SYNERGISTIC LINKAGES OF BOLE INTERNATIONAL AIRPORT TO ADDIS ABABA FOR SUSTAINABLE URBAN DEVELOPMENT

Bereket Birhanu Hailu

A Thesis Submitted to the Department of Architecture and urban planning and design
College of Civil Engineering and Architecture

Presented in Partial Fulfillment of the Requirement for the Degree of Master's in urban planning and design

Office of Graduate Studies

Adama Science and Technology University

Dec,2024

Adama, Ethiopia

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Approve of Board of Examiners

I the advisor of the thesis entitled "Synergistic Linkages of Bole International Airport to Addis Ababa for Sustainable Urban Development" and developed by Bereket Birhanu Hailu hereby certify that the recommendation and suggestions made by the board of examiners are appropriately incorporated into the final version of the thesis. Dr. Asfaw Mohammed (Ph.D.)

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We, the undersigned, members of the Board of Examiners of the thesis Bereket Birhanu Hailu have read and evaluated the thesis entitled Examining "**Synergistic Linkages of Bole International Airport to Addis Ababa for Sustainable Urban Development**" and examined the candidate during open defense. This is, therefore, to certify that the thesis is accepted for partial fulfillment of the requirement of the degree of Master of Science in Urban Planning and Design.

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Eternal Examiner	Signature	Date

Finally, approval and acceptance of the thesis is contingent upon submission of its final copy to the Office of Postgraduate Studies (OPGS) through the Department Graduate Council (DGC) and School Graduate Committee (SGC).

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Declaration

I hereby declare that this Master Thesis entitled “Synergistic Linkages of Bole International Airport to Addis Ababa for Sustainable Urban Development” is my original work. That is, it has not been submitted for the award of any academic degree, diploma or certificate in any other university. All sources of materials that are used for this thesis have been duly acknowledged through citation.

_____	_____	_____
Name of student	Signature	Date

ACKNOWLEDGMENT

Above all, I thank my almighty God for always being there with me and guiding me all the time during my academic study and at the time of research. Next, I would like to extend my gratitude to my advisor Dr. Asfaw Mohammed (Ph.D.) For his moral support, academic consultation, suggestions, patience and unlimited feedback. I would like also to express my deepest gratitude to my colic's, for inspiring me to do this research starting from the beginning. Additionally, I would like also to thank retail owners at bole area for their willingness to assist in providing me with information. And special thanks to Ethiopian airlines workers who supported me to complete my research. Finally, I would like to express my deepest appreciation to my family for their prayer and support throughout my study time and research period. Thank you all to those who contributed directly and indirectly to making this thesis possible.

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LIST OF ACRONYMS AND ABBREVIATIONS

AIP Aeronautical Information Publication

EAE Ethiopian Airports Enterprise

ECAA Ethiopian Civil Aviation Authority

GPS Global Positioning System

IATA International Air Transport Association

ICAO International Civil Aviation Organization

ICT Information and Communications Technology

UN United Nations

UN-Habitat United Nations Human Settlements Programme

ABSTRACT

Synergistic Linkages of Bole International Airport to Addis Ababa for Sustainable Urban Development

Bereket Birhanu Hailu

Airports have historically been located on the outside of cities to serve as a global gateway to the metropolis and it is challenging to integrate and minimize spatial disconnection and become a major economic development hub. The study aimed to evaluate the interconnected relationships between Bole International Airport and the sustainable development of Addis Ababa City. The study uses both the quantitative and qualitative analysis of the data. Moreover, mapping, document analysis, and descriptive statistics are used. As a result, the analysis indicates that the airport is not functionally well integrated with the neighboring city part. The streetscapes are not safe for users of the selected routes as pedestrians. This is mainly because of the regulatory criteria of the aviation industries and their ports' development should follow. Then various policies, planning, and design strategies and tools are also indicated to improve the conditions of the area. Therefore, Airport users and stakeholders, including airlines, general aviation, border security, customs, immigration authorities, suppliers, and operators, should be consulted and actively involved in the planning process. Additionally, collaboration with infrastructure and surface transportation authorities, such as highway and railway officials, as well as potential customers, is essential.

