan scale (Nelson 2021). In the study area, infrastructure networks such as roads, drainage systems, and waste flows naturally extend across municipal borders; however, planning decisions continue to be made primarily within separate institutional structures. This mismatch between the functional urban region and administrative boundaries creates operational challenges for integrated infrastructure development (Netshiswinzhe *et al.* 2023).

The challenges identified in the study area reflect broader urbanization dynamics in Ethiopia. Addis Ababa and Sheger are experiencing rapid spatial expansion, increasing the demand for coordinated infrastructure services. Without mechanisms that enable cross-jurisdictional planning, cities may struggle to address region-wide issues such as transportation congestion, waste management, and water and sanitation systems. Therefore, the findings reveal the need for governance arrangements capable of coordinating infrastructure planning beyond municipal boundaries.

Comparative experiences from other metropolitan regions illustrate how governance arrangements can influence infrastructure coordination. In cities such as Bogotá and Johannesburg, the establishment of metropolitan governance bodies has facilitated integrated infrastructure planning and improved service delivery across municipal jurisdictions (McCarney 2010, Andersson 2014). These frameworks allow cities to collectively address region-wide challenges, streamline resource allocation, and support coordinated urban development strategies. In contrast, the absence of similar mechanisms in the study area contributes to the diligence of fragmented planning practices.

In addition, international experiences suggest that formal metropolitan institutions are not the only pathway to regional coordination. In several European metropolitan regions, informal collaboration and inter-municipal agreements have enabled cities to coordinate infrastructure planning without creating new governance structures (Storper 2013, Fox-Rogers and Murphy 2014). Although such approaches demonstrate the potential value of cooperative planning, the interviews conducted in this study suggest that informal collaboration alone may not be sufficient in the Ethiopian context. Given the rapid pace of urban growth and the complex administrative relationships between Addis Ababa and Sheger, a hybrid governance approach combining formal coordination mechanisms with flexible inter-municipal partnerships may offer a more practical pathway toward integrated infrastructure planning (Toxopeus *et al.* 2020, Yahia *et al.* 2021).

Generally, the findings indicate that the key challenge is not simply the absence of infrastructure investment, but institutional fragmentation that constrains coordinated planning across the metropolitan region. Addressing this governance gap could significantly improve the capacity of Addis Ababa and the emerging Sheger metropolitan area to plan, finance, and manage shared infrastructure systems in a more integrated and sustainable manner.

Metropolitan governance practices: a regional perspective

The survey results reveal that experts perceive metropolitan governance practices to be largely absent in the Addis Ababa – Sheger metropolitan region. In response to the survey question, 86.7% of respondents indicated that metropolitan governance practices do not exist, while 13.3% acknowledged some level of coordination. At a basic level, this result reflects a clear governance gap in the management of cross-boundary urban systems. However, beyond the numerical distribution, these finding points to deeper institutional and political dynamics that shapes infrastructure planning in the region. Without a recognized metropolitan framework, infrastructure sectors that

inherently operate across administrative boundaries such as transport corridors, drainage networks, and solid waste flows are managed through separate municipal systems (Moore-Cherry *et al.* 2021, Oedl-Wieser *et al.* 2020). This fragmented arrangement limits the capacity of the two cities to address shared infrastructure needs through coordinated planning.

Qualitative evidence from interviews and focus group discussions provides deeper insights into why metropolitan coordination has historically struggled to emerge. Several participants emphasized that administrative boundaries strongly shape planning authority and budgeting procedures. One senior planner from Addis Ababa explained during an interview: *'Infrastructure planning is done according to the administrative mandate of each city. When projects reach the border with Sheger, there is no joint planning framework to continue them seamlessly'*. This situation often results in infrastructure discontinuities, particularly in road expansion and drainage systems that physically extend beyond municipal borders. Participants in the focus group discussions also noted that planning institutions prioritize local mandates over regional considerations. As one participant from the Gelan sub-city stated, *'Each administration prepares its own development plan and budget. Even if the infrastructure networks are connected, the planning decisions remain separate'*. These narratives suggest that the absence of metropolitan governance is not merely an institutional oversight but a structural outcome of how planning authority is distributed among different levels of government.

These challenges are closely tied to federal – regional governance dynamics in Ethiopia, which shape institutional relationships between Addis Ababa and the surrounding Oromia-administered cities. Addis Ababa functions as a federal city administration, while Sheger operates within the Oromia regional state. This dual governance arrangement often complicates coordination, as infrastructure planning and service deliveries are influenced by different administrative hierarchies, regulatory frameworks, and political priorities (McGuirk 2007). Interview participants frequently pointed out that projects requiring cross-jurisdictional collaboration must navigate complex approval processes across these administrative systems. Consequently, even when technical experts recognize the need for integrated infrastructure planning, institutional arrangements may discourage sustained cooperation.

Sectoral analysis further reveals that fragmentation is not uniform across all infrastructure sectors. Respondents indicated that transport infrastructure particularly road networks experiences some level of informal coordination because roads physically connect the two urban areas and require operational continuity. However, other sectors, such as solid waste management and drainage systems, exhibit greater fragmentation. Waste management services are typically organized within municipal service structures, making cross-boundary coordination less common. Similarly, drainage and sewerage infrastructure often suffers from planning discontinuities, in which administrative borders interrupt system integration. These sectoral differences reflect variations in institutional mandates, financial responsibilities, and operational incentives among municipal departments.

The survey findings indicating that 13.3% of experts recognize some form of metropolitan governance practice should therefore be interpreted within this broader context. Interviews revealed that respondents were largely referring to informal or project-based coordination mechanisms, such as occasional joint meetings between sector offices or temporary collaborations when infrastructure projects overlap. One respondent explained: *'When a road project reaches the city boundary, the technical offices may communicate to adjust the design, but this is usually done informally and depends on personal relationships'*. While such informal cooperation demonstrates a willingness among technical professionals to address shared problems, it lacks the institutional authority, financial resources, and continuity required for long-term metropolitan planning (Shrestha 2018).

From a theoretical perspective, these findings align closely with the concept of fragmented metropolitan governance, which occurs when multiple administrative jurisdictions manage interconnected urban systems without a coordinating institutional framework (Chiodelli *et al.* 2021). In Addis Ababa and Sheger context, infrastructure networks function across the metropolitan region; however, planning authority remains territorially bounded within separate administrations. The empirical evidence from both the quantitative survey and qualitative results demonstrates how this institutional mismatch creates operational barriers to integrated infrastructure development.

Comparative experiences from other developing metropolitan regions further highlight the implications of this governance gap (Kelly *et al.* 2018). In countries such as Kenya, metropolitan governance frameworks have been introduced to coordinate infrastructure planning and service delivery across jurisdictions (Ambole *et al.* 2019). These arrangements provide institutional platforms for joint decision-making, enabling cities to address shared challenges, such as transportation congestion and regional waste management, more effectively. By contrast, the absence of a comparable coordinating structure in the Addis Ababa and Sheger metropolitan region contributes to fragmented planning practices and reduces the capacity of local governments to respond collectively to rapid urban growth.

Nevertheless, the presence of informal collaboration among sector offices suggests that institutional foundations for metropolitan coordination may already exist, albeit in a limited form. Technical professionals frequently interact across jurisdictions to address immediate operational issues, indicating that cooperation is possible when institutional barriers are reduced. However, as several interview participants emphasized, informal arrangements alone cannot address large-scale infrastructure challenges that require coordinated investments, long-term planning, and shared governance mechanisms.

Generally, addressing this governance gap, whether through formal metropolitan institutions, strengthened intergovernmental cooperation, or hybrid governance models, could significantly enhance the capacity of the region to manage infrastructure systems in a more integrated and sustainable manner.

Spatial integration

Roles of civil society in inter-jurisdictional coordination

The findings on Figure 2 indicate that while respondents are actively involved in planning, the roles of civil society in other areas, such as resource mobilization, committee participation, and consultation, are notably limited. This suggests that while civil society plays a significant role in the planning stages of inter jurisdictional coordination, its involvement in other crucial areas, such as resource mobilization and decision-making, remains minimal. This could suggest an underutilization of civil society's potential to contribute to more comprehensive coordination efforts. Strengthening civil society's engagement in resource mobilization and active participation in committees could enhance its influence in shaping more inclusive and sustainable infrastructure planning and service delivery strategies

The findings that respondents are involved in planning, but only participate in committees, mobilize resources, or provide consultation, highlight a significant concentration of civil society engagement in the early stages of planning while neglecting other crucial phases of inter-jurisdictional coordination. This pattern suggests that while civil society plays an active role in shaping ideas, its influence may diminish when it comes to implementation and resource mobilization. Theoretically, this aligns with the concept of participatory governance, where civil society is recognized for contributing to policy development but may face institutional barriers or limited authority in other areas of governance, such as resource allocation and implementation (Shunglu *et al.* 2022). This observation is particularly relevant to the Ethiopian context, where civil society organizations are often restricted in their capacity to engage in comprehensive governance processes due to regulatory limitations and political constraints (Anheier *et al.* 2019).

International literature offers a more nuanced perspective on civil society's role in urban governance. For example, studies in Latin America demonstrate that civil society can significantly impact inter-jurisdictional coordination, not only in planning but also in advocacy, resource mobilization, and implementation (de Mello-Théry *et al.* 2022). In these cases, well-established civil society organizations have been able to bridge the gap between government agencies and local communities, playing an essential role in the management of shared resources and regional development. In contrast, in many European cities, civil society's role extends significantly into resource mobilization and operational decision-making. Here, civil society organizations are often integrated into committees responsible for infrastructure planning and implementation (Lovan *et al.* 2017). The study area case, where civil society's engagement is largely limited to planning, underscored the need for structural and regulatory reforms to facilitate a broader role in inter-jurisdictional coordination.

Impact of administrative boundaries on integrated infrastructure planning

Administrative boundaries significantly impact integrated infrastructure planning, according to the majority of respondents (72.7%), while (27.3%)

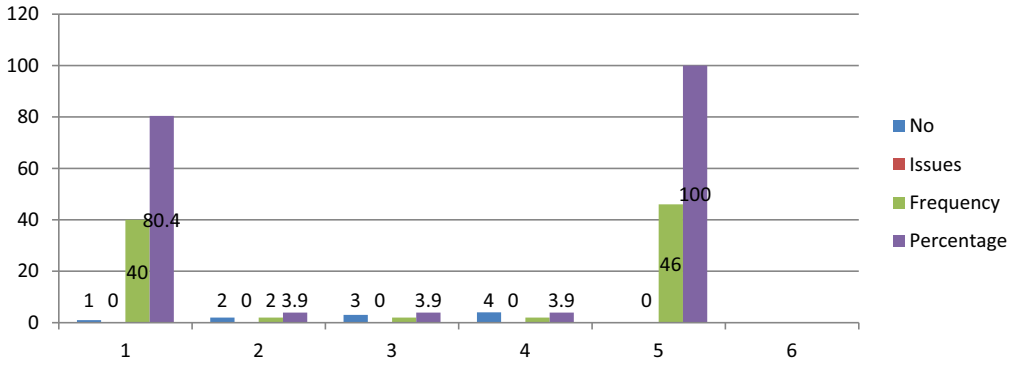

Figure 2. The roles of civil society in inter-jurisdictional coordination.

believed they have no influence. This suggests that rigid administrative divisions can hinder the development of coordinated infrastructure projects across regions, as each jurisdiction may prioritize its own needs and resources over collective goals. In the context of the study area, this finding is particularly relevant as the country's federal structure and regional boundaries can create challenges in aligning policies and infrastructure development efforts between neighboring regions and municipalities. On the other hand, some respondents in interview believed that administrative boundaries have no influence on integrated planning, suggesting that effective coordination can still occur despite administrative divisions, provided that there is political will, proper communication, and collaborative governance frameworks. However, the significant portion of respondents who see administrative boundaries as a barrier highlights the need for institutional reforms and mechanisms that facilitate cross-boundary collaboration in infrastructure planning. This underscored the importance of overcoming jurisdictional barriers to ensure that infrastructure development aligns with regional and urban growth

The finding fits with the idea of fragmented governance, which says that divisions of jurisdiction often lead to silos that make it harder to work together on urban planning and infrastructure development. Theories of urban governance, such as the 'territorial trap' (Shah 2012, Gualini 2016), emphasize how political and administrative boundaries can limit the scope of urban planning and the effective management of shared resources. In metropolitan areas, especially those experiencing rapid growth, administrative boundaries often do not coincide with the functional areas required for integrated planning, such as transportation, and waste management. This is particularly evident in Ethiopia, where the decentralized system, underpinned by ethnic federalism, has created multiple administrative boundaries at various levels, often making it difficult to coordinate infrastructure projects that span across regions (Mekonnen 2018, Faguet 2021). In cities like Addis Ababa, infrastructure development frequently faces challenges due to competing regional interests and a lack of coordinated planning across these administrative borders.

In contrast, the respondents who believe that administrative boundaries have no influence on infrastructure planning reflect an alternative view rooted in the idea that strong governance frameworks and collaborative institutions can overcome the barriers posed by territorial divisions. This perspective aligns with the theory of collaborative governance, which emphasizes the importance of cooperation among local governments, stakeholders, and other actors, regardless of administrative boundaries (Gollagher and Hartz-Karp 2013, Agger and Sørensen 2018). From this perspective, infrastructure planning can still be effective if governments are willing to engage in joint efforts and overcome institutional fragmentation. International examples, such as metropolitan governance models in cities like Toronto or Singapore, show that effective urban planning can occur across administrative boundaries if there is political commitment, strong institutional frameworks, and mechanisms for cross-jurisdictional collaboration (Blakely and Crommerlin 2016). These models suggest that it is not the boundaries themselves that limit effective planning, but rather the lack of mechanisms to facilitate coordination and the absence of collaborative political will.

This study's findings thus highlight the need for reforms that facilitate cross-regional collaboration, such as joint governance committees or inter-regional planning bodies that can bridge administrative boundaries. The contrasting findings in this study emphasize that while administrative boundaries may pose challenges, there are opportunities to create collaborative mechanisms that allow for more integrated urban planning, ultimately supporting more sustainable and equitable infrastructure development across Ethiopia's urban regions. As shown in cities like Barcelona, metropolitan regions with multiple administrative divisions have overcome these barriers by establishing shared governance bodies and integrated planning strategies (Pagliarin 2018, Sauer *et al.* 2021).

Financial integration

The source of finance for integrated infrastructure planning

The results shown in Table 3 show that respondents consider dedicated government funds as the most significant source of financing for integrated infrastructure planning, and they support this option. This is indicative of a dependence on public funding as the primary driver of infrastructure development, particularly in situations where the private sector may lack the necessary capacity or inclination to invest. This is especially pertinent in the Ethiopian context, as the government plays a central role in the financing and implementation of significant infrastructure projects, including urban development, energy, and roads. While government funding is crucial, the challenge lies in allocating and managing these resources to optimize their impact.

Table 3. The source of finance for integrated infrastructure planning.

No	Issues	Frequency	Percentage
1	domestic investors	5	11
2	public utilities	2	3.9
3	dedicated government funds	37	81
4	banks and other financial institutions	2	3.9
	Total	46	100

Source(s): Expertise survey, 2023.

In contrast, the relatively low percentages for domestic investors, public utilities, and banks and financial institutions indicate a restricted reliance on alternative or private sector sources of financing. This implies that there may be obstacles to attracting private sector investment in infrastructure, such as high-risk perceptions, regulatory challenges, or restricted access to capital markets. This finding suggests that a concerted effort to create a more favorable environment for the private sector to participate is necessary to improve financial integration and infrastructure development.

According to the theory of state-driven development, dedicated government funds are the most popular way to pay for integrated infrastructure planning. This makes sense in situations where public funding is a major source of infrastructure investment. This preference reflects a reliance on government resources, which is common in developing countries where financial markets and private sector involvement in large-scale infrastructure projects are often underdeveloped. The theory of state-centric urban governance suggests that in countries with limited access to international capital markets and domestic private investment, the government plays a central role in financing public infrastructure (Allain-Dupré 2011, Lai 2023). In Ethiopia, the government has historically been the primary source of funding for major infrastructure projects, such as roads, energy, and housing. While public funding remains essential, the challenge lies in the capacity of the government to mobilize and efficiently allocate these resources for large-scale, integrated infrastructure projects.

In contrast, the limited support for domestic investors and financial institutions reflects the barriers that hinder private sector participation in infrastructure development. Theories of financial integration and public-private partnerships suggest that infrastructure financing can be more sustainable when private sector actors are involved, as they bring in capital, expertise, and innovation (Cheng *et al.* 2021, Ma *et al.* 2022). However, the relatively low percentage of respondents favoring private investors suggests that the institutional and financial environment in the study area does not yet fully facilitate private sector participation. Research indicates that high-risk perceptions, unclear regulatory frameworks, and restricted credit market access frequently hinder private sector participation in infrastructure development in Ethiopia (Megistu 2013, Debela and Negussie 2023). The broader context of infrastructure finance in developing economies mirrors these challenges, emphasizing the need to address barriers to private sector involvement through policy reforms, improved access to finance, and stronger legal protections for investors (Laplane and Mazzucato 2020).

The importance of state-owned enterprises in many developing economies, including Ethiopia, explains the minor preference for public utilities as a source of financing (Benitez *et al.* 2012, Zheng 2016). In the Ethiopian context, public utilities have historically depended on government subsidies and investments for expansion and maintenance, particularly in areas where private sector participation is minimal. This finding highlights the need for greater efficiency and innovation within public utilities to address infrastructure challenges and improve service delivery.

Comparing these findings with global experiences, countries with more developed infrastructure financing systems often rely on a combination of public and private sources. In developed nations like the United States and Germany, infrastructure financing often combines government funding, public-private partnerships, and financial institutions to reduce the burden on the state and increase investment in long-term infrastructure projects (de Mello and Sutherland 2015, Bielenberg *et al.* 2016). This contrasts with the study area context, where government funding remains the primary source and private sector participation is still limited. This highlights the importance of diversifying financing mechanisms, encouraging private sector involvement, and establishing a conducive policy environment to create a more balanced and sustainable approach to infrastructure financing in the study area.

Challenges of metropolitan governance

88% of respondents identified challenges in metropolitan governance, while 12% indicated that there were no challenges at all. The interviews, focus group discussions, and questionnaires completed by the respondents indicate that metropolitan governance presents challenges for city regions. The finding that respondents identified challenges in metropolitan governance suggests that there are significant obstacles in managing urban and regional development cohesively. This implies that issues such as fragmented authority, limited resources, or lack of coordination across city regions may be impacting the effectiveness of governance frameworks. Conversely, the respondents who did not perceive challenges in metropolitan governance indicate that there may be differing experiences or perceptions across regions. This could imply that while some areas struggle with governance coordination, others may have better frameworks or practices in place. Overall, the feedback from interviews, focus group discussions, and questionnaires underscores the complexity of metropolitan governance in city regions. The findings suggest a need for targeted reforms and strengthened inter-jurisdictional collaboration to address these challenges, as effective

metropolitan governance is key to managing the unique demands of interconnected urban areas.

The finding that respondents identified challenges in metropolitan governance aligns with existing theories that highlight the complexities of governing interconnected urban areas. Metropolitan regions often encompass multiple jurisdictions, each with its own administrative boundaries, interests, and priorities, making unified governance difficult (Andersson 2014, Smith 2023). Fragmented authority, competing political interests, and resource constraints often lead to coordination issues that impede effective policy implementation and infrastructure planning (Wang *et al.* 2018, Bitew *et al.* 2024). The finding supports the theoretical basis that metropolitan governance requires collaborative frameworks to address these structural barriers effectively.

The presence of respondents who did not perceive challenges in metropolitan governance suggests a variance in perspectives and potentially reflects differences in institutional effectiveness or regional experiences. In some cases, stronger coordination mechanisms, shared goals, or collaborative leadership can mitigate the challenges of fragmented governance, as seen in cities with effective metropolitan councils or joint planning bodies (Palhano *et al.* 2010). These positive experiences underscored that certain conditions such as established frameworks for inter-jurisdictional collaboration or incentivized partnerships can alleviate governance difficulties. The majority of respondents noted challenges in metropolitan governance, highlighting how the study area political and administrative structure may exacerbate issues of fragmentation and inefficiency in metropolitan governance. Scholars argue that in such contexts, establishing formal governance frameworks, such as metropolitan authorities or councils, could improve coordination (Butt *et al.* 2021). However, implementing such frameworks may require political will and commitment from multiple administrative levels, as well as an emphasis on shared regional goals to overcome deeply entrenched structural divides.

International comparisons show that metropolitan regions in other countries have addressed similar challenges by implementing governance structures that facilitate regional collaboration. For example, metropolitan planning organizations in the United States and similar bodies in European city-regions offer models for bringing together multiple jurisdictions to create unified plans for transportation, housing, and infrastructure (Herzog and Sohn 2014, O'Brien *et al.* 2019). Research has shown that these structures effectively align policies across boundaries in metropolitan governance. In summary, the findings emphasize the complexities of metropolitan governance in the study area, underscoring the need for governance reforms that prioritize inter-jurisdictional collaboration. International experiences demonstrate the potential benefits of establishing formal metropolitan authorities or collaborative frameworks to unify city-region planning efforts

The major challenges of metropolitan governance

The high percentage of respondents on Figure 3 identifying the lack of a legal framework as a major challenge imply that there is a critical need for clear laws and policies to support metropolitan governance. The equal proportion of respondents citing boundary disputes and inefficient administrative systems as challenges highlights additional barriers to cohesive governance. Boundary disputes can create jurisdictional conflicts that complicate resource allocation and policy execution, while inefficient administrative systems may slow down the coordination and responsiveness of metropolitan governance bodies. The respondents pointing to insufficient resources indicate that funding limitations also impede effective metropolitan governance. Limited financial resources can restrict the capacity to invest in infrastructure, enforce policies, and support collaborative initiatives. This finding underscored the importance of securing adequate resources, possibly through government funding, partnerships, or alternative financing mechanisms, to enable sustainable and functional metropolitan governance structures.

The finding that respondents cited the lack of a legal framework as a primary challenge in metropolitan governance supports existing theories on the importance of formalized structures in urban

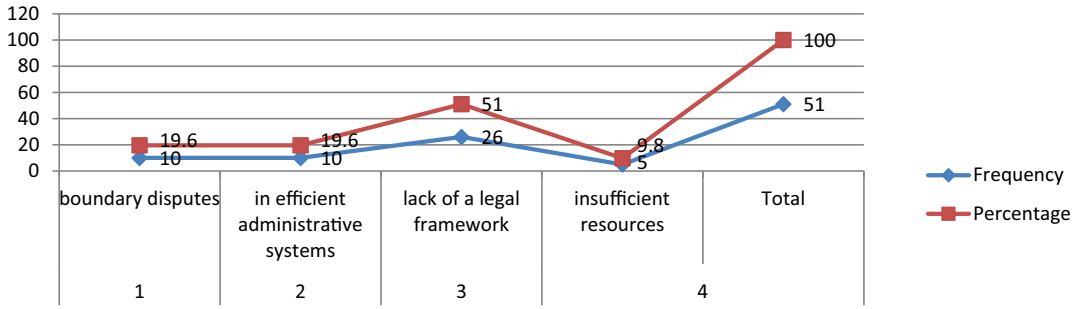

Figure 3. The challenges of metropolitan governance.

governance. According to urban governance scholars, the absence of a defined legal structure can result in ad hoc, inconsistent policy approaches and hinder the establishment of shared objectives across jurisdictions (Monstadt and Schmidt 2019). A legal framework provides the authority for regional governance, delineates responsibilities, and establishes mechanisms for decision-making, which are critical for cohesive metropolitan governance (Gómez-Álvarez *et al.* 2017). In Ethiopia, where there is significant regional autonomy, the lack of a unifying legal framework for metropolitan governance means that city-regions struggle to implement coordinated planning or align priorities, leading to fragmented and often conflicting efforts in infrastructure development and service provision (Huchzermeyer *et al.* 2024).

An equal number of respondents said that boundary disputes and inefficient administrative systems were problems. This shows that there are more problems with running a metro area that are common in places with more than one jurisdiction. Boundary disputes create ambiguity and conflict over jurisdictional control, which can delay or prevent joint initiatives and resource sharing (Salminen 2016). Empirical examples from Addis metropolitan region highlight the practical importance of metropolitan governance mechanisms. Infrastructure systems frequently extend beyond administrative boundaries, creating interdependencies between cities and surrounding towns. Waste management infrastructure provides another example of cross-boundary governance challenges. Disposal facilities located outside Addis Ababa have sometimes become politically contested, as illustrated by disputes related to waste disposal in areas such as Sendafa previously. For example, the water supply system of Addis Ababa relies heavily on reservoirs located within the Oromia Region, demonstrating the need for coordinated water resource management across regional boundaries. Similarly, metropolitan transport systems face coordination challenges due to the limited integration between the Addis Ababa Light Rail Transit, the Anbessa City Bus Service Enterprise, and emerging transport services in surrounding urban areas

These conflicts highlight the need for metropolitan-level governance arrangements capable of managing shared infrastructure systems. Inefficiencies within administrative systems, such as bureaucratic delays or redundant processes, further exacerbate the difficulty of coordinating across city-region boundaries. This fragmentation reinforces the need for the study area to establish clearer governance frameworks that can resolve boundary ambiguities and improve administrative coordination for better urban management.

The mention of insufficient resources by respondents as a hindrance to effective metropolitan governance aligns with theories that emphasize the importance of financial capacity for sustainable governance. Metropolitan regions require adequate resources to fund infrastructure, enforce policies, and provide services, yet many regions struggle with limited budgets and access to financial tools (Andres *et al.* 2014). This challenge is particularly relevant in Ethiopia, where budgetary constraints and limited private sector involvement often restrict metropolitan areas from accessing the funds needed to support urban development projects (Keller and Mukudi-Omwami 2017, Alem 2021). This finding suggests that strengthening metropolitan governance in the study area may require not only legal and administrative reforms but also strategies for mobilizing additional financial resources, such as public-private partnerships or international funding sources.

Internationally, metropolitan regions facing similar challenges have addressed these issues through regional governance models that foster cooperation and shared resources across jurisdictions. For instance, metropolitan planning organizations in the United States provide a platform for cross-jurisdictional coordination, integrating legal, administrative, and financial resources to support regional initiatives (Weinreich and Skuzinski 2021). Additionally, cities like London and Tokyo have used legislation to grant metropolitan authorities greater control over boundary disputes and resource allocation, ensuring that metropolitan governance is both efficient and aligned with regional goals (Gómez-Álvarez *et al.* 2017, Ohashi *et al.* 2022). Finally, the problems that people pointed out support the idea that for metropolitan governance to work well, there needs to be a consistent set of laws, clear lines of authority, streamlined government systems, and enough money. Applying these insights to the study area context, there is a clear need for governance reforms that address structural fragmentation and financial constraints.

Conclusion

The findings highlight significant challenges in Ethiopia's metropolitan governance, particularly in coordinating infrastructure and service delivery across rapidly expanding urban regions. A key issue is the absence of a formal metropolitan governance framework to manage urban development between Addis Ababa and the surrounding Sheger cities. Most respondents reported that neither formal nor structured informal mechanisms exist, limiting collaboration, alignment of responsibilities, and coordinated use of resources across jurisdictions. Fragmented authority, jurisdictional tensions, and limited institutional capacity exacerbate inefficiencies, while

Ethiopia's federal system where Addis Ababa is a federal city and Sheger falls under Oromia further complicates cross-regional coordination.

These governance gaps have tangible consequences for infrastructure systems. Addis Ababa relies on water resources located in Oromia, where planning and protection of reservoirs require cross-jurisdictional coordination. Transport corridors, including light-rail and bus systems, suffer from mismatches in service coverage, and the closure of the Sendafa waste disposal site underscores how political and institutional disputes can disrupt regional infrastructure operations previously. Additionally, inconsistencies in building standards, development control, and land administration across Sheger sub-cities create challenges in managing urban expansion, particularly along the western and eastern metropolitan edges, where land pressures are high.

Despite these challenges, stakeholders recognize the importance of collaborative governance. Informal cooperation among technical professionals, civil society, and local actors exists, but remains limited and insufficient for addressing metropolitan-scale issues. International examples, such as Johannesburg and hybrid governance models, illustrate how formal institutions combined with flexible partnerships can improve regional infrastructure planning and service delivery. In Ethiopia, federal support is critical for establishing policy frameworks, resolving jurisdictional disputes, and providing incentives for metropolitan initiatives.

In general, sustainable development in the Addis Ababa – Sheger region depends on creating integrated governance arrangements that coordinate infrastructure planning, harmonize regulatory standards, and facilitate cooperation across jurisdictions, ensuring efficient, equitable, and long-term urban growth.

Authors' contribution

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Geremew Worku and Dagachew Adugna. The first draft of the manuscript was written by Geremew Worku and the other author commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Availability of data and materials

The datasets/DAS/ generated during and/or analyzed during the current study are available from the corresponding author, [Geremew Worku], upon reasonable request.

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Research Article

The Practices of an Integrated Infrastructure Planning in Ethiopian Metropolitan Cities, the Case of Addis Ababa and Sheger Cities

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Abstract

Integrated infrastructure planning between cities is a strategic approach that aligns critical systems such as transportation networks, waste management, water supply, and digital connectivity across municipal boundaries. This study examines the coordinated efforts of Addis Ababa and Sheger to create synergy between their infrastructure systems, focusing on three core areas: transport and road networks, sewerage and drainage systems, and solid waste management. Effective inter-city collaboration fosters economic growth, environmental sustainability, and social equity by improving connectivity, resource sharing, and resilience. Conversely, fragmented planning often results in urban sprawl, traffic congestion, poor public service delivery, environmental degradation, and systemic inefficiencies. Using a mixed-methods approach, the study employed convenience sampling to collect data through questionnaires, surveys, interviews, and focus group discussions. It processed and interpreted the data using analytical tools such as Microsoft Excel, ArcGIS, and SPSS. The findings highlight opportunities to enhance the efficiency and sustainability of shared infrastructure systems while addressing pressing challenges, such as institutional silos, limited financial resources, and inadequate stakeholder engagement. The study underscored the importance of aligning infrastructure planning with regional development goals, emphasizing coordinated strategies that reduce redundancies and foster sustainable urban environments. Key recommendations include establishing joint planning bodies, enhancing data-sharing mechanisms, and fostering public-private partnerships to optimize resource use. By addressing these challenges, Addis Ababa and Sheger can achieve interconnected, sustainable, and resilient infrastructure systems that serve the broader metropolitan region effectively. This study contributes to the discourse on regional infrastructure planning by providing actionable insights into how cities can collaboratively address shared challenges while supporting sustainable development objectives. The findings have significant implications for policymakers, urban planners, and stakeholders committed to advancing cohesive urban environments that benefit communities across metropolitan regions.

Keywords

Integrated Infrastructure Planning, Metropolitan Cities, Addis Ababa, Sheger, Urban Development, Sustainable Cities, Stakeholder Collaboration, Transport, Waste

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1. Introduction

Growing cities increasingly recognize urban infrastructure planning as a critical element in their sustainable development [1]. As cities' populations grow, they face increased demands on transportation, water supply, energy, sanitation, and telecommunications networks [2, 3]. In the face of rapid urbanization, aging infrastructure and growing environmental challenges, siloed planning and fragmented decision-making are losing to integrated infrastructure planning, a comprehensive and sustainable approach to forward-thinking corridor development [4, 5]. Integrated infrastructure planning (IIP), a comprehensive approach to infrastructure planning, coordinates a variety of infrastructure systems to ensure the efficient use of resources, reduce environmental impacts, and establish cohesive urban environments [6]. This holistic perspective encourages cities to align their infrastructure goals with broader societal objectives, such as economic growth, social equity, and environmental sustainability, providing a robust framework for long-term urban development [7, 8]. Rather than planning each system in isolation, integration aims to connect them, creating efficiencies and improving service delivery. In urban contexts, integration also extends to considering the interdependencies between infrastructure and land use, social services, and economic development [9, 10].

The integration of infrastructure systems offers significant benefits in terms of resource efficiency, environmental impact reduction, and economic viability [11, 12]. When infrastructure planning is integrated, it promotes synergies that reduce redundancies such as shared energy grids or water management systems thereby lowering costs. Environmental benefits also arise when integrated systems help reduce emissions, decrease land disturbance, and conserve resources [13]. Economically, integration can foster innovation, create jobs, and increase the appeal of cities to investors [14].

Ethiopia's capital, Addis Ababa, and Sheger are collaborating to address urban expansion, population growth and interdependencies. They are implementing integrated planning to address shared concerns like transportation networks, water resources, and waste management. The goal is to create a balanced urban development trajectory that aligns with both cities' goals. Public transportation initiatives aim to reduce traffic congestion, improve accessibility, and enhance mobility. Road network developments support economic activities and smoother travel between the two cities. There are also efforts underway to enhance water supply infrastructure, including the expansion of wastewater treatment plants and distribution networks, ensuring reliable access to clean water and proper sanitation facilities, water distribution networks, wastewater treatment, parks, green spaces, and urban forestry initiatives that are integrated into urban planning for residents.

In metropolitan regions where cities are physically or economically interconnected, the concept of integration takes on a regional dimension [15-17]. Integration across urban boundaries implies that cities collaborate to manage shared resources and develop joint infrastructure solutions [18, 19]. This is crucial in areas where urban expansion has led to overlapping infrastructure needs, such as transportation corridors or water systems. In the case of Addis Ababa and Sheger, regional integration enables both cities to manage growth more effectively, addressing issues like traffic congestion, environmental degradation, and resource scarcity. Cross-boundary integration enhances the resilience of the region by allowing for more coordinated responses to challenges that affect both cities [20, 21]. Despite ongoing efforts to address integrated infrastructure needs, there are concerns about the effectiveness of integrated infrastructure planning and collaboration between Addis Ababa and Sheger metropolitan cities. Fragmented approaches to development and infrastructure investment could lead to inefficiencies, inequality, and unsustainable urban expansion [22].

Therefore, we chose Addis Ababa and Sheger, Ethiopia's capital and peri-urban area, for a study on integrated infrastructure planning due to their strategic importance, rapid urbanization, and interconnected development needs. These cities form an essential urban corridor, addressing challenges like housing shortages, transportation congestion, water supply, and waste management. Integrated planning can create economic synergies, reduce commuting times, facilitate trade, and improve job market access. Addressing the lack of integrated infrastructure planning requires a collaborative framework between policymakers, urban planners, and stakeholders.

This study underscored the potential of integrated infrastructure planning to enhance sustainable urban development and resilience between Addis Ababa and Sheger. By investigating the practice and feasibility of coordinated infrastructure approaches, this study seeks to pave the way for improved urban management and inter-city cooperation that can serve as a model for other regions facing similar growth challenges. Therefore, the aim of this article is to create cohesive, sustainable, and well-connected urban environments that benefit the public across both metropolitan regions on three different cases, namely transport and road networks, sewerage and drainage systems, and solid waste management".

2. Materials and Method

2.1. Study Area

Addis Ababa, as Ethiopia's capital city, serves as its political, economic, and cultural hub [23] and [24]. According to the latest estimates, the population of Addis Ababa, the capital city of Ethiopia, is approximately 5,704,000 [25]. The city has experienced rapid growth in recent years, driven by urbanization, economic development, and migration from rural areas

[26, 27]. However, population numbers can vary depending on the source, as official censuses may lag behind real-time growth. Rapid population growth has created opportunities for economic development in the developing world, but it has also created social, environmental, and cultural challenges, leading to a mismatch between the demand and the supply of services [23]. Understanding the dynamics of urbanization and infrastructure development in Addis Ababa is crucial for assessing the effectiveness of integrated planning efforts.

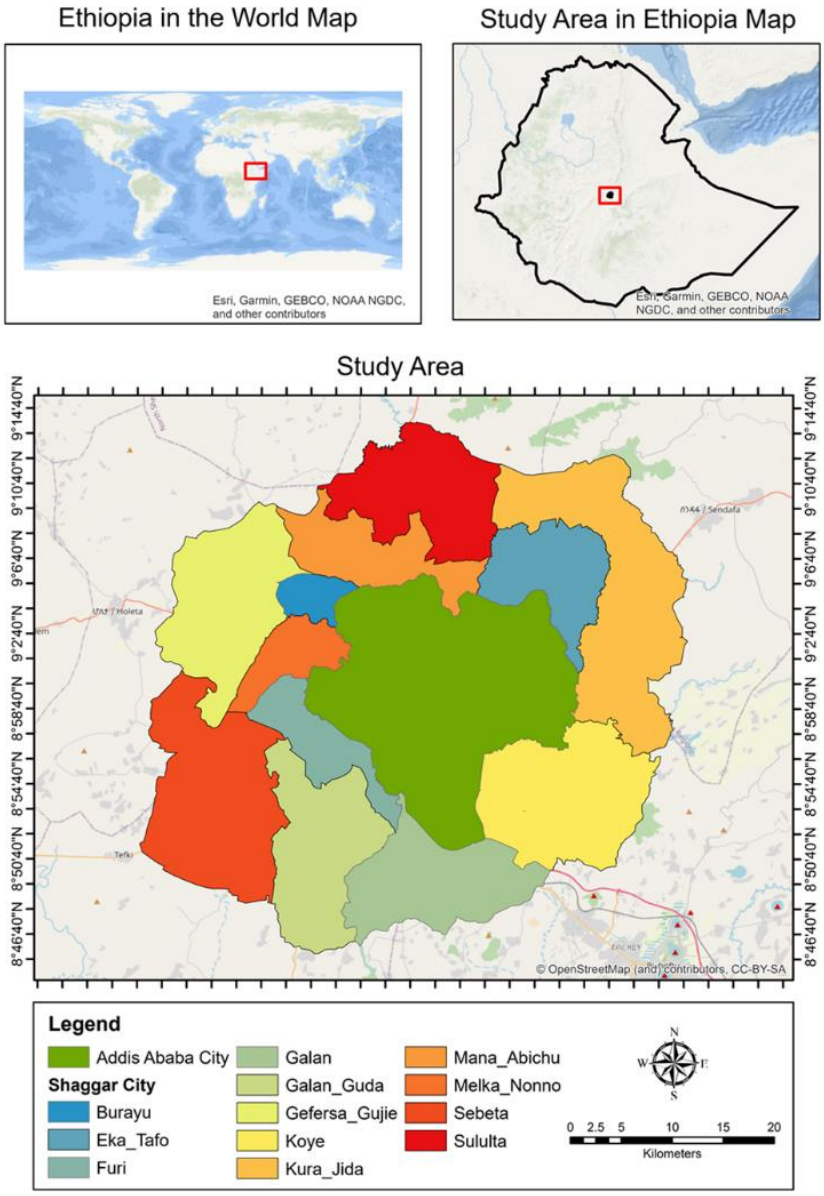

Figure 1. *Location map of the study area.*

Its social and physical infrastructure has increased quantitatively in the past few decades, but it is still in need of significant improvement in terms of quality and distribution [24]. The government's strategies behind its extensive urban investments, which integrate the improvement of the urban environment with the creation of economic opportunities, especially for urban youth, have shown some promising results [24]. However, we need to evaluate, modify, or replace the policies and strategies based on their contribution to alleviating the chronic problems of the city [24].