Keywords: Metropolis, Aerotropolis, synergy, center-periphery

CHAPTER ONE: INTRODUCTION

1.1. Background

Promoting sustainable expansion of the urban and aviation sectors begins with the integration of airport infrastructure development and aviation development. A coordinated effort must be made to harmonize national and local urban expansion rules, policies, and programs at both the national and local levels. The social, economic, and environmental pillars should all be taken into account while planning a sustainable airport and city. Synergies between the airport and the local community will be facilitated through the implementation of these three pillars at the local, regional, and national levels (Runze Wang, 2018).

Urban regions experience forces that interact to provide favorable growth synergies that may be used to enhance sustainable urban expansion. It is necessary to support change in urban and territorial planning and development through data, proper legal and policy documents, encouragement of implementable institutional transformation, and responsibility. Decentralization of urban services, encouragement of collaboration with and among partners in urban development, specialized capacity building at the level of urban management, reduction of inequality, and urban governance These will eventually result in more compact, climate change-resistant, human rights-responsive, and linked more sustainable urban communities (Bai Yangmin, 2021).

Cities with airports are significant economic centers that have seen significant growth and profitability. However, the transition from an airport to an airport city is challenging; many airports have tried and failed to make the transition. The primary trends in the aviation industry over the past few decades are tied to the advent of this form of development. Airport operators now heavily rely on non aerial income as a result of globalization and liberalization activities. The requirement for income diversification and a strategy to increase non-aeronautical revenues lead to real estate development concentrated around airports. Finding the crucial, underlying aspects in the development of an airport and promoting synergy is the aim of this study (Stangel, 2019).

1.2. Statement of problem

Airport space has been severely hindered by urban growth. Airport amenities are invaded by urban land users, which results in a crowded environment. Airports need room for flying lanes where there should be little to no activity. However, as towns and cities expand, more people live in the urban areas closer to aircraft lines. The operational safety and effectiveness of an airport, the safety of the surrounding communities, and the exposure of those populations to the environmental repercussions of airport activities can all be impacted by land use decisions. Therefore, these aspects must be taken into consideration when creating airport master plans as well as municipal and regional land use plans. The community is better informed about the causes and consequences of land use changes because of community participation (Stangel, 2019). Rapid and hazardous development has made it challenging to find extra space for airport expansion. Land Uses Around Airports and Other Aviation Facilities That Are Incompatible or Unrestricted (Stangel, 2019).

A rise in the plinth area of airport facilities is necessary to accommodate the growth that occurs as a result of time and demand. More land must be purchased to accommodate the growth. In the growing urban environment that has a high demand for space in the urban sector; diminishing land resources in the urban area prevent an airport from growing in size. Without growth in aviation facilities, aviation growth would be impeded by the absence of support facilities and operations (Stevens, 2012).

The surrounding community has to be informed of the plans to ensure effective communication and collaboration. There have been several growth-related issues at Bole International Airport. To address the airport's overcrowding issues, the Ethiopian Airports Enterprise intends to replace Bole International Airport with a new facility outside of the city. The surrounding community has to be informed of the plans to ensure effective communication and collaboration. There have been several growth-related issues at Bole International Airport. To address the airport's overcrowding issues, the Ethiopian Airports Enterprise intends to replace Bole International Airport with a new facility outside of the city.

1.3. Research objective

1.3.1. General objective

The general objective of the study is to assess the synergistic linkages between Addis Ababa City and Bole International Airport for sustainable urban development.

1.3.2. Specific objective

The specific objectives of the study are to:

- investigate the current level of integration between Bole International Airport and Addis Ababa City.
- identify the primary factors impeding the integration of Bole International Airport with the city.
- explore strategies and tools to foster a synergistic connection between the airport and the surrounding neighborhoods of the city.

1.4. Research Questions

1. what is the current situation regarding to the prevalence of synergistic linkage between Bole International Airport and Addia Ababa City?
2. What are the limiting factors for inadequate integration between the airport and the city?
3. What are the possible solutions either in policy improvement or better planning and design solutions?

1.5. Significance of the research

The Air transport system is an essential part of a sustainable city with a direct relation to social equity, environmental effectiveness, and economic efficiency. This study explores the need for a strategy of integration of an airport and a city in rapidly growing towns like Addis Ababa.

The findings could also contribute to the solution of the same problem in the region. There are international studies conducted about this issue but they are not mainly related in urban planning and designing sense, most focused on the social attributes. The findings of this study are expected to strengthen the need for the integration of the Bole International Airport and the city.