Sheger, like the Addis Ababa metropolitan area, is experiencing significant population growth and urban expansion, leading to increased pressure on infrastructure and services. Examining the integration of planning processes and infrastructure investments across the Sheger Metropolitan Area provides insights into regional development dynamics and interdependencies. It consists of several satellite cities and towns that surround the capital. The Oromia Spatial Planning Team estimates Sheger City's total population at 1,657,228 (2022). It is one of the Oromia National Regional State's

late-established cities and consists of 12 sub cities and towns. From this, we purposefully selected three of these sub cities, namely Burayu, Sebeta/Furi, and Galan, as case study sites (Figure 1). We selected these cities because they are the economic powerhouses in Ethiopia and Oromia regions, are actively expanding their gray infrastructure to support the economy, and are experiencing rapid population growth, which is placing significant pressure on green spaces.

2.2. Research Methodology

We conducted the investigation using a descriptive methodology. In order to acquire a thorough understanding of the practice of integrated infrastructure planning in the study area, the investigation implemented a mixed-methods approach that integrated both qualitative and quantitative research methodologies [28, 29]. We analyzed the practice of integrated urban infrastructure in the studied areas using descriptive and explanatory research designs. We developed the study design as a comprehensive framework to direct the research activities while taking into account the objectives. The nature of the research, the identified problems, and the available data are the primary determinants of the types of data and tools used to capture relevant information. The research aimed to answer the following four fundamental questions.

1) What is the current state of infrastructure and planning practices in Addis Ababa and Sheger, and where are the critical points of interdependence?
2) How can integrated infrastructure planning contribute to resource efficiency and service improvement in both cities?
3) What are the main challenges to implementing integrated infrastructure planning, especially regarding governance and policy coherence?
4) How can Addis Ababa and Sheger practically adopt a framework for coordinated infrastructure planning, and what best practices could be adapted from other regions?

2.3. Data Types and Sources

We used questionnaires, key informant interviews (KII), focus group discussions (FGDs), and document analysis as data sources to collect both primary and secondary data in the study areas. We collected primary data through surveys KII and FGDs. We extracted secondary data from research findings, books, review articles, published and unpublished reports, and field observation.

2.4. Sampling Techniques and Determining Sample Size

We selected convenient sampling techniques for surveys, KII and FGDs based on their availability and accessibility, especially when targeting specific groups or populations. We selected experts from five sectors the cities based on their experience and educational level. This helps to provide sufficient information about the integrated infrastructure planning in the study areas shown in Figures 1 and 2.

Figure 2. *City of the Respondent.*

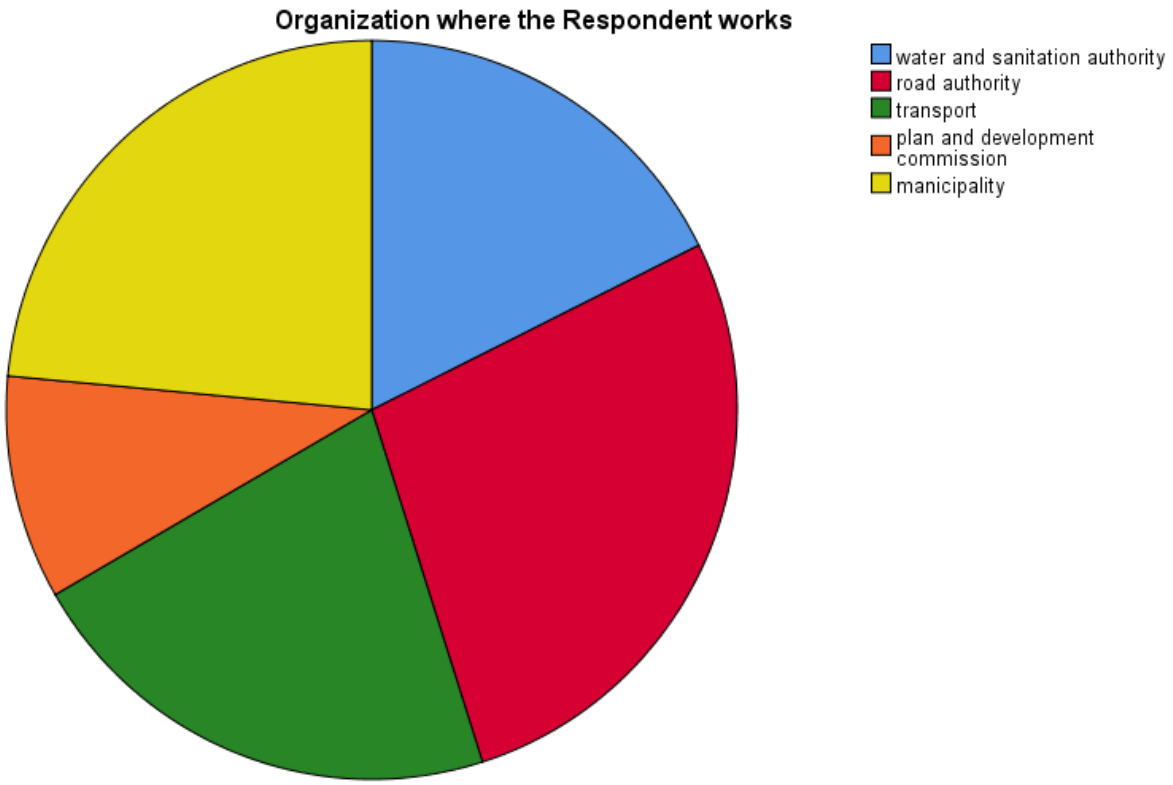

Figure 3. *Organization of the Respondent.*

According to [2, 30] the number of participants in the FGD session was 40. For fair representation, 10 participants participated in each case study area.

2.5. Data Collection Methods

We gathered both qualitative and quantitative data for the present research through a survey, structured and semi-structured interviews, and focus group discussions [31, 32]. Therefore, we conducted interviews with officials, professionals, community representatives, and relevant stakeholders. Furthermore, as [33, 34] employed during his data collection, we extensively used participant observations to capture typologies of development on the ground and modalities of the infrastructure through photographs, note-taking, and typo morphological mapping. Furthermore, during the data collection process, we conducted extensive participant observations to document the infrastructure modalities and development typologies present on the ground. Based on this, the researcher employed the following data collection methods in our study. We provided both closed-ended and open-ended questionnaires to the respondents. We employed the questionnaire to gather insights from the sector expertise of various infrastructure providers.

2.6. Data Analyses

We edited, coded, classified, and encoded all the gathered data into a computer for analysis using Microsoft Excel, AutoCAD, ArcGIS, and Statistical Package for Social Science (SPSS) Version 22 software. We analyzed and presented the qualitative data in a non-numerical form. We first transcribed these into text, and then categorized them based on the frequency of ideas. We used each coded response category as a variable in SPSS for subsequent statistical analyses.

2.7. Data Presentation

Presentations of the analyzed data include tables, graphs, charts, and percentages. Additionally, we have integrated GIS and CAD figures along with field surveys.

3. Results and Discussions

3.1. Sewerage System

3.1.1. Assessment of Sewerage System Integration Between the Cities

For a variety of reasons, a sizable majority of respondents (85.7%) in the study areas indicated that there was no integrated sewerage system between the two cities under study, as revealed in Table 1 below.

Table 1. The absence of integrated sewerage system.

S/N	Issues	Frequency	percentage
1	Lack of agreement between the cities	7	24
2	Disagreements on boundaries	4	13.2
3	Lack of a compensation mechanism	6	20
4	Lack of a legal framework	12	42.9
	Total	29	100

Source(s): Expertise survey, 2023

The findings suggest that the lack of an integrated sewerage system between cities has serious implications for public health, environmental sustainability, and regional development. Key obstacles such as administrative disagreements, boundary disputes, absence of compensation mechanisms, and lack of a legal framework hinder collaborative infrastructure projects [35, 36]. This can lead to inefficient waste management, increased pollution, and strained inter-city relations, highlighting the need for cohesive policies and legal framework to support sustainable urban development

The issue of lack of sewerage integration between urban centers, as reported by the respondents, aligns with findings from various studies across both developing and developed countries [37, 38]. Similar issues emerged in a Lagos, Nigeria, study, where municipalities struggled to integrate sewerage disposal due to a lack of cohesive planning frameworks and institutional cooperation [39, 40]. This aligns with the respondents who noted the absence of an integrated sewerage disposal site, pointing to complex barriers that make inter-city coordination challenging. Findings from Southeast Asian cities [41, 42] repeat the structural and political challenges in developing such systems, including the absence of agreement among cities. For instance, historical disputes or unclear jurisdictional delineations in Latin America often lead to boundary-related conflicts in many metropolitan areas [43, 44]. Additionally, inadequate compensation mechanisms can inhibit waste management initiatives, as affected communities and municipalities often demand assurances of equitable resource allocation and compensation [45]. From all, the absence of a legal framework is crucial for successful inter-city infrastructure projects, as it provides guidelines, standards, and enforceable measures for collaboration. In Kenya, legal ambiguities in environmental and sanitation policies have led to stalled waste management initiatives between cities [46, 47]. The absence of a legal structure may exacerbate existing disputes and complicate resource allocation, further delaying essential infrastructure development.

3.1.2. Perceptions of a Shared Sewerage Disposal Site: Implications for Waste Management and Environmental Health

According to the study, (30.9%) stated that there is a common sewerage disposal area, while (69.1%) stated that there is no such common disposal site. The result suggests that the majority (69.1%) perceives an absence of a shared disposal site, indicating potential challenges in waste management and environmental health due to fragmented disposal practices. This lack of a unified system can lead to increased pollution, inefficient resource use, and possible health risks for surrounding communities [48, 49]. Establishing a common disposal site could improve coordination and promote sustainable waste management across the cities involved.

The majority of respondents indicated the absence/inadequate of a common disposal site, which is consistent with other rapidly urbanizing regions where waste management infrastructure often lags behind population growth, like in Dhaka, Bangladesh [50]. The minority reported the existence of a common disposal site, potentially due to isolated efforts by certain neighborhoods or sectors, consistent with similar patterns observed in Jakarta, Indonesia [51, 52]. The lack of inter municipal coordination and planning may also contribute to confusion and inefficiency in waste management, which is consistent with studies in metropolitan areas like Mumbai, India [53-55].

3.2. Drainage System

3.2.1. Analysis of Common Storm Water Master Plan Adoption Between the Cities

When asked whether the cities have common storm water master plan, 17.4 percent of respondents indicated that cities have a common drainage master plan. While 82.6 percent of respondents stated that cities do not have a common storm water master plan. The lack of a common drainage master plan, as indicated by respondents, implies significant risks for

the cities, including increased vulnerability to flooding, water pollution, and infrastructure damage [56, 57]. This absence of coordinated planning could result in costly repairs, environmental degradation, and health risks for residents. Developing a shared drainage management strategy is crucial for enhancing urban resilience and mitigating these risks, especially as climate change intensifies extreme weather events.

The lack of a common drainage master plan in urban areas, as reported by respondents, is a significant gap in urban water management. Studies from other rapidly urbanizing areas, like Nairobi, Kenya, have reported similar findings, highlighting how the lack of an integrated drainage management system between neighboring jurisdictions has exacerbated flood risks, damaged infrastructure, and contributed to water contamination [58, 59]. The small percentage of respondents acknowledging a shared drainage plan suggests isolated agreements or fragmented efforts. In urban regions like Johannesburg, South Africa, partial or fragmented drainage management initiatives within city sections often create inconsistencies, failing to address broader drainage issues and placing isolated neighborhoods at higher risk during heavy rainfall [60, 61]. A coordinated approach to drainage management across cities can reduce flood risk, protect ecosystems, and improve urban resilience. Adopting a shared drainage master plan could offer environmental and economic benefits, reducing the need for costly repairs and providing better protection for residents [62, 63]. It also, underlies issues in inter-city governance, as seen in case studies from metropolitan areas in Asia. For example, in the Pearl River Delta region in China, studies have shown that competing priorities and inadequate policy alignment between neighboring cities often hinder the development of regional water management plans [64, 65]. Similarly, research in Latin America demonstrates that a coordinated approach to drainage management across cities can reduce flood risk, protect ecosystems, and improve urban resilience [66, 67].

Regarding strategies for flood protection in lower reaches, 16% of respondents reported the existence of strategies to protect people in lower reaches from floods. And 81.3% of respondents stated that there were no strategies in place to protect people in lower reaches from floods. The lack of flood protection strategies for lower-lying areas, as reported by 81.3% of respondents, suggests the high vulnerability of these communities to flood risks [68-70]. This absence of protective measures increases the likelihood of severe damage to homes, infrastructure, and public health in these flood-prone areas.

The study illustrates a critical vulnerability in urban flood management in lower-lying areas, which are increasingly susceptible to flooding due to their proximity to waterways and their location. This absence of strategic intervention, which is also evident in other rapidly urbanizing regions, such as Dhaka, Bangladesh [71], places low-lying areas at a high risk of flooding due to inadequate protective infrastructure and inadequate urban planning. In urban areas like Manila, Philippines, the small percentage of respondents who acknowledge the existence of flood protection strategies may suggest that these strategies are isolated initiatives or pilot programs that are specific to specific communities rather than a comprehensive municipal plan [72, 73]. This fragmented approach can result in disparate levels of protection, which places the most vulnerable communities at a higher risk. Fragmented policies, resource limitations, and a lack of intergovernmental cooperation frequently impede the development of comprehensive flood protection measures in urban resilience literature, particularly in Lagos, Nigeria [74-77] conducted comparative studies in New Orleans, USA, demonstrating that the implementation of sturdy flood protection systems, such as levees and storm surge barriers, significantly reduces the risk of catastrophic damage in vulnerable areas. Additionally, the absence of flood protection strategies for the lower reaches may impact the urban ecosystem [78, 79].

3.2.2. Future Prospects for Establishing Shared Institutions Between the Cities

The overwhelming majority of respondents (78.3%) indicated that their organization intends to establish shared institutions with other cities in the future. However, a smaller proportion of respondents (17.4%) indicated that they do not or intend to prioritize such coordinating efforts at this time. The strong interest in establishing shared institutions suggests a significant desire for collaboration and coordinated governance among cities, which could enhance resource sharing and improve service delivery [80, 81].

The finding of respondents express an intention to establish shared institutions with other cities signals a robust interest in collaborative governance as a means to address shared challenges. For instance, studies in the context of metropolitan governance in North America demonstrate that shared institutions can lead to improved service delivery, increased efficiency, and better alignment of regional development goals [82]. However, the respondents who do not prioritize establishing shared institutions highlight a significant minority perspective that warrants attention. This contrasts with the majority's enthusiasm and suggests potential barriers or concerns regarding collaborative efforts [83, 84]. For example, in metropolitan areas like Los Angeles, attempts to create regional governance structures have faced challenges due to entrenched local interests and skepticism about the benefits of cooperation [85, 86].

Furthermore, the desire for shared institutions may not always translate into effective collaboration without addressing the underlying governance structures and processes. As noted in the literature, establishing shared institutions requires careful negotiation of governance frameworks that delineate responsibilities, authority, and accountability among participating entities [87, 88]. The presence of a sizable minority who are not prioritizing coordination efforts suggests that there may be unresolved questions or concerns about how such shared institutions would function in practice. Moreover, this division in perspectives may also reflect varying levels of readiness or capacity among organizations to engage in col-

laborative governance. For instance, a study of inter municipal cooperation in Europe indicated that local governments with limited administrative capacity were less likely to engage in collaborative initiatives, opting instead to focus on internal improvements [89, 90].

3.2.3. Legal Frameworks for Institutional Integration Among Stakeholders

Regarding the existence of rules, frameworks, or other legal circumstances that support institutional integration among stakeholders, the survey's results showed that (47.8%) of respondents said "yes." (51.2%) of respondents, on the other hand, indicated that they did not have such laws or rules in place. The survey results reveal a significant gap in legal and regulatory structures necessary for effective collaboration among stakeholders, respondents acknowledging the existence of supportive rules or frameworks for institutional integration. The majority who indicate the absence of such support suggest challenges in fostering inter-organizational cooperation, potentially hindering efforts to address shared urban issues. This underscored the need for the development and implementation of clear legal frameworks that facilitate collaboration, enhance governance, and promote resource sharing among stakeholders to improve overall institutional integration.

In line with other research on urban governance [91], survey respondents indicate a significant lack of the legal framework required for effective integrated infrastructure. In many urban settings, the absence of such frameworks can lead to fragmented efforts, undermining the potential benefits of integrated governance. For instance, studies on regional governance in the United States have demonstrated that clear legal guidelines can facilitate partnerships between municipalities, resulting in more coordinated responses to complex urban challenges [92, 93]. The fact that a slight majority of respondents indicated that there are no supportive laws or rules in place suggests a significant obstacle to the institutional integration that many urban areas seek. This finding is consistent with research from metropolitan regions like Los Angeles, California; for instance, a lack of inter-jurisdictional agreements has led to inefficiencies in addressing regional issues like transportation and challenges in achieving integrated governance and environmental management [94, 95].

Lack of legal frameworks in urban regions like Nairobi, Kenya, exacerbates governance capacity and institutional trust issues, leading to mistrust and reluctance to cooperate [96, 97]. The study areas may exhibit a lack of trust among stakeholders, exacerbated by unclear legal frameworks, which may hinder the establishment of shared institutions for integrated governance [98, 99]. The Greater Toronto Area in Canada has successfully implemented inter-city cooperation due to the presence of supportive legal frameworks among municipalities [100]. The cities under study stand to gain from the development of these frameworks, as they can foster collaboration and improve governance outcomes.

3.2.4. Collaborative Projects Through Shared Financing: Survey and Qualitative Insights

Regarding whether cities have collaborative projects through shared finance, (53.8%) of respondents said "yes," while (65.3%) said "no." Focus group discussions and interviews verified that cities do, in fact, currently have collaborative projects underway. The survey results underscored a discrepancy between perceptions and actuality in the context of intercity collaboration. Despite the existence of ongoing projects, a substantial number of stakeholders may not fully understand or participate in these initiatives. The implication is that it is imperative to improve the communication and visibility of these collaborative endeavors in order to encourage a broader base of support and participation. Furthermore, addressing the concerns of who perceive a lack of collaboration could enhance trust and investment in shared financial initiatives among cities.

The survey findings highlight the complexity of fostering inter-city cooperation, as effective collaboration often hinges not only on the presence of projects but also on stakeholders' awareness and engagement with these initiatives [101-103]. In the context of the study cities, the perceived lack of collaboration could hinder the potential benefits of shared financial projects, indicating a need for improved outreach and education about existing initiatives. The discrepancy between the survey results and the verified existence of collaborative projects underscored the challenges inherent in promoting inter-organizational cooperation. For instance, studies in metropolitan regions like São Paulo, Brazil, demonstrate that even when collaborative projects are in place, local stakeholders may remain unaware due to insufficient communication strategies from governing bodies [104, 105]. This suggests that, for the cities under study, enhancing communication strategies and providing clear information about collaborative initiatives is critical to bridging the gap between perception and reality. To address this issue, it is essential for city leaders to engage a broader range of stakeholders in discussions about ongoing projects, thereby fostering a sense of ownership and increasing awareness of shared financial initiatives.