And because of the similarity of most fast-growing cities, the findings could also contribute to the solution of the same problem in the region. Furthermore, it is hoped that the study will add to the body of knowledge in the field of sustainable urban development, with a particular focus on the synergy between an airport and a city and it will also serve as a partial fulfillment requirement for the MSc in Urban Planning and Design. The chosen site runs from Bole International Airport in different three directions. The streets are distinguished by its diverse urban land uses, which include commercial, mixed-use, residential, and governmental offices, but commercial activities are predominant.

1.6. Scope of the research

The research will focus on identifying the possible systematic ways to create a synergy between an airport and a city. In addition, once the systematic approaches are identified, the possible solutions for the current inefficiency will be suggested. Since addressing the whole impact and linkage of Addis Ababa since it is vast, the study area will mostly be confined and focused in the vicinity area around bole international airport. This kind of proximity selection of an area will helps to study the effective impact of an airport in a surrounding area and this would help to come up with appropriate and local solutions.

Finally, the study will summarize the case study on the best practice of other cities' experiences and study towards synergy between airports and the city in developing countries.

1.7. Description of the Study Area

The site is located in the Bole sub-city, Addis Ababa at 9°1′48″N 38°44′24″E with elevation of 2,355 meters.

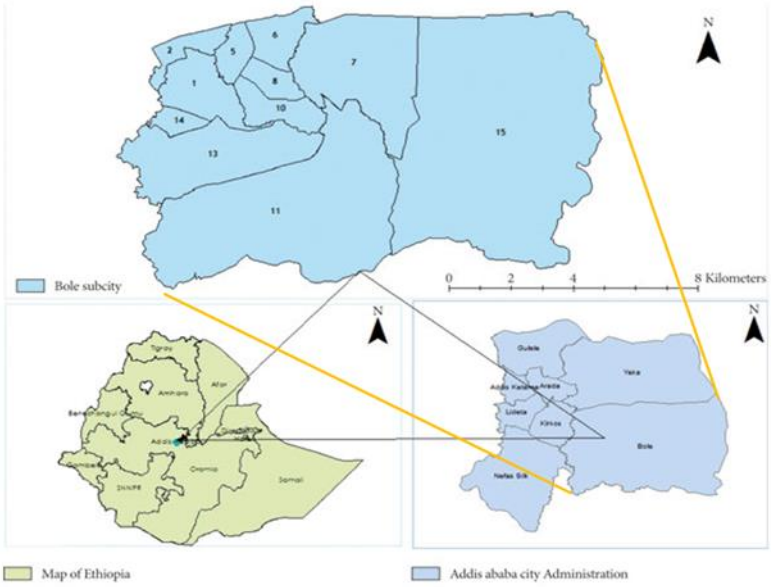


Fig 1.1, Description of the study area

1.8. Limitation of the study

The greatest challenge will be, the existence of corona virus pandemic, which will make data collection difficult. Majorly primary data collection will be affected negatively. However I will overcome the situation by putting extra effort and talking necessary precaution and collect the necessary data for the research.

The process of data gathering includes having access to people, organizations, municipal data, or documents. A lack of these data or of reliable data will limit the scope of the analysis, the size of samples, or it will be a significant obstacle in finding a trend and a meaningful relationship

1.7. Organization structure of the research

The thesis is going to be organized into five chapters. Each chapter systematically and effectively examines the content and data of the study accordingly. The fundamental chapter in the thesis is further demonstrated as follows.

Chapter One: Introduction to the study introduces the thesis by lighting the main topic of the study, research problems, objectives, questions, significance, scope, description of the study area, limitation, and organizing.

Chapter Two: The second chapter is literature review. The Part of the study in which main topics like**:** what is an airport city means, how airport and cities are linked, how we can create a synergy or mutual benefit between them and the challenges and some international trends to minimize and solve them are well defined from scholarly perspectives and discussed from other countries experience.

Chapter Three: The third chapter is Research Methodology. The part of research in which the methods used for data collection and analysis are mentioned and explained.

Chapter Four: The fourth chapter is result and discussion. It is section of the research that discusses the results of qualitative and quantitative data findings.

Chapter Five: The fifth chapter is the conclusion and recommendation. Conclusion and recommendation is the concluding part of the research. The chapter is going to make a conclusion based on the findings from the measurements, the case study of Bole International Airport: Addis Ababa, and based on the collected data, comparing to international guidelines and local interpretation, the study will conclude the results and discussion as well as it stated some recommendations.

CHAPTER TWO: LITERATURE REVIEW

This chapter gives a general theoretical framework for airport city and the synergistic linkage between city and airport. it also presents facts, definitions, arguments, debates, and about the concept that has been researched. In addition, it explains variables that are used for linkage between city and airport. Previous reports related to synergistic linkage between city and airport as well. Finally, it summarizes gaps that have been seen and analyzed, and interpret effectively.

2.1 Theoretical Literature Review

Because human society is built on ongoing relationships, mobility has played a significant role in both human behavior and historical patterns of settlement. Transport by land, rail, water, and air has made it easier to move people, products, and services around. Even remote and inaccessible places now have increasing connectivity thanks to air travel. The economic expansion and urbanization of the regions are significantly impacted by this interconnectedness. Being able to access (global) markets improves economic potential for trade, tourism, and human connection on a global scale. (Ravetz, 2013)

Airports have evolved from simple grassy and gravel airfields to elaborate airport cities (aerotropolises); with large-scale airport infrastructure to handle passenger and cargo traffic, and their attendant aviation services as well as non-aviation related undertakings, such as conference centers.An essential component of a multimodal transportation system, air travel supports economic and social activities like travel, trade, business, urban forms, and habitation patterns. The international community is aware that the ambitious and forward-looking Agenda 2030 cannot be realized without fast, reliable, safe, and environmentally friendly global connection. (Bai Yangmin, 2021)

Airports have important bearings on planning around and beyond the city and region of location. Airports are located in close proximities to major cities or other major land uses such as tourism sites and major economic zones; to offer faster and con/venient travel modes to the users of other land uses in the proximity of the airport. On another hand, cities are beginning to develop around airports. This development includes not just hotels and restaurants, but also, more

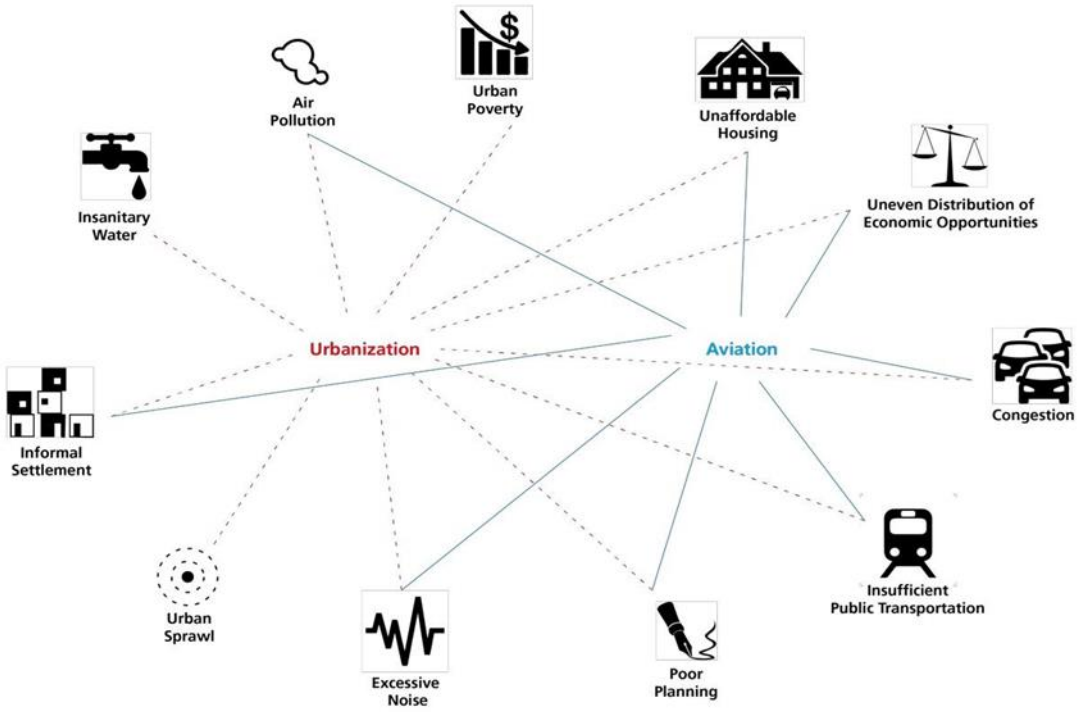
importantly, transport-focused or transport-dependent businesses. "City airports are becoming "airport cities" (Runze Wang, 2018).