Furthermore, the majority of respondents indicated "no collaboration," which may indicate structural or governance issues hindering the success of shared finance initiatives and requiring strong governance structures and mutual benefit commitments, as noted by [106]. Successful collaborative finance projects in regions such as the European Union rely on the establishment of clear agreements, mutual trust, and equitable resource sharing among diverse stakeholders [107], [108]. For the cities under study, addressing governance challenges and ensuring equitable frameworks for collaboration will be crucial for increasing both the visibility and effectiveness of shared financial initiatives.

3.2.5. Funding Sources for Urban Projects

In response to a question concerning a project's funding source, participants gave the following breakdown: (19.2%) identified municipal funds, (30.8%) stated special savings, and (34.6%) confirmed government loans. The funding breakdown, identifying government loans as the primary source, indicates a reliance on external financial support for projects, which may impact sustainability and long-term planning. The significant portion suggests some proactive financial management at the local level, while the smaller percentage relying on municipal funds may reflect constraints in local budgets or priorities. These findings imply a need for diversified funding strategies to reduce dependency on government loans, enhance local fiscal capacity, and ensure the sustainability of projects.

Participants identified government loans as the primary funding source, highlighting a significant reliance on external financial support for project implementation. This is consistent with trends observed in urban infrastructure financing to bridge funding gaps, particularly in developing regions [109-111]. For example, research on urban development in South Africa shows that excessive reliance on loans can lead to unsustainable debt levels, impacting future budgetary flexibility [112, 113]. In contrast, the respondents citing special savings as a funding source suggest some degree of proactive financial management among local stakeholders. Studies show that municipalities that establish dedicated savings funds for infrastructure projects can achieve greater financial stability and flexibility in funding decisions [114]. However, the management practices employed and the adequate support from broader fiscal policies will determine the effectiveness of these savings mechanisms.

A minor percentage (3.8%) of respondents answered affirmatively to the question of whether the topography of the cities impedes the integration infrastructure, while the majority (77.7%) answered negatively. The small percentage of respondents suggests that local entities do not perceive geographical factors as a significant barrier to collaboration. In contrast, the majority indicates that topography does not impede integration; rather, other factors, such as governance structures or community engagement, may play a more critical role in facilitating or hindering integration.

The survey results suggest that geographical features are not seen as significant barriers to integration of infrastructure. This perspective aligns with literature that highlights the adaptability of urban systems to geographic constraints through innovative land-use planning, creative engineering solutions and infrastructure development [9]. The respondents' overwhelming majority believe that topography does not impede integration indicates a recognition of the potential for strategic planning to mitigate geographical obstacles, thereby fostering inter-city collaboration.

3.3. Solid Waste Management

3.3.1. Prevalence of Common Solid Waste Disposal Sites

The survey revealed that a mere (24%) reported the existence of a common solid waste disposal site in the study area, while a substantial majority (76%) reported the absence of such a facility. The survey results reveal that the lack of a centralized disposal facility may lead to increased environmental degradation and public health concerns, as improper waste disposal practices could become prevalent in the absence of a designated site [115, 116]. The findings imply a pressing need for local authorities to prioritize the establishment of a common solid waste disposal facility to enhance waste management efforts, promote sustainability, and protect community health. Additionally, the issue of stakeholder engagement and awareness in the planning and implementation of waste management solutions suggests that improving communication and collaboration among community members and local governments is essential for effective waste management strategies.

The survey results reveal a significant gap in the perception of solid waste disposal sites in a region, with respondents recognizing the existence of a common site and asserting its absence. This disparity suggests that many people may be unaware of existing facilities or that they may not be effectively serving the community's needs. Inadequate waste disposal facilities can have serious implications for public health and environmental sustainability, contributing to pollution, vector-borne diseases, and negative health outcomes [117, 118]. The lack of a common disposal site suggests an urgent need for local authorities to develop effective waste management strategies that prioritize community health and environmental protection. The text emphasizes the significance of infrastructure investment and planning in addressing solid waste management issues, emphasizing the need for effective waste management strategies and stakeholder engagement [119, 120].

3.3.2. The Reason for the Lack of a Common Solid Waste Disposal Area

Table 2. *The reason for the lack of a common solid waste disposal area.*

S/N	Issues	Frequency	percentage
1	Lack of an integrated plan	17	34

S/N	Issues	Frequency	percentage
2	Lack of agreement	1	2
3	Lack of Compensation mechanism	8	16
4	administrative problems	24	48
	Total	50	100

Source(s): Expertise survey, 2023

As indicated in Table 2, these results mean that fixing inefficient administrative processes, creating an integrated waste management plan, and setting up ways for people to get paid will be needed to make it easier to build a common solid waste disposal area and improve waste management in the region as a whole.

Administrative problems pose a significant challenge in governance and management structures, contributing to the lack of a common solid waste disposal area. These issues, such as poor coordination, unclear responsibilities, and inadequate regulatory frameworks, often hinder effective waste management [121, 122]. Additionally, the lack of an integrated plan, a gap in strategic planning, can impede collaborative waste management efforts. Compensation mechanisms, which ensure equitable resource distribution and incentivize participation from various stakeholders, can enhance collaboration and facilitate the development of a common solid waste disposal area [123, 124]. The survey findings highlight the need for improved governance, strategic planning, equitable resource distribution, and stakeholder engagement in waste management initiatives.

3.3.3. Assessment of Integrated Solid Waste Management Plans: Gaps and Future Needs

When asked about the existence of integrated solid waste management plan, only 18% of respondents answered yes, while a substantial majority of 82% answered no. These findings highlighted a lack of coordinated and future-oriented planning for solid waste management infrastructure. Administrative challenges can hinder effective decision-making, resource allocation, and coordination among municipal authorities, leading to gaps in infrastructure planning and implementation.

The survey results highlight a critical gap in integrated strategic planning for waste management; comprehensive waste management plans are essential for effective and sustainable waste disposal practices [120-125]. Without a formalized plan, cities may struggle with waste collection, recycling, and disposal, leading to increased environmental pollution and public health risks. The absence of integrated solid waste management plan can significantly impede the effectiveness of waste management initiatives, as it requires an integrated approach that includes planning, financing, implementation, and monitoring [126, 127]. The findings also highlight the importance of developing a participatory approach in the formulation of integrated solid waste management plans, involving residents, businesses, and community organizations [128, 129].

The alternative questions about who should assume responsibility for joint cooperation received representation from the mayor's committee (30%), a newly established institute (13%), and no institute (57%). The survey results highlight that without a clear coordinating body, there is a risk of disorganization and missed opportunities for effective collaboration, necessitating urgent attention from local authorities to facilitate cooperation in waste management efforts.

The survey results reveal the lack of designated leadership can lead to fragmented efforts and inefficiencies, inhibiting effective collaboration and the implementation of comprehensive waste management strategies. The lack of a designated institute may contribute to ineffective waste management practices and failure to address urban waste challenges [130, 131]. The respondents' suggestion of a newly established institute as a coordinator presents an opportunity for innovation in waste management governance, but it requires clear mandates and sufficient resources.

3.3.4. Demand for New Solid Waste Disposal Sites

When asked if cities need new solid waste disposal sites, the survey results show that a majority (98%) of respondents agreed. Conversely, a small minority (2%) expressed that there is no need for additional waste disposal facilities. The survey results indicate that cities require new solid waste disposal sites, underscored the necessity of acknowledging the deficiencies in current waste management infrastructure, and recommend that local authorities prioritize the development of additional waste disposal sites to address the increasing waste management challenges. This highlighted fears about the potential for environmental degradation, public health dangers, and the inefficiencies of current facilities.

The survey results show that respondents believe cities need new solid waste disposal sites, highlighting the need for improved waste management infrastructure. This is in line with urban environmental studies, which show that inadequacies in waste disposal capacity can lead to environmental degradation, public health risks, and operational challenges [132, 133]. The need for new sites indicates a critical aware-

ness of the unsustainable nature of current waste management practices. The overwhelming support for new waste disposal sites may also reflect a desire for modern and sustainable waste management practices, such as recycling, composting, and waste-to-energy technologies [134, 135]. It also suggests that local authorities should engage in comprehensive planning and community involvement in waste management decision-making processes.

3.3.5. Methods of Collaboration Between the Cities

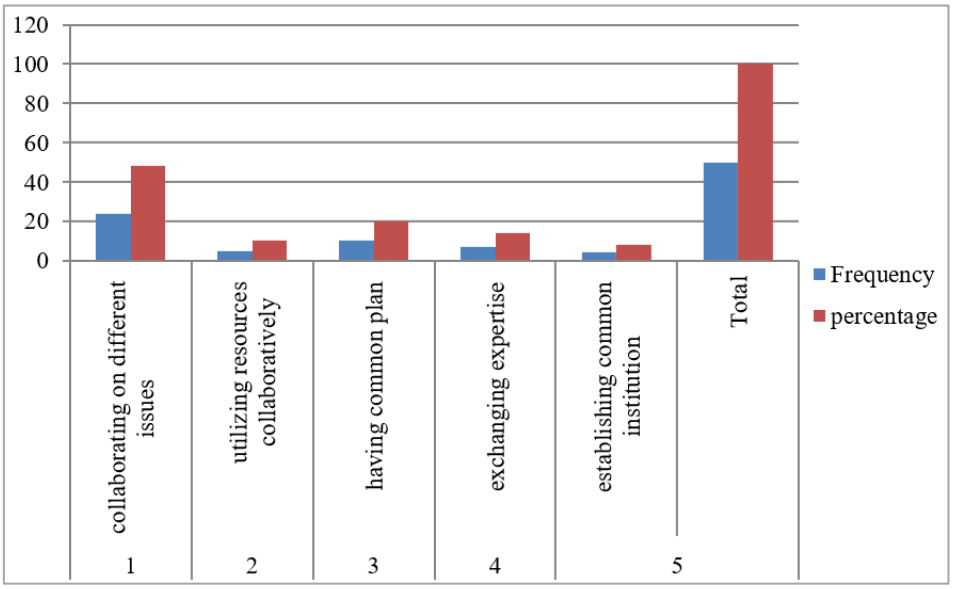

Figure 4. *Methods of collaboration between the cities.*

The implicational findings of Figure 4 suggest that cooperation between cities primarily focuses on collaborative efforts and joint planning, as these accounts for a significant portion of the responses (48% and 20%, respectively). This indicates that cities see the value in aligning goals and strategies to address shared challenges and opportunities. Additionally, the aspects of using resources together, exchanging experts, and establishing shared institutions highlight a broader understanding that effective cooperation requires resource sharing, knowledge exchange, and potentially formalized partnerships. These insights suggest that policymakers should prioritize the development of collaborative frameworks and planning mechanisms to ensure successful intercity cooperation.

The survey responses reveal a diverse approach to inter-city cooperation that aligns with research suggesting collaboration across cities is essential for addressing common urban challenges, such as waste management, infrastructure, and environmental issues [136]. The preference for informal collaboration suggests that respondents may view flexibility as critical in building effective partnerships. Resource-sharing is a strategy that urban governance literature supports as a means of achieving cost savings and efficiency gains [137, 138]. Respondents support joint planning, acknowledging the advantages of coordinated urban development [139], respondents support [140]. A formalized approach to collaboration is supported by those who advocate for the establishment of a shared institution. These preferences align with literature emphasizing the benefits of flexible, informal arrangements in fostering effective partnerships while also highlighting the potential of structured approaches in certain contexts [119, 141].

3.4. Transport and Road Network System

3.4.1. Availability of Transportation Infrastructure Connecting the Cities

The results of the survey show that 34.6% of participants said "yes," indicating that there are sufficient parking lots, bus terminals, and other forms of transportation to link the two cities. On the other hand, 65.4% of respondents said "no," indicating deficiencies in the infrastructure of transportation connecting the cities. The survey results of respondents indicated insufficient transportation infrastructure (parking lots, bus terminals, etc.) connecting the two cities, implying significant logistical and accessibility challenges for intercity movement. This deficiency likely hampers efficient commuting, economic activity, and urban integration between cities [142, 143]. The lack of adequate infrastructure can lead to increased congestion, longer travel times, and limited options for residents and businesses relying on inter-city connections [144, 145].

The survey results reveal a significant lack of transportation infrastructure between two cities, highlighting the need for systemic improvements. The majority of respondents believe

that adequate transportation facilities are crucial for urban integration and regional economic growth. Inadequate infrastructure can lead to increased congestion, reduced accessibility, and impeded economic flows, contributing to urban inefficiency [144, 146]. The lack of connectivity can restrict labor mobility and limit access to essential services, exacerbate socioeconomic disparities, and contribute to environmental degradation. The survey also highlights the importance of sustainable urban planning, which emphasizes the role of efficient public transport systems in reducing traffic congestion, emissions, and resource consumption [147-149].

3.4.2. Assessment of Transportation Infrastructure

The results showed that 26.9% of people rated the state and condition of the transportation infrastructure as good, 53% as medium, and 49.2% as terrible. The varied survey responses imply significant concerns about infrastructure quality and performance. The medium opinions suggest that while some areas or aspects of the infrastructure may meet basic standards, a substantial portion is perceived as subpar. This range of perspectives highlights the need for targeted improvements to enhance the reliability, safety, and accessibility of transportation infrastructure.

The survey results reveal significant disparities in perceived quality of transportation infrastructure in growing cities. The majority rated the infrastructure as "medium," suggesting that the transportation network is functional but may lack critical features of high-quality infrastructure, such as reliability, accessibility, and efficiency. This rating implies that while residents can navigate the current infrastructure, improvements are necessary to elevate its effectiveness, especially as cities expand and demand increases. The high percentage rating the infrastructure as terrible highlights a serious concern, pointing to fundamental deficiencies such as inadequate capacity, poor maintenance, or lack of integration in the transport network [150, 151]. This disparity suggests that infrastructure quality may be inconsistent across different locations within the cities, with some areas enjoying better conditions than others. The mixed ratings of infrastructure quality are consistent with common challenges faced by rapidly urbanizing regions, where transportation systems often struggle to keep pace with population growth and demand [152, 153].

3.4.3. Factors Influencing Integration

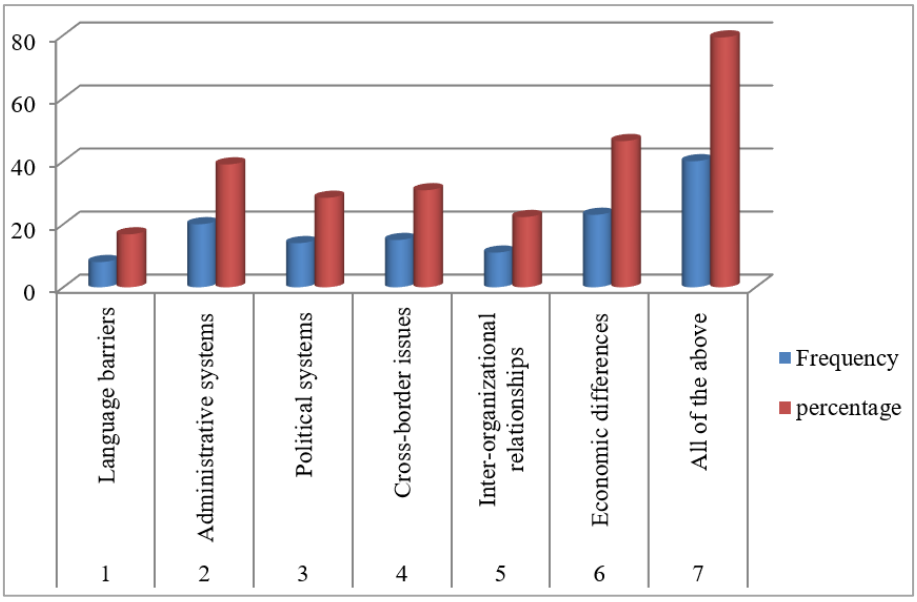

Figure 5. *Factors influence integration.*

As the findings indicate in Figure 5, participants in focus groups and interviews reiterated similar arguments and added other elements influencing integration. Respondents acknowledge a complex array of factors that hinder integration efforts. Economic disparities, administrative systems, and cross-border issues particularly underscored the multi-layered challenges to integration. This implies that successful integration requires a holistic approach, addressing economic inequalities, harmonizing administrative and political systems, and fostering inter-organizational collaboration [154]. Without a coordinated strategy that tackles these interwoven factors, integration efforts may be limited, with fragmented progress across different areas.

The survey results reveal a complex landscape of factors influencing integration efforts, with respondents identifying all these as barriers [154, 155]. Economic differences were the

most commonly cited factor, highlighting economic inequality as a significant barrier to collaborative efforts across regions. The study also identified administrative systems and political systems as obstacles, underscoring institutional and governance-related barriers. The study identified cross-border issues as a significant barrier, necessitating logistical coordination and legal frameworks to account for shared resources and responsibilities. Organizational relations and inter-organizational relationships were significant, reflecting the importance of trust, communication, and collaboration among organizations. Despite being a minor factor, language barriers can still impede integration, especially when diverse linguistic groups are involved. The survey results emphasize the need for an integrated, multi-level strategy that addresses economic disparities, harmonizes administrative and political systems, and fosters strong inter-organizational relationships. Tailored solutions that incorporate both structural reforms (such as aligning regulatory frameworks) and relational strategies (such as building trust among organizations) are likely necessary to overcome these complex barriers and realize successful integration.

3.4.4. Effects of Population Growth on Integrated Infrastructure Planning

Table 3. *Effects of population growth on integrated infrastructure planning.*

S/N	Issues	Frequency	percentage
1	increased demand for infrastructure	25	50
2	the need for collaborative management	24	48
3	necessity of open finance	29.2	58.4
4	all these impacts were possible	41.6	83.1
	Total		

Source(s): Expertise survey, 2023

Table 3's survey result highlights that Population growth significantly influences infrastructure planning; increasing demand and necessitating open financing and collaborative management, according to the survey. 83.1% of respondents acknowledge the combined impact of these factors, suggesting that infrastructure planning needs adjustments to facilitate sustainable growth. This means cities need integrated approaches that include resource sharing, transparent financial strategies, and coordinated efforts to meet increasing demands. Ignoring any of these factors could result in strained resources and inadequate infrastructure to support population expansion effectively.

Respondents indicated increased demand for infrastructure, indicating that urban population surges often outpace adequate development [153, 156]. This can strain existing systems, necessitating a reevaluation of infrastructure planning strategies. 48% of respondents noted the need for collaborative management, highlighting the importance of integrated approaches in addressing complexities introduced by population growth [157]. 58.4% of respondents emphasized [158]. 83.1% of respondents acknowledged the interconnectedness of demand, collaboration, and financing, highlighting the need for a comprehensive strategy that considers social, economic, and environmental factors [159, 160]. These findings underscored the critical need for coordinated efforts and innovative funding mechanisms to ensure sustainable infrastructure development for urban areas.

3.4.5. The Reasons for the Absence of Integrated Infrastructure Planning

Table 4. *The reasons for the absence of integrated infrastructure planning.*

S/N	Issues	Frequency	percentage
1	Hesitancy among stakeholders	5	10
2	Lack of support from policymakers	11	21.2
3	Lack of leadership	16	31.2

S/N	Issues	Frequency	percentage
4	Lack of attention	18	36.1
	Total	50	100

Source(s): Expertise survey, 2023

Table 3's results indicate that the most significant obstacles to integrated infrastructure planning are a lack of attention and leadership. This suggests that effective planning requires both strong, visionary leadership and priority-setting. The absence of support from policymakers and stakeholder hesitancy further underscores the necessity for increased political commitment and confidence among all parties involved. This implies that policymakers and planners must take proactive measures to secure policy support and engage stakeholders, thereby mitigating hesitation and promoting integrated infrastructure planning. Additionally, they will need to increase their focus and leadership.

The survey results reveal several barriers to integrated infrastructure planning, including stakeholder hesitancy, lack of support from policymakers, a lack of leadership, and lack of attention. Stakeholder hesitancy can stem from fears of losing control over decision-making, resource allocation concerns, or apprehensions about the efficacy of collective efforts. Policymakers play a crucial role in facilitating or obstructing collaborative efforts, and advocacy for policy reforms that promote integrated planning and allocate resources can help overcome these challenges [3, 161]. A clear strategic vision is also essential, as without a unified focus; stakeholders may become disengaged, leading to fragmented initiatives. Increasing awareness of the long-term benefits of integrated planning can address the institutional bias towards siloed planning efforts reflected in the lack of attention to integrated planning [162, 163].

Within the infrastructure-provider sectors, we observe the following patterns of coordination: There are three different levels of coordination: strong (26.9%), weak (57.7%), and unknown (11.5%). This indicates that people generally perceive infrastructure suppliers to be poorly coordinated. This can lead to inefficiencies and challenges in managing intricate, interdependent services. A dominant approach with weak coordination leads to a fragmented approach, where providers operate in silos. This fragmentation can lead to higher costs, duplicated efforts, and slow response times during crises, underscoring the need for standardized practices and improved communication.

Research on coordination in the infrastructure-provider sector reveals challenges and tendencies towards weak coordination [164]. This lack of cohesion can hinder service reliability and reduce operational costs. Addressing these issues could help improve data transparency and develop more rigorous assessment tools. Public administration literature, which emphasizes the difficulties in cross-sector coordination due to competing objectives and limited incentives for alignment, aligns with the perception of poorly coordinated infrastructure suppliers.

4. Conclusion and Recommendations

4.1. Conclusion

Lack of an integrated sewerage system between cities is a global issue, involving issues such as disagreement, boundary disputes, inadequate compensation, and lack of a legal framework. This highlights the need for cohesive policies and cooperative governance to improve urban living conditions and environmental health. The survey results also reveal a significant gap in coordinated drainage management, highlighting the need for cities to prioritize collaborative efforts in developing and implementing shared drainage management strategies. The lack of flood protection for vulnerable populations in lower reaches also highlights the need for urgent development and implementation of flood protection strategies. The majority of respondents express a positive outlook toward collaboration among cities and sub-cities, but significant minorities do not prioritize these efforts. The survey results also highlight a significant challenge in institutional integration among stakeholders, emphasizing the need for clear legal structures that promote collaboration and enhance inter-agency coordination. The survey also reveals a critical gap in the perception of solid waste disposal facilities, with a majority indicating the absence of a common site. The findings call for local authorities to prioritize the development of effective waste management strategies, improve stakeholder engagement, and invest in necessary infrastructure.

The survey results reveal significant challenges in strategic planning and stakeholder engagement in urban areas, with only a few respondents recognizing the existence of a solid waste management plan. The lack of a specific institute for coordinating joint cooperation in solid waste management suggests the need for local authorities to establish formal governance structures for effective waste management. The respondents assert the necessity for new solid waste disposal sites, underscoring a deficiency in waste management infrastructure. The majority of respondents favor collaboration on various issues, with smaller groups advocating for resource sharing, joint planning, knowledge exchange, and institutional establishment. Transportation infrastructure gaps hinder economic and social integration, and the majority view existing facilities as adequate.

The survey results emphasize the need for an integrated, multi-level strategy that addresses economic disparities, harmonizes administrative and political systems, and fosters strong inter-organizational relationships. Tailored solutions, incorporating structural reforms and relational strategies, are likely necessary to overcome complex barriers and achieve successful outcomes. The survey findings resonate with existing literature on integrated infrastructure planning in the context of population growth.

4.2. Recommendations

We propose the following recommendations to improve the integrated infrastructure planning practices between Addis Ababa and Sheger metropolitan cities, based on the study's findings and conclusions.

1) The concerned body, particularly the cities administration should establish a legal framework for cooperation.
2) The cities administration planning institutes should develop integrated infrastructure plan for well-coordinated infrastructure management.
3) The cities Road Authority should expand flood protection and stormwater management.
4) The Federal Government and the cities administration should create institutional support for ongoing collaboration.
5) The cities administration should encourage public and political support for integration.
6) The cities administration and concerned body should improve transportation connectivity and infrastructure quality.
7) The Federal Government and the cities administration should address economic, political, and administrative barriers to integration.
8) The cities administration and concerned body should enhance infrastructure coordination levels.

Abbreviations

FGDs	Focus Group Discussions
KIIs	Key Informant Interviews
SPSS	Statistical Package for the Social Sciences

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Author Contributions

Geremew Worku: Comprehended and designed the experiments; executed the experiments; analyzed and interpreted the data; contributed components, materials, analysis tools or data; and wrote the paper.

Dagnachew Adugna: Comprehended and designed the experiments; executed the experiments; analyzed and interpreted the data; contributed components, materials, analysis tools or data; and wrote the paper.

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Conflicts of Interest

The authors declare no conflicts of interest

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Research Article

The Challenges of Integrated Infrastructure Planning Between the Metropolitan Cities of Ethiopia, the Case of Addis Ababa and Sheger

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Abstract

Rapid urbanization in developing countries necessitates enhanced infrastructure provision, management, and integration but often faces challenges like inadequate provision, inefficient governance, poor maintenance, and lack of integrated planning. As a result, the aim of this study is to identify and analyze the key challenges that are associated with the effective planning and implementation of integrated infrastructure planning in the study area. The study used a mixed-methods approach and descriptive and explanatory research designs, convenient sampling and empirical data collection from questionnaires, surveys, interviews, and FGDs are analyzed using Microsoft Excel, ArcGIS, and SPSS. The finding of the study highlights critical challenges in urban infrastructure development, including poor stakeholder coordination, resource constraints, and inadequate governance. Rapid urbanization, outdated infrastructure, and weak planning exacerbate key issues such as insufficient urban drainage, sewerage, solid waste management, and transportation systems. Global comparisons underline the need for integrated planning, advanced technology, and strong institutional frameworks to enhance efficiency and sustainability in addressing these problems. Therefore, the study recommends that to solve problems with urban infrastructure, it is important to encourage stakeholders to work together and use comprehensive planning strategies to improve resource allocation, capacity-building programs, and meaningful community engagement.

Keywords

Challenges, Integrated Infrastructures Planning, Metropolitan Region, Coordination

1. Introduction

Nowadays, a global trend of rapid urbanization demands better provision, management, and integration of infrastructure through sound planning and delivery [1, 2]. According to [3, 4], institutions and structures that emerged in the late nineteenth and early twentieth centuries, along with incremental, ad hoc, and largely path-dependent changes in technology, markets, and regulatory processes, manage and organize nearly all infrastructures in the developed world. Evidence indicates that developed countries have improved integration among institutions and infrastructure. As a result of this rapid urbanization and urban growth inevitably expands beyond cities' original boundaries to neighboring jurisdictions [5, 6]. There is a

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growing discussion today that various forms of 'infrastructure integration' could enable networks to become smarter, more cost-effective, and more environmentally friendly [7-10]. Urbanization creates metropolitan areas or city regions, consisting of a densely populated urban core and it's sparsely populated surrounding territories that share industry, infrastructure, and housing [11]. The general populace perceives metropolitan areas as generators of regional development in a globalizing world [12-15].

Integrated infrastructure is a cornerstone of sustainable urban development, ensuring efficient service delivery, resource optimization, and enhanced quality of life for residents [16, 17]. In Ethiopia, the growing urbanization and rapid expansion of metropolitan cities, in Addis Ababa and Sheger, have amplified the need for coordinated infrastructure planning. Effective integration of infrastructure systems spanning transportation, utilities, housing, and public services is essential for fostering economic growth and environmental sustainability [7]. However, achieving this level of integration poses significant challenges in the Ethiopian context.

One of the primary obstacles is the lack of collaboration among key stakeholders, including municipal authorities, urban planners, developers, and local communities. This disjointed approach often results in fragmented planning efforts, inefficiencies, and delays in project implementation. Additionally, resource constraints financial and technical further exacerbate the challenges, leaving critical infrastructure projects underfunded and under-resourced. The shortage of skilled personnel, lack of technology and limited access to modern machinery also hinder the effective design and execution of integrated infrastructure systems in the study area.

Existing literature highlights the importance of addressing these barriers to achieving sustainable urban development. However, there is a notable gap in research exploring the specific challenges faced by Ethiopian metropolitan cities in planning and implementing integrated infrastructure [18, 19]. This study seeks to fill this gap by identifying and analyzing the key obstacles to integrated municipal infrastructure planning between Addis Ababa and Sheger, offering insights that can inform policy and practice. For this as a rationale, we chose these cities because they are the economic hubs of the Ethiopia and Oromia regions, are actively expanding their gray infrastructure to support the economy, and are experiencing rapid population growth, which is exerting substantial pressure on green spaces.

Furthermore, a significant number of government and private employees work in Addis Ababa while residing in Sheger City, and vice versa. However, a lack of integrated infrastructure planning, financial planning, and institutional collaboration between the two cities could significantly impact the smooth operation of transportation infrastructure systems, thereby reducing the efficiency and quality of life of the employees. Furthermore, the upstream wastewater production has a significant potential impact on the downstream environment. Consequently, a lack of integrated development intervention between the two metropolitan cities is likely to perpetuate such circumstances.

As a result, the aim of this study is to identify and critically analyze the key challenges hindering the effective planning and implementation of integrated infrastructure between the cities of Addis Ababa and Sheger. The other subsidiary objectives are: 1)The study aims to identify and categorize the main institutional, financial, and technical challenges affecting integrated municipal infrastructure planning in the study area.2)The study aims to evaluate the efficacy of current policies, frameworks, and coordination mechanisms in municipal infrastructure planning in the study area.3) Formulate evidence-based recommendations for the enhancement of coordination, resource allocation, and implementation of integrated infrastructure planning.

The study's results will provide a comprehensive understanding of these challenges. It will serve as a valuable resource, offering essential insights to policymakers, development administrators, urban planners, and government decision-makers to facilitate the implementation of policies and strategies. Additionally, we anticipate a more comprehensive understanding of the obstacles associated with the planning of integrated infrastructure, which will clarify the policy-making process for urban development in Ethiopia and other comparable contexts in developing countries.

2. Materials, Methods and the Study Area

2.1. Study Area

Ethiopia's capital city, Addis Ababa, functions as its political, economic, and cultural epicenter [20] and [21]. The most recent data [22] estimates the population of Addis Ababa, Ethiopia's capital metropolis, at approximately 5,704,000. Urbanization, economic development, and migration from rural areas have all contributed to the city's accelerated growth in recent years [23, 24]. Nevertheless, the accuracy of population estimates may differ depending on the source, as official censuses may not accurately reflect real-time development. The developing world has experienced economic development opportunities as a result of rapid population growth. However, this growth has also brought about social, environmental, and cultural challenges, leading to a discrepancy between the demand and supply of services [20]. It is imperative to comprehend the dynamics of urbanization and infrastructure development in Addis Ababa in order to evaluate the efficacy of integrated planning initiatives.

In recent decades, there has been a substantial increase in the quantity of social and physical infrastructure; however, there is still a significant need for enhancement in terms of quality and distribution [21]. The government's strategies for its extensive urban investments, which combine the enhancement of the urban environment with the creation of economic opportunities, particularly for urban youth, have yielded some promising results [21]. Nevertheless, it is imperative that we assess, ad-

just, or supplant the policies and strategies in accordance with their effectiveness in addressing the city's chronic issues [21].

The Addis Ababa metropolitan area, as well as Sheger, is currently experiencing substantial population growth and urban expansion, which is resulting in heightened pressure on infrastructure and services. Analyzing the integration of planning processes and infrastructure investments throughout the Sheger Metropolitan Area provides insights into regional development dynamics and interdependencies. A number of satellite cities and villages surround the capital.

Sheger City, a late-established city in the Oromia National Regional State, consists of 12 subcities and villages. Out of this, we deliberately selected three of these sub cities as case study sites: Burayu, Sebeta/Furi, and Galan (Figure 1). For this as a rational, we chose these cities because they are the economic hubs of the Ethiopia and Oromia regions, are actively expanding their gray infrastructure to support the economy, and are experiencing rapid population growth, which is exerting substantial pressure on green spaces. The following Figure 1 shows the location map of the study area.

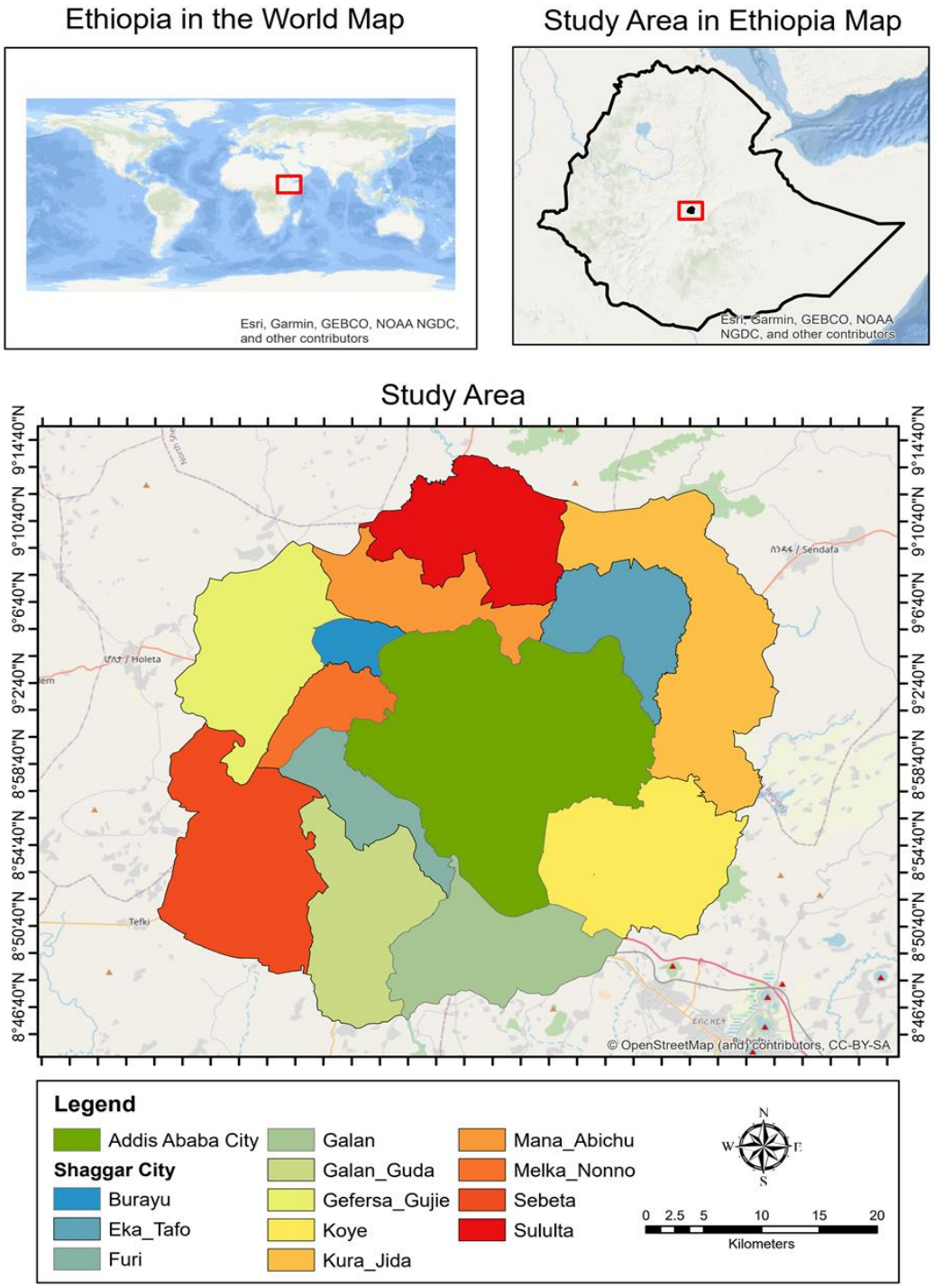

Figure 1. *Location map of the study area.*

2.2. Research Methodology

This study uses descriptive and explanatory research designs to investigate the challenges of integrated municipal infrastructure planning among Ethiopian metropolitan cities. Descriptive analysis highlights key issues, while explanatory analysis examines causal relationships and contributing factors [25]. We apply a mixed-methods approach, combining quantitative and qualitative research to ensure a comprehensive understanding. Quantitative data offers measurable insights, while qualitative data provides contextual and stakeholder perspectives [26]. The study sites encompass metropolitan areas like Addis Ababa and Sheger city, as well as selected sub cities such as Burayu, Gelan, and Sebeta/Furi, chosen for their unique urban development characteristics. These locations reflect diverse urbanization and infrastructure integration contexts.

We employ a convenient sampling strategy to select towns and participants, with a focus on municipal officials, urban planners, and community representatives. Infrastructure categories include transport and road networks, sewerage and drainage systems, and solid waste management systems. Data collection involves structured surveys for quantitative insights, in-depth interviews, focus group discussions, and field observations for qualitative analysis. Secondary data from government reports and plans supplement primary data collection. Data analysis combines statistical techniques for quantitative findings and thematic analysis for qualitative narratives. Triangulation ensures the reliability of results and highlights any inconsistencies between data sources. The study adheres to ethical guidelines, including informed consent, data confidentiality, and cultural considerations, ensuring a responsible and inclusive research process.

2.3. Data Types and Sources

This study has extensively used both primary and secondary data, including both quantitative and qualitative from Addis Ababa and Sheger city (Burayu subcity, Galan subcity, and Furi subcity), which were the sources of the data. We collected the primary data through various methods and tools such as questionnaires, Focal group discussions (FGDs), and structured and semi-structured interviews with city officials, professionals, and community representatives. We also conducted field observations to enhance the quality of the data and gather additional insights.

We extracted secondary data from research findings, books, review articles, and both published and unpublished reports to compare and bolster the primary sources.

2.4. Sampling Techniques and Sample Size Determination

The study employed a non-probability sampling method to collect data from 257 experts working across five critical urban infrastructure sectors in Addis Ababa and three selected subcities (Burayu subcity, Galan subcity, and Furi subcity) of Sheger City, as shown in Table 2 below. The human resource report of Addis Ababa and the subcities of Burrayu, Galan, and Furi in Sheger city indicate that 980 experts or professionals are relevant to the research topic. This approach allowed the researchers to focus on individuals with specialized knowledge and expertise in transport and road networks, waste management systems, and drainage and sewerage systems. The sampling frame consisted of the entire population of experts in the selected sectors, ensuring the inclusion of only qualified individuals with relevant educational backgrounds and professional experience.