Due to airports' close proximity to major cities, development corridors have been established between airport amenities and central cities. Studying the function of airports as drivers for development will be vital for future urban, metropolitan, and regional planning because airports have a significant impact on a region's social, economic, and ecological elements. It is important to research and demonstrate how to locate, develop, operate, and maintain airports in connection to major cities through working with the public sector, the general public, and private businesses (Stevens, 2012).

2.2. Relations between aviation and urban growth

Airports are crucial planning tools in cities and regions that can inform the development character and other development options that can be exploited to enhance economic output and promote prosperity in cities, regions and countries. Development policies based on transit oriented development models applied to airport development and urban development are crucial determinants in the level of economic activity and the spread of the value of goods and services associated with the use of airport facilities. (: Runze Wang (UN-Habitat), 2018)

A crucial element in fostering growth synergy throughout the corridors connecting airports to other land uses and informing land use planning in urban areas is the successful relationship of land uses inter-phasing airports and urban regions. For sustainable urban growth, it is important to regulate the interaction between these corridor amenities connecting various socioeconomic growth zones as well as their environmental effects (Runze Wang, 2018).



©Runze, 2016, Source: UPP data extracted from United Nations Environment Programme. GlobalEnvironment Outlook, GEO Data Portal, Human Development Index (HDI) (2010)
Figure 2.2: Relations between aviation and urban growth

2.3. Transport Corridors in Metropolitan Development

In urban and regional planning, transportation takes up one of the largest proportions of land use allocation; due to the extensive web of transport networks permeating the city such as airports, roads, cycle paths, railways, metros, cableways and pedestrian footpaths. Thus, airports have been key development nodes in planning urban areas, and have a unique eventual role in facilitating movement and distribution systems towards the urban and regional planning framework. There is a strong correlation between airports and the development of metropolitan areas. In the early development of airports, they were often built outside the urban area, however as communities increase by growth, they are now encroaching upon airports which requires effective land use planning between the airports and communities (Runze Wang, 2018).

Airport hubs create nodal points in a city region. They are connected to the city and the rural area using transport corridor routes to facilitate the circulation of goods and services.

Consequently, there are other transportation links from other areas such as the CBD and rural hinterlands of the city to connect the airport (Ravetz, 2013).

Land use in the city and its region can be utilized as a nodal point to organize and manage other land use activities around the airport infrastructure, which is a significant landmark. This idea also encompasses the corridor for growth leading to the central business district and the direction of the nearby rural interphase. It is an essential link that connects people to opportunities both locally and globally, as well as to societal integration (Runze Wang, 2018)

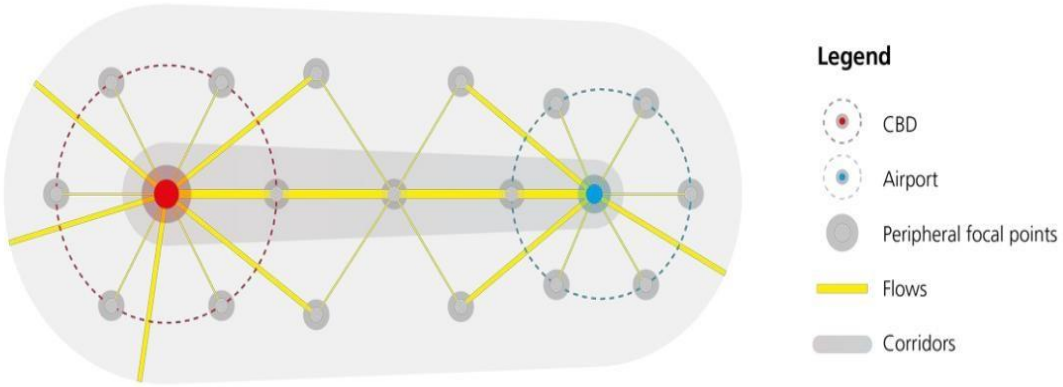


Fig 2.3, Transport Corridors in Metropolitan Development
©Runze, 2016, Source: Adapted from Rodriquez, J.P (2007) Gateways, Corridors and Global Freight Distribution: Transpacific Issues