We used a convenient sampling technique to select participants from each sector, highlighting their professional relevance and contributions to integrated infrastructure planning. This deliberate selection process ensured the inclusion of those most capable of providing comprehensive and reliable data [27, 28]. Furthermore, the targeted selection allowed for efficient data collection, avoiding the unnecessary sampling of individuals with limited knowledge of the subject matter.

We conducted focus group discussions (FGDs) and interviews with selected respondents to capture diverse perspectives for qualitative data. Following the recommendation that FGD sessions should not exceed 10 participants [29], the study organized FGDs with a total of 90 participants from various population segments. The selection process aimed to ensure fair representation across different sub cities, with participants drawn from community representatives, technical experts, and local authorities. Table 1 and Figure 2 summarizing the number of FGDs and respondents across the Addis Ababa and Sheger sub cities reflect a balanced and structured sampling framework. The study makes sure that problems with integrated infrastructure planning are looked at in a strong and critical way by using purposeful sampling and a clear process for choosing participants. This strategic approach maximizes the reliability of insights while maintaining methodological rigor [30, 31].

Table 1. *Number of FGDs conducted in Addis Ababa and each sub city.*

No	Sub city	No. of FGD	Participant per FGD	Total number of participants
1	Addis Ababa	3	10	30

No	Sub city	No. of FGD	Participant per FGD	Total number of participants
2	Sabata/Furi	2	10	20
3	Gelan	2	10	20
4	Burayu	2	10	20
	Total	9	10	90

Source(s): FGDs survey, 2023

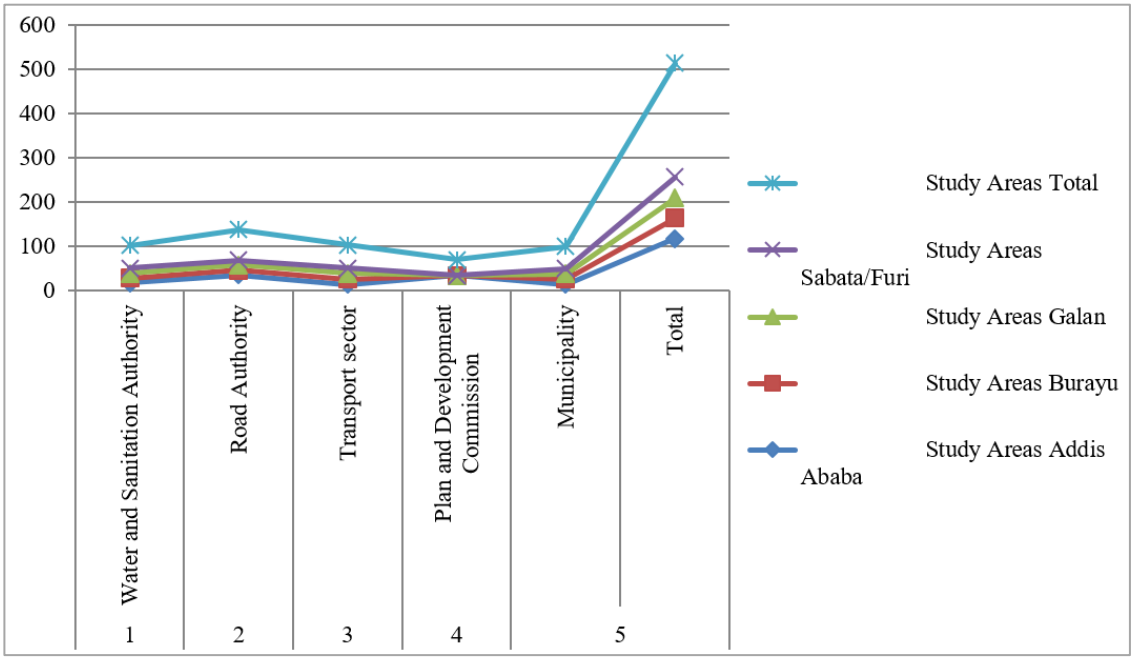

Figure 2. *The number of respondents from different sectors answered the questionnaires.*

2.5. Data Collection Methods

In order to accomplish the research objectives, we implemented a blend of quantitative and qualitative data collection methodologies. This investigation employed both primary and secondary data. To supplement these methodologies and collect primary data, we developed both closed-ended and open-ended questionnaires. We disseminated these to experts in a variety of infrastructure sectors, addressing a variety of topics, including planning, integration, challenges, and proposed solutions. The questionnaires also inquired about the existence or absence of infrastructure management and collaborative or integrated planning. We acquire secondary data from a variety of sources, including periodicals, books, journals, and reports. It is imperative to possess a comprehensive understanding of the survey area and its inhabitants prior to employing any formal questionnaire procedure [32]. Subsequently, we devised a variety of inquiries for expert perspectives, focus group discussions, and key informant interviews, following a comprehensive examination of the study area and adherence to the objectives. We have sufficiently devised the questions to ensure that the research focuses on the pertinent aspects required to provide responses to the research topics. Twenty graduate students from a variety of university backgrounds, well-versed in research ethics, conducted the data collection over a two-month period. We conducted the investigation in two phases. The initial stage consisted of the preliminary data collection and pre-survey preparation. Before the full-scale administration, we verified that the queries were substantively significant, logical, and appropriate. In conclusion, in total, we disseminated questionnaires to 257 experts, and we were able to collect 100% of them.

2.5.1. Expert Perspectives

In order to acquire primary and secondary data for both quantitative and qualitative analysis, we elected to implement a field survey. The questionnaire surveys were the most critical component of the fieldwork that occurred during the summer of 2023. This study implemented the "formal standardized questionnaire method" in conjunction with other data collection methodologies. The primary objective of the

expert survey was to acquire a deeper understanding of the planning of integrated infrastructure. We distributed survey questionnaires to 257 purposefully selected and pertinent professionals in the five sectors of the study area. With the help of the data collectors, we made significant efforts to ensure accurate completion and return of all questionnaires. The questionnaires consist of both open-ended and closed-ended queries in order to collect additional information regarding the knowledge gap. As part of a retrospective data-gathering strategy, we were collecting current information. Selected professionals with expertise in urban infrastructure planning comprised the cohort. In order to expedite the process of contacting respondents, researchers implemented convenience and snowballing sampling methods after determining the total number of respondents.

2.5.2. Focal Group Discussions

The study also utilized focus group discussions (FGDs). We utilized 9 groups, each with 10 participants, as seen in Table 1 to foster an open exchange of ideas, which is particularly beneficial for exploring complex issues related to infrastructure development and integration. Additionally,

2.5.3. Key Informant Interviews

This study utilized structured and semi-structured interviews to gather data on integrated infrastructure planning. We conducted the interviews on-site and in office, with permission, recorded them using an audio recorder to ensure accuracy and detail [33, 34]. We conducted interviews with key informant stakeholders, officials, and community representatives to understand the challenges of integrated infrastructure planning in the study area. We conducted the interviews in the study area, each lasting an average of 35 minutes. The interviews were focused on the city's policies, strategies, legal frameworks, challenges, and coping mechanisms.

2.5.4. Field Observations

We utilized a methodology similar to, which involved extensive participant observation. We conducted these observations using a camera and short notes to investigate and assess existing integrated infrastructure planning problems arising from poor integration, planning, and management, thereby providing a visual representation of the identified challenges.

2.5.5. Documents

This study used secondary data to develop information on legal and policy frameworks, reports, infrastructure development trends, and other critical data. Consequently, we collected secondary data from a diverse range of sources, including academic journals, books, published and unpublished documents, government policy documents, proclamations, and statistical data. We collected secondary data from sources such as Addis Ababa structural plan, the federal urban planning institute, Addis Ababa transport policy document, the Addis Ababa draft sanitation plan, Addis Ababa draft drainage plan, Shegere draft structural plan, and urban planning implementation manual.

2.6. Data Analysis and Presentation

Data gathered using interview, questionnaires, observation and focus group discussion were analyzed in two ways. Quantitative data collected through closed-ended questionnaire were edited, coded, classified, and then encoded into a computer and analyzed using Microsoft excel, AutoCAD and ArcGIS software, Statistical Package for Social Science (SPSS), Version 24 software. We employed a methodical approach to analyze data from focus group discussions (FGD) and observations. Initially, we transcribed the FGD recordings and categorized the responses into thematic areas, with a particular emphasis on recurring patterns, critical insights, and differences in perspectives. We compiled field notes to collect observation data, emphasizing specific behaviors, interactions, and environmental contexts. To validate or contrast the findings, we then triangulated both data sets by comparing the FGD insights with observed actions. The analyzed data is presented in tables, graphs, charts, and percentages.

3. Results and Discussion

Regional infrastructure development is a critical mechanism for promoting sustainable development [35-37]. The region's socio-economic system generally views infrastructure as a component that fosters economic growth. Integration necessitates both coordination and cooperation, as it involves the unification of individuals into a single system. It also advocates for the establishment of a unified, formalized decision-making system and the procedures that enable its operation [38]. The precinct is of significant importance to national economic drivers, and it is imperative that we implement integrated infrastructure planning to mitigate potential future constraints that could limit its productivity and efficiency [39, 40]. We address the following topics in the context of these circumstances:

3.1. Urban Drainage System

3.1.1. Challenges of Integrated Drainage System Development

Table 2. *Challenges of integrated drainage system development.*

No	Issues	Frequency	Percentage
1	Lack of collaboration among multiple stakeholders	114	44.5

No	Issues	Frequency	Percentage
2	Inadequate financial resources	73	28.3
3	Inadequate skilled man power	49	19
4	Insufficient machinery	21	8.2
	Total	257	100

Source(s): Expertise survey, 2023

The findings in Table 2 highlighted the critical need for enhanced collaboration among stakeholders in addressing integrated infrastructure challenges. The respondents cited the absence of collaboration, highlighting how disjointed efforts between users, designers, developers, and other parties hinder progress. This lack of coordination underscored the importance of fostering stakeholder engagement and joint planning to streamline efforts and maximize impact. Additionally, resource-related issues, including insufficient funding, skilled manpower, and machinery, further exacerbate the situation. These limitations indicate that a comprehensive strategy to allocate resources effectively and build local capacity is essential.

The results align well with the study's objectives of identifying key obstacles to integrated municipal infrastructure planning. The prioritization of challenges confirms that stakeholder collaboration is a critical factor, directly impacting resource allocation and capacity building. This suggests that the development of an integrated urban drainage system in the study area necessitates the coordination and collaboration of a variety of stakeholders [41, 42]. However, a lack of effective coordination mechanisms can lead to resource inefficiency, conflicting priorities, and duplication of efforts, as confirmed during focus group discussions and key informant interviews.

For example, there is no agreement between the two cities regarding the location of a solid waste disposal site or the construction of a dam for drinking water. Hence, effective infrastructure development and maintenance necessitate sufficient financial, human, and technological resources [7, 35, 43, 44]. As document analysis indicates, there were no common financial sources for the development of integrated urban infrastructure like roads, dams, flood protections, and others. A lack of adequate resources can impede the implementation of integrated urban infrastructure projects and the resolution of urgent issues, such as flooding [45, 46].

Other developing countries facing rapid urbanization have documented similar challenges. Studies from sub-Saharan Africa, South Asia, and Latin America consistently highlight the importance of stakeholder coordination and resource mobilization in infrastructure planning [47, 48]. For instance, research in Kenya and India emphasizes that collaborative frameworks significantly improve project efficiency and sustainability. These parallels validate the relevance of the findings within a broader global context, demonstrating that the issues faced by Ethiopian metropolitan cities are part of a larger pattern in comparable regions.

The study contributes to the theoretical advancement of urban infrastructure planning by emphasizing the interplay between collaboration, resource availability, and technical capacity. Conceptually, it underscored the necessity of adopting a systems-based approach, where multiple stakeholders work cohesively to address shared challenges. Methodologically, the study provides a framework for identifying and prioritizing barriers, which can guide future research and policy formulation in similar urban contexts.

3.1.2. Perspectives and Challenges in the Adequacy of Urban Drainage System

The study's findings highlight a critical issue regarding the inadequacy of drainage systems in the study area. The significant disparity in perceptions, with only 21.7% of respondents considering the system sufficient and 78.9% deeming it inadequate, underscores the urgent need for improved drainage infrastructure. Field observations corroborate this perception, revealing the absence or scarcity of both open and closed drainage systems, particularly in older road networks. These results suggest systemic neglect in urban infrastructure maintenance and planning, which poses risks of flooding, road degradation, and public health concerns. Such areas lack drainage facilities, indicating inadequate upgrades or maintenance to meet contemporary needs. This phenomenon is frequently observed in rapidly urbanizing regions, where drainage system development is unable to keep pace with population growth and urban expansion [49-51]. The findings align with the study's objectives of assessing infrastructure challenges and highlight drainage as a critical bottleneck in urban planning.

The overwhelming perception of insufficient drainage systems highlights a potential gap in urban infrastructure planning and investment. The absence of proper drainage system, particularly on older roads, points to a need for systematic retrofitting and upgrading of outdated infrastructure [52, 53]. Urban planners and local governments must prioritize drainage in their planning agendas to ensure that both new and old parts of the cities are resilient to environmental stresses. Additionally, the study suggests that the focus on building flood drains only along newly built highways is an example of an approach to development that puts more emphasis on building new infrastructure than on installing new systems and making them better. The mismatch between infrastructure provision and community requirements underscored the significance of meaningful community engagement and participation in infrastructure planning and decision-making processes [54, 55]. Inadequate consideration of local knowledge and preferences can result in a disconnection between infrastructure solutions and the realities and priorities of residents [56, 57]. The results mirror challenges observed in other rapidly urbanizing regions in developing countries. For instance, studies in cities like Nairobi and Dhaka have similarly identified insufficient

drainage infrastructure as a significant urban challenge. These cases linked poor drainage systems to increased flooding, erosion, and public health risks. The parallels between these findings and the current study indicate that the challenges faced in Ethiopian metropolitan cities are not unique but part of a broader trend in under-resourced urban environments. This study underscores the significance of drainage systems in older road networks for urban infrastructure planning, emphasizing the necessity for a thorough assessment and prioritization of infrastructure upgrades in rapidly expanding urban areas.

3.2. Major Challenges of Sewerage Management System

Table 3. *Major challenges of Sewerage management system.*

No	Issues	Frequency	Percentage
1	lack of financial resources	131	50.9
2	lack of coordination among stakeholders	84	32.7
3	lack of skilled human power and geographical landscape	42	16.4
4	Total	257	100

Source(s): Expertise survey, 2023

The data in Table 3 reveals significant challenges in infrastructure development, with (50.9%) of respondents citing a lack of financial resources as the most pressing issue. This indicates that financial constraints significantly hinder the ability to implement and maintain essential sewerage treatment plant projects. The lack of coordination among stakeholders, cited by (32.7%) of respondents, suggests that even when resources are available, inefficiencies and misalignment between municipalities, private sectors, and local communities, as also observed from FGDs, prevent effective project execution. Additionally, (164%) of respondents point to a lack of skilled human power, and geographical landscape means terrain such as mountains, hills, and uneven surfaces found in the study areas can complicate construction efforts and increase costs. The slope in the study areas is gentle, and the flow line from the sewerage to the treatment plant is from the upper area to the bottom, in contrast to the present literature, as indicated by the respondents' responses. Additionally, some specific areas prone to flooding or with unstable soil conditions require specialized engineering solutions to ensure structural stability and long-term functionality.

The results align with the study's objectives of identifying and analyzing challenges in sewerage management. The prioritization of financial resources as the primary issue validates the hypothesis that resource constraints are a fundamental barrier to sustainable sewerage systems [58, 59]. For example, in India, inadequate funding for sewage treatment plants has contributed to widespread water pollution issues. Furthermore, the inclusion of stakeholder coordination and technical capacity issues supports the study's premise that these challenges are interrelated and require a holistic approach to address them effectively. Effective liquid waste management requires collaboration and coordination among various stakeholders, including government agencies, private sector entities, and community organizations [60]. For instance, in Kenya, fragmented governance structures have hindered efforts to improve sanitation services in urban areas [61, 62]. Insufficient human resources and terrain significantly influence the design and functionality of sewerage systems, which primarily rely on gravity flow to transport wastewater. Gravity can effectively transport effluent in regions with a consistent, moderate slope, thereby minimizing the necessity for mechanical pumps. However, level terrains pose challenges [63], as an inadequate slope hinders the natural flow, often requiring the installation of costly pumping stations and increasing the risk of stagnation. In countries like Nepal, the rugged terrain and shortage of trained personnel have hampered efforts to provide adequate sanitation services in remote areas [64]. The absence of established formal structures for coordinating urban development and infrastructure provision exacerbates the challenges associated with sewerage systems [65, 66] highlight the importance of multi-stakeholder collaboration and partnerships in urban infrastructure development. Integrated urban planning approaches that consider multiple sectors and stakeholders are essential for addressing complex urban challenges holistically. Examples from cities like Curitiba, Brazil, highlight the benefits of integrated planning in improving urban infrastructure and quality of life [67-69].

The findings suggest a pressing need for a multi-faceted approach to address the identified challenges, involving increased investment, improved coordination among stakeholders, capacity building, technological innovation, and coherent policy frameworks. Addressing these challenges requires a comprehensive strategy that acknowledges the interconnectedness of urban development and waste management issues. The difficulties in managing sewerage systems in the study areas are indicative of broader patterns observed in urban areas globally, highlighting the need for a holistic approach to tackle wastewater management challenges. The challenges identified are consistent with findings from similar studies in other developing countries. Research from regions such as South Asia and sub-Saharan Africa has highlighted financial limitations as a primary obstacle to effective sewerage management [70, 71]. For example, studies in India and Kenya have shown that inadequate funding leads to poorly maintained sewerage systems, exacerbating public health risks. Similarly, the lack of stakeholder coordination has been recognized as a global challenge, emphasizing the need for integrated planning and governance frameworks [72]. The alignment of these findings with the current study underscores the universality of these

challenges in under-resourced urban contexts. The study highlights the need for a systems-based approach to address financial, organizational, and technical barriers in sewerage management. It provides a model for analyzing issues, highlighting targeted investments and collaborative governance.

3.2.1. Impact of Rapid Urbanization on Sewerage Systems and the Need for Innovative Solutions

The findings emphasize the significant impact of rapid urbanization (85.7%) on the sewerage system. As urban areas expand, the volume of wastewater increases, necessitating advanced technology and innovative solutions to manage the growing complexity effectively. This underlines the strain urbanization places on existing sewerage infrastructure, making it clear that traditional methods are insufficient to handle the rising demands. The key informant interviews conducted further validate these findings, highlighting the substantial financial investments required to construct and maintain modern sewerage systems and lines in urban regions. This result indicates a strong correlation between urban growth and the increasing complexity of infrastructure challenges, particularly in sewerage management. The results directly align with the study's goals of understanding the effects of urbanization on sewerage systems [73, 74]. The confirmation by respondents and interviewees reinforces the validity of the data, showing consistency across different sources. Additionally, the identification of technological needs and financial constraints supports the study's premise that urbanization not only increases system demands but also necessitates comprehensive planning and resource allocation to address these challenges effectively.