2.4. Impacts of aviation on urbanization and socio-economic activities

The opportunity to meet the fundamental needs and provide basic services to urban people in Africa at reasonable prices has been made possible by urbanization, which has been a key factor in the continent's development. The majority of the GDPs of most nations were produced in metropolitan regions. Urban locations where forces interact produce favorable growth synergies that can be used to encourage long-term urban development. (: Runze Wang (UN-Habitat), 2018)

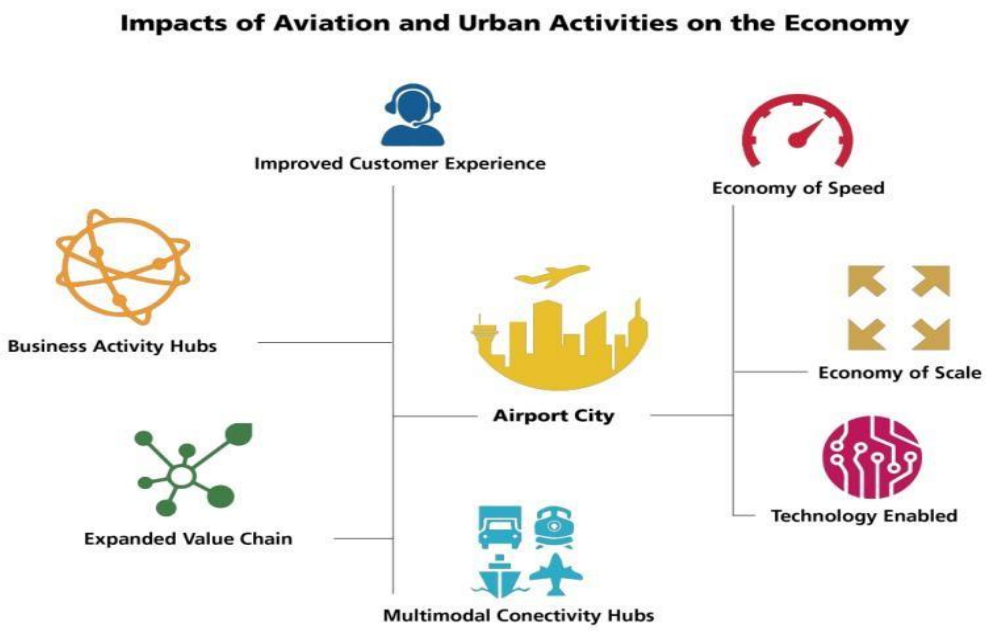


Fig 2.4, Impacts of aviation and urban activities on the economy

The promotion of implementable institutional reform, the responsible decentralization of urban services, the encouragement of collaboration with and among urban development partners, specialized capacity building at the level of urban management, the reduction of inequality, and urban governance are all necessary to support reform in urban and territorial planning and development. These will ultimately result in more environmentally friendly urban settlements that are connected, compact, and resilient to climate change. Airports can also serve as catalysts for neighborhood projects that promote ecologically friendly efforts (such as installing electric vehicle charging stations and promoting best practices in water and trash management, for example). (: Runze Wang (UN-Habitat), 2018)

Promoting sustainable expansion of the urban and aviation sectors begins with the integration of airport infrastructure development and aviation development. All stakeholders in the urban and aviation sectors must work cooperatively to harmonize top-down regulatory frameworks and bottom-up national and local urban growth regulations, policies, and programs to ensure sustainable urbanization, realize synergies, and meet the targets outlined in the Sustainable Development Goals. (: Runze Wang (UN-Habitat), 2018)

2.5. Air Transport Users and the City

Air travelers anticipate quick and straightforward connections from the city center to the airport. The airport offers easy connections between terminals, quick and convenient baggage transfers, specialized services in multimodal terminals, and special services for individuals with limited mobility. Using many modes of transportation helps minimize greenhouse gas emissions and improves local air quality. It promotes the use of corridors to mitigate land use impacts. The government should promote corridor planning to integrate land uses and improve infrastructure efficiency, including highways, pipelines, and electricity (Runze Wang, 2018). Cargo businesses need quick turnaround for products traveling through airports, accessible access to markets and storage facilities, and efficient clearance processes for goods entering and exiting airports (Runze Wang, 2018).

2.6. Passengers, Meeters, and Greeters Facilitation

The city administration should design a multimodal urban transportation system to improve traffic flow from and to airports. Airport authorities may not be responsible for providing a good public transportation infrastructure, but they may encourage employees to utilize it. Inter-modal interchange facilities can be designed into new airport layouts and infrastructure additions, including terminals. Passengers may use many modes of transportation, including light, conventional, and high-speed rail, as well as regional and local bus services, which are very convenient for employees (Runze Wang, 2018).

To provide such amenities, an airport public transit plan should be developed based on local factors and cooperation with suppliers. Airports should work with towns to incorporate easy intermodal transportation into their planning. Although there is a connection between surface and air transport, there is still a need for improved airport access and terminal connectivity. Timetables for surface public transit can promote connection and facilitate travel (Runze Wang, 2018)

Airports and cities should promote environmentally friendly modes of transportation, such as public transit, alternative fuel cars, and hybrids. Reducing congestion in the urban surface transport network can improve mobility and ensure the timely delivery of perishable air cargo to

designated warehouses or storage facilities at airports. Intermodal public transportation links might include bus stops, train stations (light and heavy), and ferry terminals to facilitate airport transfers. Airport infrastructure play a crucial role in reducing emissions and ensuring long-term sustainability for both the airport and its surroundings. Airport developers must participate in regional planning to guarantee integration with regional and national transportation plans. This would minimize travel costs, time, and environmental effects.

The objective is to transition from private to public transportation, which is safer, more efficient, and environmentally friendly (Runze Wang, 2018). Access to Addis Ababa Bole International Airport is acceptable. There are four entrance points to passenger terminals and two for air freight terminals. Road traffic flow is scheduled to allow for deviations or rerouting in case of anticipated congestion or accidents. A prearrangement method can also be used for unanticipated scenarios. Public transportation serves the airport; however, it is not well-coordinated and does not follow a timetable. Public transportation is supplemented by rental cars, hotels, and tour operator shuttles. Surface transport traffic is steady, but metropolitan authorities must plan to accommodate the city's growing automobile fleet.

Approximately 85% of airport users arrive by public transportation. Train connections are planned for the airport. There are no integrated single-ticket journeys between air and surface transit. The lack of convenience for air passengers, freight, postal delivery, and meet-and-greets at Bole International Airport. To improve traffic flow, metropolitan authorities should redesign their urban transportation systems to include multimodal connections. Accelerating the multimodal connectivity development plan is crucial for its success. Although the number of automobiles in Addis Ababa is rising, the infrastructure has not kept up. This causes delays for customers, increasing no-shows, and late personnel reporting to duty stations, thereby impacting service quality. Improve collaboration among parties involved. Incentives for public transportation can benefit both passengers and staff (Runze Wang, 2018).

A well-planned layout for local and arterial traffic is necessary to maximize throughput for arrival and departure zones, as well as other airport activities. Minimizing traffic, congestion, and idling on airport access routes can improve local air quality. Approximately 80% of travelers

use public transportation, such as taxis, to reach the airport. There is no regular public surface transit between Bole International Airport to the city (Runze Wang, 2018).

Public transportation options surrounding Bole International Airport are limited, however, there is potential for improvement due to traffic congestion during peak hours. The airline administration is doing some reformation around the airport, connecting the city in different directions. Currently, just 25% of airport users take public transit. The airport has 5,000 parking spots, which adds to the transportation difficulty. Private automobile owners choose to drive and park at the airport until their flight concludes (Runze Wang, 2018).

The parking lots contribute to non-aeronautical earnings. To stimulate the use of electric mobility, facilities such as priority parking for hybrid and electric cars (EV) and charging stations can be given. Airports can collaborate with start-ups to conduct demonstration projects for emerging EV charging technology. Technology such as green lights over unoccupied areas (Runze Wang, 2018)

2.7. Public Health and Airports

Public health control involves taking measures (e.g., spraying, trapping) to reduce the density of vectors and diseases, which are defined by International Health Regulations (IHR) as "an insect or other animal that normally transports an infectious agent that constitutes a public health risk." ICAO helps create a single registry for airports and states to share information on vector control methods, assisting in risk assessment. Airport vector and disease control aims to maintain a vector-free region within the airport's 400-meter perimeter, as per the IHR. Implement standard WHO recommendations for airport vector control following the IHR 2005. According to WHO guidelines, states should increase awareness of vector control measures and promote uniformity in disinfection techniques. Disinfection regulations are based on individual state risk assessments. To estimate risk, states should consider the likelihood of infected individuals entering the state, the availability of mosquito vectors at departure airports and entrance points, and the likelihood of vector importation across states (Runze Wang, 2018).