The findings highlighted the urgent need to address the impact of rapid urbanization on sewerage systems and the importance of investing in innovative solutions to effectively manage increased wastewater volumes in the study areas [75, 76]. These challenges highlighted the necessity for coordinated efforts among various stakeholders to develop and implement sustainable solutions for urban wastewater management. The challenges in managing sewerage systems in the study areas are representative of broader urbanization-related issues seen globally. Both developed and developing countries design contemporary integrated sewerage management systems in city regions to tackle the challenges of urbanization, environmental protection, and public health [77, 78]. Integrated urban planning techniques that consider various sectors and stakeholders are crucial for enhancing urban infrastructure and quality of life, as evidenced by successful examples such as Curitiba, Brazil [79, 80]. The challenges identified in this study are consistent with global trends observed in other rapidly urbanizing cities. For example, studies in cities like Lagos and Mumbai have shown that rapid urbanization exacerbates the strain on sewerage systems, leading to higher volumes of wastewater and requiring significant technological innovation and financial investment [81, 82]. The findings also align with research highlighting the complexity of urban sewerage systems in developing regions, where outdated infrastructure struggles to cope with rapid growth. These similarities confirm that the issues faced in the study area are part of a broader global phenomenon. This study explores the relationship between urbanization and sewerage system challenges, emphasizing the need for innovative technology and adaptive solutions, using quantitative survey data and qualitative insights for future research.

3.2.2. Institutional Gaps in Sewerage Service Coordination

The results reveal a critical gap in sewerage service management, with 86% of respondents indicating the absence of formal or informal institutions dedicated to organizing sewerage services in the study area. This indicates a lack of institutional frameworks for planning, coordinating, and managing essential sewerage infrastructure. The absence of such structures can lead to uncoordinated efforts, inefficiencies, and the inability to address growing urban sewerage challenges effectively. These findings underscored the fundamental role of governance and institutional mechanisms in ensuring the functionality and sustainability of urban sewerage systems. The identified challenges in sewerage management highlight the necessity for comprehensive interventions that encompass institutional reforms, legal frameworks, financial investments, government attention, awareness-raising efforts, and institutional cooperation.

The absence of formal institutions and legal frameworks to coordinate sewerage management reflects broader challenges in urban governance and infrastructure development, particularly in developing countries [83-85]. The observation of comparable challenges in urban sanitation in other countries, such as Nigeria and Bangladesh, underscored the significance of robust institutional capacity and coordination mechanisms [86, 87]

The results are consistent with similar findings in other rapidly urbanizing regions of developing countries. Studies in cities like Dar es Salaam, and Dhaka, have highlighted the absence or inefficiency of formal institutions as a major impediment to effective sewerage management [88]. These cases have linked weak governance to inadequate planning, underfunded infrastructure, and public health risks. The alignment of these findings with global patterns reinforces the broader relevance of the current study, situating its conclusions within the context of international urban infrastructure challenges. The study underscores the importance of institutional frameworks in urban infrastructure management, emphasizing the need for robust governance structures to address complex infrastructure challenges and establish or strengthen institutions for sustainable sewerage management in rapidly growing urban areas.

3.3. Urban Solid Waste Management

3.3.1. Challenges in Multi-stakeholder Collaboration: Addressing Barriers in Resources, Manpower, and Infrastructure

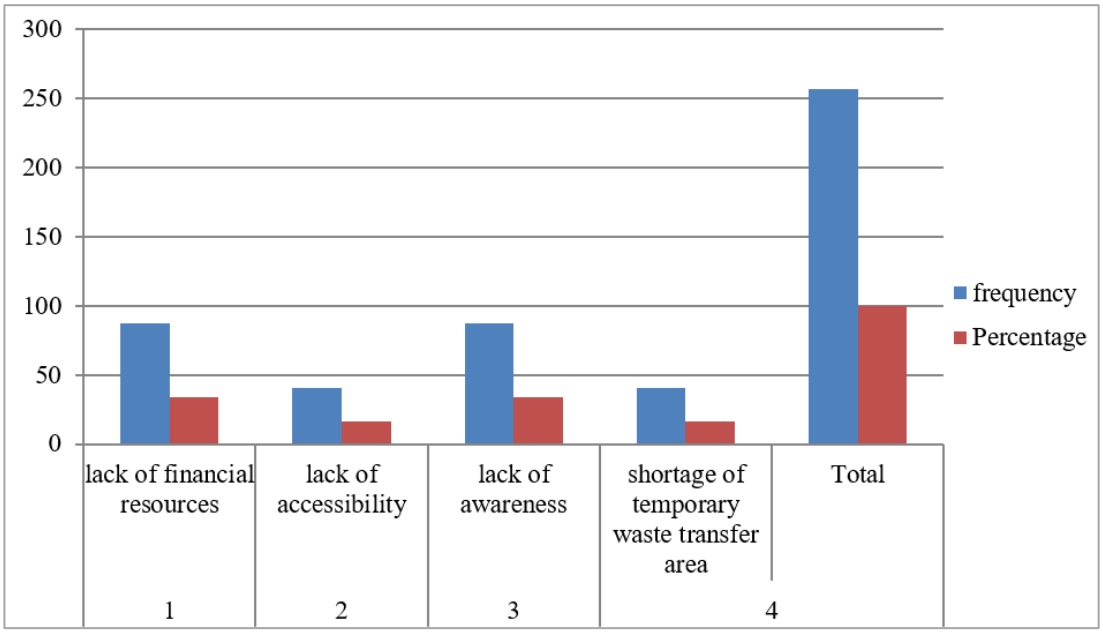

Figure 3. *Challenges in Multi-Stakeholder Collaboration.*

The responses of the respondent summarize on Figure 3 reveals four key challenges faced solid waste collection stations. The two most frequently cited issues lack of financial resources and lack of public awareness each account for (34%) of the responses. Accessibility issues and a shortage of temporary waste transfer areas, affecting (16%) of respondents each, were also noted. Site observations further support these findings, showing poor solid waste management practices in Burayu, Gelan, and Sebata sub-cities, where solid waste is scattered throughout the area. Additionally, the Raphi solid waste dumping site in Addis Ababa was found to be incompatible with other land uses.

The lack of financial resources, noted by (34%) of respondents, is a significant obstacle to effective solid waste management. This insufficient funding limits investments in infrastructure, staff, and proper collection of the waste. Similarly, a lack of public awareness, also affecting (34%) of respondents, suggests that many individuals may not understand proper waste disposal methods. This lack of awareness was observed during field observations, where scattered solid waste was prevalent in several sub-cities. Accessibility challenges, cited by (16%) of respondents, imply that certain areas may have poor infrastructure or difficult-to-reach locations, which can hinder the efficiency of waste collection. Additionally, 16% of respondents pointed to a shortage of temporary waste transfer areas, indicating logistical issues in the flow of waste from collection points to final disposal sites. The Raphi solid waste dumping site's incompatibility with surrounding land uses, as seen in Addis Ababa, further complicates the situation.

The lack of financial resources suggests that the waste collection system is severely underfunded, affecting the overall efficiency and effectiveness of solid waste management in the areas. Without sufficient funding, it becomes challenging to improve infrastructure, hire adequate staff, or implement proper waste management practices. This underfunding likely contributes to the poor solid waste management practices observed in Burayu, Gelan, and Sebata sub-cities, where waste is scattered and poorly managed. Public awareness also plays a crucial role. The scattered waste in the observed areas indicates that residents may not be fully informed about proper solid waste disposal practices. This lack of awareness, compounded by the lack of financial resources, exacerbates environmental and public health risks. Additionally, accessibility issues and the shortage of temporary transfer stations further slowdown the waste management process, contributing to the accumulation of waste in certain areas. The incompatibility of the Raphi dumping site with other land uses in Addis Ababa suggests poor urban planning. The lack of integration between waste management facilities and surrounding land uses creates conflicts and inefficiencies in the broader urban environment, further complicating waste management efforts.

The challenges outlined and supported by site observations

reveal a waste management system that faces both financial and logistical constraints. The top two challenges lack of financial resources and lack of public awareness are deeply intertwined. Without adequate funding, authorities cannot improve infrastructure or run effective public awareness campaigns, leading to a cycle of poor waste management and scattered waste, as seen in Burayu, Gelan, and Sebata sub-cities.

Accessibility issues and the shortage of temporary transfer areas further complicate the situation, pointing to weaknesses in urban planning and logistics. When solid waste collection sites are difficult to access or there are insufficient places to temporarily store waste, the entire system becomes inefficient, leading to the accumulation of waste in neighborhoods [89, 90]. The incompatibility of the Raphi dumping site with residential the land use type highlights the need for better integration of waste management within broader urban planning efforts to prevent conflicts and improve sustainability.

3.3.2. Key Challenges in Integrated Solid Waste Management: The Role of Urban Planning and Household Awareness

The study highlights several key challenges in integrated solid waste management. The most significant issue, as indicated by (48%) of respondents, is weak urban planning and a lack of understanding of waste management at the household level. When households are unaware of how to sort, handle, and dispose of waste correctly, it leads to improper segregation, increased littering, and reliance on unsanitary methods like open dumping or burning. This behavior not only overwhelms waste collection systems but also contributes to environmental pollution, public health hazards, and inefficient recycling processes. Ultimately, without proper education and awareness, household-level waste management becomes a critical bottleneck in the overall waste disposal system. This suggests that both infrastructure planning and public awareness regarding proper waste disposal practices are insufficient.

Additionally, (34%) of respondents identified the lack of financial support for waste management agencies, while (18%) cited poor coordination and the absence of a legal framework. Insights from interviews and focus group discussions reinforce these findings, with weak planning, insufficient public awareness, and inadequate funding emerging as primary obstacles to effective waste management. Governance issues, including the absence of appropriate legal frameworks and federal structures, hinder the progress of integrated solid waste management initiatives. Financial constraints, institutional aspects, political factors, lack of integration among stake holders, and outdated policies contribute to the challenges faced in solid waste management in the areas as identified during focus group discussion. Also, inadequate logistics, such as storage, collection, and transportation of solid waste, are significant reasons for inadequate waste management in many third-world countries.

The results align with the study's objectives that waste management challenges stem from a combination of governance, planning, and resource-related issues. The high prevalence of weak urban planning and inadequate household waste management understanding emphasizes the importance of integrating community-based and systemic approaches [91, 92]. The identification of financial and legal barriers reinforces the study’s framework by validating its focus on structural challenges as key areas of concern.

These findings indicate that without strong urban planning and public engagement, waste management systems will continue to be ineffective. Weak urban planning contributes to poorly design waste collection systems, while a lack of awareness at the household level leads to improper waste disposal, complicating management efforts [89]. The lack of financial support for agencies also impedes their ability to invest in necessary resources, further weakening the system. The absence of coordination and legal frameworks suggests that regulatory oversight and stakeholder cooperation are inadequate, which hinders the development of a cohesive and efficient waste management strategy [93]. The combination of weak urban planning and lack of public awareness highlights the need for more holistic and integrated approaches to solid waste management. Local governments must prioritize better urban planning, including robust waste disposal systems, while also launching educational campaigns to raise public awareness about responsible waste management at the household level. The lack of financial support for waste management agencies suggests that a more sustainable funding model is required, possibly through public-private partnerships or government subsidies [94, 95]. Moreover, the lack of coordination and legal frameworks indicates a governance gap, necessitating stronger laws, policies, and inter-agency cooperation to align all stakeholders and streamline waste management processes. Strengthening both regulatory and financial structures will be key to improving waste management outcomes in the study areas.

These findings align with challenges identified in other urban contexts, particularly in developing nations. For instance, studies in Nairobi and Dhaka have similarly reported weak urban planning, insufficient funding, and lack of legal frameworks as major obstacles to waste management [96, 97]. The lack of coordination among stakeholders is a recurring theme globally, often cited as a significant impediment to implementing sustainable waste systems. This alignment situates the study within a broader body of literature, emphasizing the universal relevance of the identified challenges. The study emphasizes the importance of financial, governance, and social factors in urban waste management, emphasizing the need for community education and systemic planning. It provides a framework for future research and practical insights.

3.3.3. Barriers to Establishing Common Solid Waste Disposal Areas: Policy, Communication, and Accessibility Issues

Table 4. Barriers to Establishing Common Solid Waste Disposal Areas.

No	Issues	Frequency	Percentage
1	lack of confidence in administrative boundaries	26	10
2	lack of policy direction	72	28
3	lack of communication on the distribution system	87	34
4	lack of accessibility	72	28
	Total	257	100

Source(s): Expertise survey, 2023

The results of the study in Table 4: highlight key challenges faced in establishing common solid waste disposal areas. These findings emphasize the critical role that governance, policy, and communication play in managing urban waste. Lack of confidence in administrative boundaries reflects the challenges of jurisdictional overlaps and unclear responsibilities, which hinder coordinated efforts to establish waste disposal systems. The lack of policy direction points to the absence of a comprehensive waste management framework, while inadequate communication complicates the proper allocation of resources. Finally, accessibility issues, which affect both waste collection and transportation, underline the logistical difficulties in creating efficient waste disposal infrastructure. These findings underscored the need for better governance, clearer policy frameworks, and improved communication strategies to overcome barriers to solid waste management.

The findings align with the study's objectives to identify and assess the challenges in setting up common solid waste disposal areas. The prominence of communication and policy-related challenges validates the objectives that waste management systems are often impeded by systemic governance issues. These results support the idea that a lack of coordination and clear policy direction at both local and regional levels complicates waste management efforts, confirming the study's focus on administrative and planning challenges [98].

Gaps in communication, lack of policy direction, and lack of accessibility are the main negative effects on the management of common solid waste disposal sites [92]. The un-integrated solid waste management planning is widely observed in the study area, reflecting a need for comprehensive strategies to address the identified challenges. Addressing the challenges of setting up common solid waste disposal areas requires integrated strategies that encompass policy direction, governance mechanisms, communication and coordination efforts, resource allocation, and institutional capacities [99, 100]. Striking the right balance between policy, governance, institutional mechanisms, and resource provision and allocation is crucial, especially in low-income countries; to effectively manage solid waste.

The challenges identified in this study are consistent with waste management issues reported in other urban regions globally. Studies in cities like Dhaka and Jakarta have similarly found that lack of coordination between governmental bodies, insufficient policy frameworks, and accessibility challenges are common barriers to effective waste management [101, 102]. In these cities, fragmented administrative boundaries and policy inconsistency have been identified as key constraints in implementing unified waste management strategies. The alignment with international case studies underscores the universality of these challenges in urban settings worldwide and provides external validation for the current study's findings. The research emphasizes the importance of integrated waste management systems, focusing on governance, communication, and accessibility [103, 104]. It explores barriers to common disposal areas and uses expert surveys to identify challenges. The findings highlight policy coherence, administrative clarity, and effective communication among stakeholders.

3.4. Urban Transport System and Road Net Work

3.4.1. Challenges in Intercity Commuting: Accessibility, Congestion, and Transportation Planning

The study conducted on Figure 4 reveals that the transportation system between the two metropolitan cities is inefficient in meeting the basic needs of commuters, particularly in terms of ease of access and overall service quality. The study areas manifest a systemic shortfall in designing a cohesive, commuter-friendly transport network, as evidenced by the prevalence of issues related to transportation planning. It involves developing policies and infrastructure to create an efficient, integrated, and sustainable transportation network that meets both current and future demands [105, 106]. It involves the design of infrastructure, the forecasting of needs, and the coordination of various modes of transport, all of which can lead to inefficiencies and inadequate infrastructure, as field observations have shown. Poor infrastructure challenges often create physical and logistical barriers that hinder people's ability to reach their destinations, resulting in extended travel times and decreased mobility. A lack of services, meanwhile, means insufficient or low-quality transportation options, such as limited public transit routes or unreliable vehicles, further restricting people's ability to access essential services and op-

portunities.

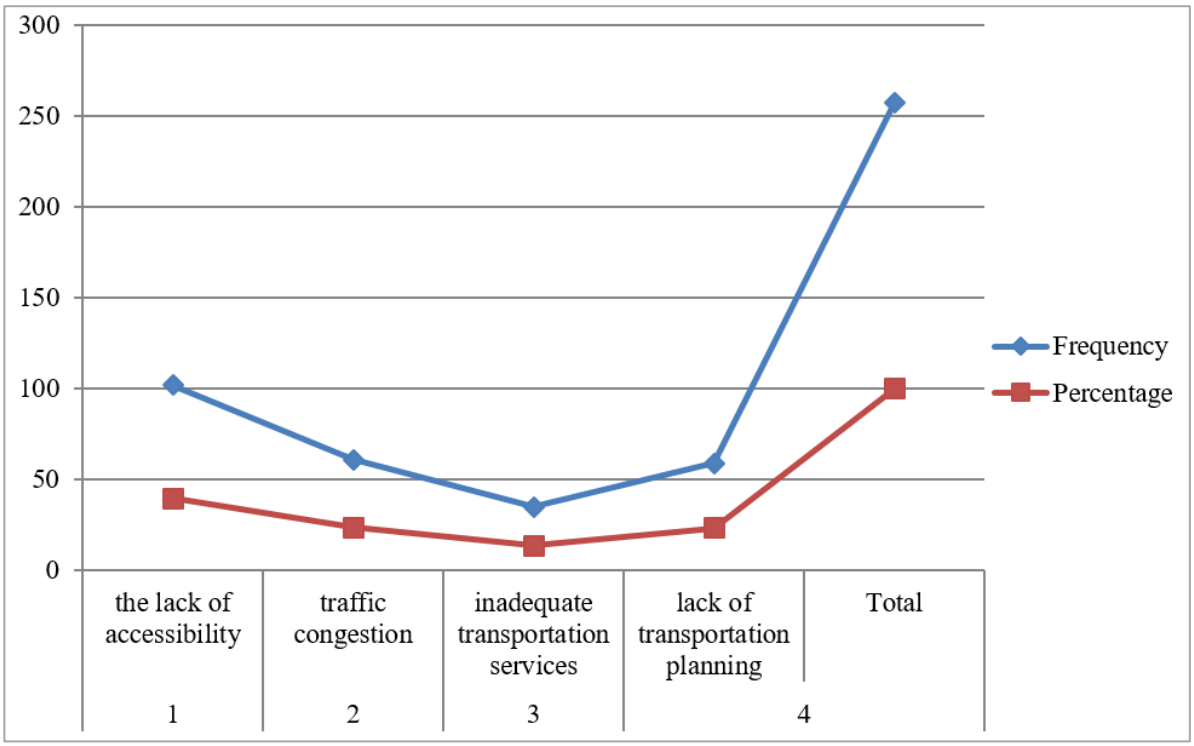

Figure 4. *Challenges in intercity commuting: accessibility, congestion, and transportation planning.*

Poor accessibility has been caused by inadequate infrastructure, such as insufficient roads or poorly designed transit routes, which make travel difficult, time-consuming, and often unreliable in the study areas, have been observed. This results in residents facing longer travel times or struggling to access public transport in the study areas, thereby reducing their overall mobility and impacting their quality of life. Slow-moving traffic in congested areas extends travel times, potentially increasing commuter stress and reducing productivity [107, 108]. In the study areas, heavy traffic can exacerbate delays and diminish the reliability of transportation systems. It can also contribute to increased vehicle emissions, worsening air quality, and overall environmental impact. Addressing congestion often involves measures such as optimizing traffic signal timings, implementing congestion pricing, and investing in alternative transportation options to alleviate pressure on busy roadways.

In the study areas, inadequate transportation services lead to overcrowding, long wait times, and difficulty in reaching destinations efficiently. This problem may particularly affect low-income or underserved communities that rely heavily on public transport. According to the interview, poor transportation planning results in inefficient transport networks, a lack of integration between different modes of transport, and a failure to anticipate future growth and demand [109, 110]. In the study areas, inadequate planning might lead to poorly designed transit systems that do not address current or future transportation needs, contributing to problems such as traffic congestion and accessibility issues.

The findings suggest that the lack of accessibility and transportation planning are critical areas that require immediate attention. The relatively high percentage of respondents indicating accessibility as a major issue suggests that many commuters struggle to access transportation options, which could lead to greater reliance on private vehicles and contribute further to traffic congestion. Furthermore, inadequate transport planning exacerbates the challenges, as it may result in poorly coordinated transport routes, inefficient timetables, and an inability to accommodate growing demand (Bruton, 2021; Vuchic, 2017. Without addressing these planning deficiencies, long-term traffic congestion is likely to worsen, which could reduce the overall efficiency of the city’s economic and social activities. The results are consistent with the study’s objectives, which sought to identify and analyze the challenges affecting intercity travel. The prioritization of accessibility challenges aligns with the hypothesis that systemic and infrastructural deficits are the primary impediments to efficient mobility. The identification of traffic congestion and inadequate transportation services complements the study's focus, confirming the need for both immediate and long-term planning solutions.

The interconnected nature of accessibility, transportation services, and planning highlights the need for holistic approaches to improving the city's transport [111]. Poor planning can often cause a lack of accessibility, while inadequate

transportation services may result from insufficient strategic foresight. Improved transport planning could help address both accessibility and service-related challenges by designing transport routes that better meet commuter demand, creating more equitable access to transportation, and reducing congestion [112]. Additionally, targeted investments in alternative modes of transport, such as public transit or bike-sharing programs, could reduce reliance on personal vehicles, mitigate traffic congestion, and improve environmental sustainability. The findings align with transportation challenges identified in other urban and peri-urban contexts. Studies in rapidly urbanizing cities like Mumbai, India, and Lagos, Nigeria, have similarly cited accessibility, traffic congestion, and insufficient transportation services as major impediments to commuter mobility [113, 114]. These challenges are often compounded by poor transportation planning, as seen in global studies, which further supports the external validity of the current findings. The alignment of these results with broader global trends highlights the universal nature of transportation challenges in urban areas experiencing rapid growth. The study highlights the interconnectedness of urban transportation, emphasizing the importance of integrated systems for accessibility and efficient traffic management [115, 116]. It provides a framework for analyzing commuter challenges and suggests strategies for enhancing road networks and public transportation options.

3.4.2. Professional Adequacy in Integrated Transport Planning: Addressing Perception Discrepancies

The survey results indicate a significant concern regarding the adequacy of professionals available to prepare integrated transport plans. A majority of respondents (87.7%) expressed that there is a shortage of professionals in the study areas qualified to carry out such planning. On the other hand, (126.3%) of respondents believed that there was no problem with the availability of professionals, pointing to a discrepancy in perceptions about the sufficiency of expertise in the field. This disparity suggests a divided opinion on the matter, potentially reflecting varying experiences or exposure to professional services in different areas. Focus group discussions and interviews also support the notion of insufficient experienced infrastructure planners in the study areas. Literature highlights the limited knowledge on integrating environmental aspects into transport planning processes, which is crucial for sustainable urban development. The literature confirms the shortage of experts in integrated transport planning and emphasizes the importance of considering environmental, social, and economic factors in transportation plans [105, 117]. This is an indication that there is a lack of enough experts who work on integrated transport infrastructure planning with in the metropolitan cities. Focus group discussions and interviews also confirmed that there are not enough experienced transport planners in the study areas. Countries like the Netherlands have invested in education and training programs to develop skilled transportation planning professionals, contributing to successful transport policy implementation [118, 119]. Also, global studies have shown that the lack of skilled professionals is a significant barrier to implementing successful transport systems, especially in developing and rapidly urbanizing regions. The findings of this study align with these international observations, suggesting that the challenge of professional shortages in transportation planning is a widespread issue faced by cities worldwide. Countries like Sweden and Singapore have developed comprehensive transport planning frameworks leveraging multidisciplinary professionals to effectively address urban transportation challenges [120]. These findings point to the importance of human capital in shaping the success of urban transportation planning. The shortage of professionals directly impacts the ability to plan and implement comprehensive, forward-thinking transport systems, and underscores the necessity of investing in education and training programs to build the expertise required for these crucial tasks.

The disparity in responses regarding the adequacy of professionals for integrated transport planning suggests a need for more comprehensive workforce development and training in the field [121]. The significant proportion of respondents citing a shortage suggests a broader expertise gap that requires attention to ensure equitable development across regions, even though some areas may receive adequate service. To bridge this gap, increased investment in education, training, and recruitment of transport planners and engineers is essential. Additionally, encouraging collaboration between government, educational institutions, and the private sector can help to create a more robust pipeline of professionals capable of managing complex, integrated transport projects [122, 123]. The study highlights the importance of human resources in urban transportation planning, highlighting the need for qualified professionals to ensure efficient and suitable transportation networks. It provides a data-driven analysis of human resource constraints, highlighting the need for professional development and educational programs to address the human capital deficit.

3.4.3. Challenges in Integrated Transport Planning and Design

Table 5. *Challenges in integrated transport planning and design.*

No	Issues	Frequency	Percentage
1	poor technology	59	23.1
2	a gap of knowledge	50	19.5
3	lack of rules and procedures	49	19.2
4	lack of financial resources	61	23.6
5	absence of standards	39	14.6

No	Issues	Frequency	Percentage
	Total	257	100

Source(s): FGDs survey, 2023

The survey results in Table 5 highlight several key challenges that experts identify as major obstacles in integrated transport planning and design. A substantial portion of respondents attribute these challenges to poor technology, indicating that the lack of modern, effective tools and systems is hindering efficient planning and design processes. This is a significant finding in scientific terms, as it underscores the growing need for advanced technological solutions in urban transport management. The respondents who cited a knowledge gap further emphasize the importance of enhancing expertise in the field of transport planning, suggesting that education and training are crucial components for overcoming these barriers. Additionally, respondents pointed to a lack of rules and procedures, highlighting the absence of standardized frameworks to guide planning processes. This lack of structure can lead to inconsistent approaches and ineffective outcomes. Other respondents identified the issue of insufficient financial resources, a challenge that is not unique to the study area but is prevalent across many cities, especially in developing countries. Finally, the absence of clear standards is seen as a contributing factor, reinforcing the need for universally accepted norms and guidelines in transport planning. Collectively, these findings emphasize that integrated transport planning is constrained by technological, institutional, financial, and knowledge-related deficiencies.

These results align directly with the study's goals, which aimed to identify key barriers to effective integrated transport planning. The findings validate the objectives that multiple challenges are contributing to the inefficiency of transport planning and design. The study's methodology using a combination of surveys, interviews, and focus group discussions ensures that these identified problems are not only perceived by experts but also observed through various methods of data collection. The consistency across responses about poor technology, knowledge gaps, lack of rules, and financial constraints suggests that these are indeed central factors in the challenges faced by urban transport planning in the study areas. Furthermore, the diversity in responses points to the complex, multi-dimensional nature of the problem, which requires comprehensive solutions.

The substantial number of respondents who identified inadequate technology as a primary cause suggests that outdated or insufficient technological tools and systems may be impeding the effective development of infrastructure [124, 125]. This could result in increased maintenance costs, delayed project execution, and suboptimal designs. The necessity of capacity-building initiatives to provide professionals with the necessary skills for contemporary integrated transport planning and design is underscored by the knowledge divide. Similarly, the absence of financial resources, rules, and procedures highlights systemic deficiencies that can result in inconsistent or incomplete planning and project delays [126, 127]. The absence of standards indicates that a uniform framework for transport development is either weak or absent, which may lead to inconsistencies across initiatives and regions.

The multitude of causes that have been identified underscores the necessity of a comprehensive approach to resolving transport planning and design issues [128]. Modern tools and systems that can improve project outcomes and expedite the design process will likely be necessary to address technological deficiencies. Furthermore, the quality of integrated transport planning and design can be improved by addressing the knowledge deficit through professional development and training programs [127, 129]. The implementation of distinct rules, procedures, and standards through the reformation of institutional frameworks will enhance accountability and consistency. Lastly, the long-term sustainability of transport networks and the successful implementation of initiatives are contingent upon the acquisition of sufficient financial resources. In an effort to establish a more efficient and well-integrated transportation system, it will be necessary for governments, private sectors, and international partners to coordinate their actions properly.

The challenges identified in this study are consistent with those observed in other urban settings, both in developing and developed countries. Similar studies in cities like Jakarta, Indonesia, and Nairobi, Kenya, have highlighted poor technology, financial constraints, and a lack of standardized procedures as significant barriers to effective transport planning [130, 131]. For example, research in Nairobi pointed to the absence of technological innovation in transport planning tools, as well as a lack of regulatory frameworks, which mirrors the results of this study. Additionally, the issue of financial resource constraints is a commonly cited challenge in urban transport planning in both low- and middle-income countries, as seen in studies from cities like Lagos and Cairo [132, 133]. This external validation of the results underscores the relevance of the study's findings within a broader, global context, indicating that these challenges are not isolated but rather part of a larger issue faced by many cities.

The results of this study are significant both conceptually and methodologically. The study suggests a holistic approach to urban transport planning, incorporating technological innovation, capacity building, and strong regulatory frameworks, based on a mixed-methods approach, addressing technological, financial, and knowledge barriers.

3.4.4. Challenges in Integrated Transport Planning

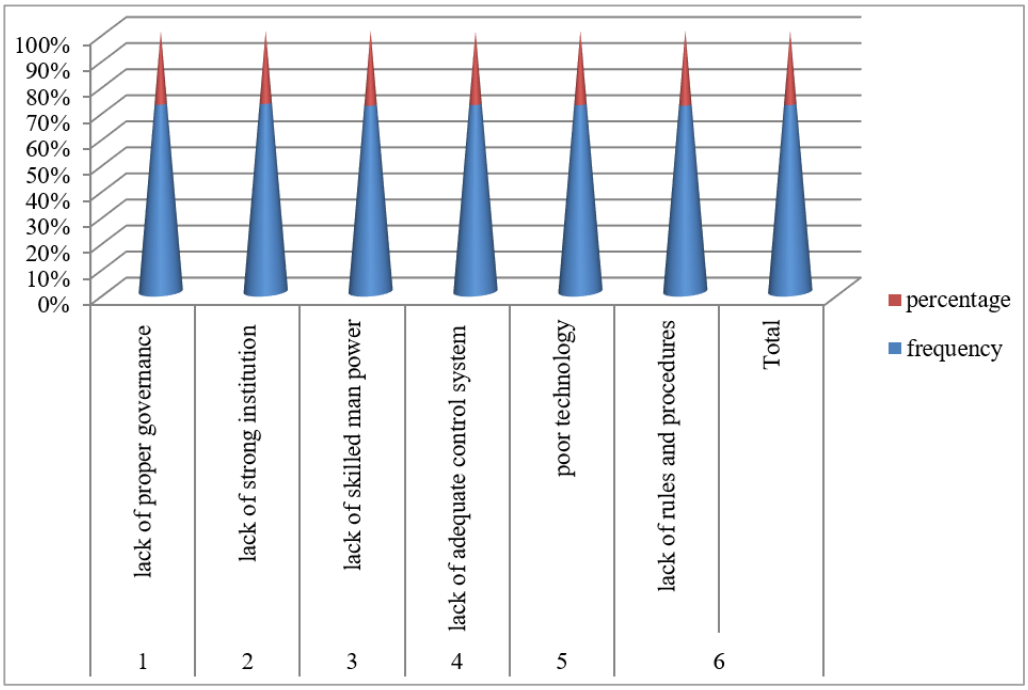

Figure 5. *Challenges in the integrated transport planning.*

The results on Figure 5 underscored the crucial obstacles that undermine the effectiveness of organizations. The most prominent issue, a lack of appropriate governance (32.5%), indicates a substantial leadership and oversight gap. The lack of competent manpower (13.4%) and poor technology (19.1%) further limits operational capability and human resource development. The absence of defined rules and procedures (12.2%), control systems (10.5%), and strong institutions (10.3%) is indicative of systemic weaknesses in accountability and organizational structure. It is essential to address these issues in a comprehensive manner in order to promote resilience, enhance performance, and achieve sustainable growth.

These findings highlight critical barriers that need to be addressed in order to improve integrated transport planning. In scientific terms, these challenges are indicative of systemic weaknesses within the governance, institutional, and technological support transport planning. Effective governance, strong institutions, skilled professionals, and robust monitoring systems, technology are foundational to creating integrated transport systems that can meet the demands of rapidly urbanizing areas. Previous literatures consistent with study findings, governance are the backbone of coordinated planning and execution [134]. Without a clear governance structure, separate agencies often plan and manage different transport modes, such as buses, trains, and cycling infrastructure, with little collaboration [135, 136]. This results in inefficiencies, as the various modes fail to complement each other, leading to higher operational costs and poor service quality. Integrated transport systems require, technology upgrades, and sustainable operations [116, 137]. Without adequate funding, cities are unable to invest in modern transport solutions like electric buses, smart traffic management systems, and sustainable infrastructure, leading to a reliance on inefficient and outdated modes of transportation. [138]. Without these, institutions struggle to manage planning processes and facilitate collaboration, leading to inefficiencies and delays. Lack of skilled manpower affects the quality of transport planning and operation, affecting the adoption of advanced technologies like intelligent transport systems [139].

These results directly align with the study's central hypothesis that challenges in governance; technology, institutional weaknesses, and lack of skilled personnel hinder effective integrated transport planning. The significant concern raised about governance corroborates previous research, which has indicated that successful transport planning depends heavily on the capacity and effectiveness of governance structures [135]. The identification of institutional weaknesses and technological challenges further supports the premise that without a strong, coordinated approach, transportation systems cannot be planned, developed, and maintained effectively. Additionally, the recognition of skill shortages and inadequate control systems reinforces the objectives that better capacity-building and stronger regulatory frameworks are essential for successful integrated transport systems.

The lack of proper governance in urban transport systems leads to limited connectivity, increased congestion, and project delays [134]. Weak institutions lack technical expertise, leading to substandard infrastructure and regulatory violations.

Strengthening institutions through capacity building and reform is critical. The shortage of professionals in the transport sector hampers innovation and limits the ability to optimize transport networks. Investing in education and training programs is necessary to build local expertise. Modern control systems, such as intelligent traffic management and data-driven decision-making tools, are essential for improving operational efficiency and enhancing the commuter experience. Additionally, the study's emphasis on skilled manpower and control systems contributes to the theoretical advancement of the field by framing human resource development and monitoring as key components of urban transport success. This insight adds to existing literature by broadening the understanding of the challenges involved in creating integrated transport systems, and provides a foundation for future studies to explore solutions to these systemic issues. This study highlights key issues for improved integrated transport planning, including governance, institutional capacity, financial support, and professional training. It identifies research and policy interventions needed in developing regions and offers insights for strengthening governance structures and institutional capacities.

4. Conclusion and Recommendations

4.1. Conclusion

The study concludes that poor stakeholder collaboration, resource constraints, and insufficient focus on maintaining existing infrastructure significantly impede integrated municipal infrastructure planning. A lack of effective coordination mechanisms exacerbates inefficiencies, while limited financial resources and technical capacity hinder the implementation of sustainable urban systems. These challenges are consistent with those observed in other rapidly urbanizing and under-resourced regions globally, underscoring the universal importance of adopting holistic and systems-based approaches to urban planning. By addressing these interconnected issues, cities can enhance resilience, sustainability, and service delivery.

The study concludes that rapid urbanization intensifies infrastructure challenges, particularly in sewerage systems and solid waste management. The lack of institutional frameworks and financial resources impedes coordinated efforts, exacerbating inefficiencies and environmental risks. Governance gaps, weak urban planning, and inadequate public awareness further hinder effective service delivery. The alignment of findings with global trends highlights the universality of these challenges, situating the study within a broader international context. Conceptually, the research emphasizes the importance of robust governance, stakeholder collaboration, and innovative technologies in addressing urban infrastructure issues. Methodologically, the integration of quantitative and qualitative data offers a replicable model for assessing urban infrastructure challenges.

The findings underline the interconnectedness of accessibility, transportation planning, and service quality as critical factors for efficient urban mobility. The lack of governance, professional expertise, and financial resources creates a compounded problem, limiting the capacity for integrated transport planning. Technological and institutional inadequacies further obstruct the development of efficient systems, reducing connectivity and increasing congestion. The study confirms the objectives that addressing governance, knowledge gaps, and technological deficiencies is essential for achieving sustainable and integrated urban transport systems.

These systemic issues are not unique to the study area but are prevalent in other global contexts, indicating a broader, universal challenge in urban transport management. The results emphasize the necessity for a holistic approach that incorporates governance reforms, capacity building, financial investment, and technology adoption to improve transportation systems.

4.2. Recommendations

Foster collaboration and coordination: Establish collaborative governance structures that facilitate coordination among stakeholders, including government agencies, private sector entities, and community organizations. Encourage joint planning initiatives and integrated decision-making processes to optimize resource utilization and avoid duplication of efforts.

Adopt holistic planning approaches: Embrace holistic planning approaches that consider the interconnections between different infrastructure systems, such as water, transportation, and energy. Integrate climate resilience considerations into infrastructure planning to enhance adaptive capacity and mitigate climate-related risks.

Enhance resource allocation: Allocate adequate financial, human, and technological resources to support the planning, design, and implementation of integrated infrastructure projects. Prioritize investment in drainage infrastructure to address pressing challenges such as flooding and waterborne diseases.

Build capacity and promote community engagement: Invest in capacity-building programs to enhance the technical expertise and skills of personnel involved in infrastructure planning and implementation. Foster meaningful community engagement and participation in decision-making processes to ensure that infrastructure solutions align with the needs and preferences of residents.

Enhance institutional frameworks and institutional reform: Establish formal institutions and legal frameworks to improve coordination, planning, and management of sewerage and solid waste systems. This includes clear administrative roles and responsibilities. Establish clear governance structures and foster collaboration among transport agencies to ensure coordinated planning and execution. Strengthen institutions through capacity building and the development of standardized rules and procedures.

Increase public awareness and adopt new technology:

Launch educational campaigns to promote proper waste segregation and disposal at the household level. Engage communities in decision-making to foster ownership and compliance. Adopt modern tools such as intelligent traffic management systems, data-driven decision-making platforms, and sustainable technologies like electric vehicles to enhance operational efficiency and commuter experience. By implementing these recommendations, policymakers, urban planners, and stakeholders can work towards overcoming the challenges associated with urban storm drainage infrastructure and create more resilient, sustainable, and livable urban environments for current and future generations.

Abbreviations

FGDs Focus Group Discussions

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Ethics Statement

The need for ethical approval was waived off by the Addis Ababa University Gradate Committee because the study involved such things as the use of publicly available data, secondary data analysis, and minimal risk to participants, and the university has no such guidelines and regulations. The Addis Ababa University Gradate Committee granted this waiver in accordance with relevant guidelines and regulations, ensuring the research adhered to ethical standards. Also, Informed consent was obtained from all individual participants included in the study.

Additional Information

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Consent Statement

Even though; informed consent was not required for this study as per the guidelines and approval of the Addis Ababa University Graduate committee given that the study involved the use of publicly available or anonymized data.

Consent Statement of Participants

Informed consent was obtained from all individual participants included in the study. Additionally, verbal consent was confirmed at the time of the interview or survey.

Consent Statement of Publication

Consent was obtained from all individual participants included in the study for the publication of their data in this manuscript.

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Data Availability Statement

The datasets/DAS/ generated during and/or analyzed during the current study are available from the corresponding author, [Geremew Worku], upon reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

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