2.8 Role of Cities in Promoting Aviation

A) Provision of Public Infrastructure and Services

Municipal authorities are responsible for providing basic services and infrastructure to inhabitants within their jurisdiction. The responsibilities of local authorities and national government vary by country. Airports and communities must collaborate to provide public infrastructure and services. Creating synergies between cities and airports may lead to sustainable development and social, economic, and environmental advantages. Local, regional, and state master plans should consider current and future airport development needs. Complementary planning criteria are necessary for successful infrastructure development. Implementing the plans will address land use conflicts, including encroachment, resulting in mutual advantages for all stakeholders. Support airport infrastructure through legislation. This includes regulations on land use, security services, road reticulation, traffic control, and solid waste management for airport facilities (Runze Wang, 2018)

B) Development and Implementation of City Level Legal and Policy Guidelines

Planning Laws, Regulations and Development Control around Airports

City authorities are legally responsible for enacting laws and regulations within their authority. These rules and regulations aim to improve the city's socio-economic environment, increase land value, and govern land usage, among other functions. Regulations are essential for ensuring adequate ground clearance for landing and take-off, as well as protecting land users from the negative impacts of aviation, such as noise pollution and property destruction during accidents.

To protect airports from security breaches and terrorist attacks, cities like Nairobi have implemented screening facilities at the airport entrance. However, city-airport relationships sometimes lack enough incentives to drive growth (Runze Wang, 2018) City Council of Addis Ababa, have rules and regulations that limit land use near airports, making them regulated development zones inside cities. Airport zones are subject to strict development controls to ensure compliance with land use laws and regulations.

2.9. Origin and destination cities air connectivity

A) Impact of air service liberalization Addis Ababa

Addis Ababa is still in its early stages. The aviation sector has significant potential for growth and development due to favorable conditions. Rapid and dependable delivery of commodities is crucial for the viability of many economies and organizations that rely heavily on-air transportation for trade. Air freight services can significantly contribute to the continent's long-term economic growth. Strategic decisions. Aviation in Ethiopia has far-reaching effects beyond only passengers. It has led to increased employment and economic benefits. The reasons behind this are stated below.

a) The aviation sector generates economic activity by providing, managing, and maintaining more air services. This covers airlines, airports, air navigation services, and other aviation-related industries. The influence can have indirect or multiple effects on the economy, such as food wholesalers supplying food for flights, transportation firms transporting commodities, and refineries producing jet fuel.

b) Tourism Sector: Air service attracts more tourists to an area or country. This comprises both business and leisure travelers. Ecotourism should be promoted to minimize harmful environmental effects. Tourist spending may benefit many tourism-related businesses, including hotels, restaurants, tour companies, theaters, and vehicle rentals. Air travel promotes outbound tourism, leading to lower economic spending. Outbound tourism generates expenditure in the local economy for travel agencies, taxis, and other services. Tourists who travel overseas may not spend the same amount on domestic tourism if there is no air service.

c) Effects on trade, investment, and productivity, often known as catalytic effects or wider economic benefits. Aviation has an influence on other economic sectors. Air transportation promotes employment and economic growth by boosting commerce, recruiting new enterprises, and stimulating investment. Improved air transport connections can bring industries and activities to a location that would not have existed otherwise.

CHAPTER THREE: RESEARCH METHODOLOGY

The methodology chapter will be, the part of the research in which data collected and research techniques used will be grouped to make a coherent picture of the whole research. This chapter explains the type of reach design used, the type of data that will be collected, and the methods used to collect the data including the target populations on which the research will be conducted are listed and discussed. As a methodology of study, different sequential steps will be followed. It involves a comprehensive and systematic review of existing literature on the synergy between Bole International Airport and Addis Ababa City. In this chapter, the methods used to analyze the collected primary sourced data is set with the main research questions and objectives to show how the data and the questions are connected and analyzed.

3.1 Study Area Description

The study area is situated in the Bolle sub-city, home to the airport. Its coordinates range from 8° 56’ 8” to 9° 1’ 18” latitude and 38° 45’ 37” to 38° 51’ 42” longitude.

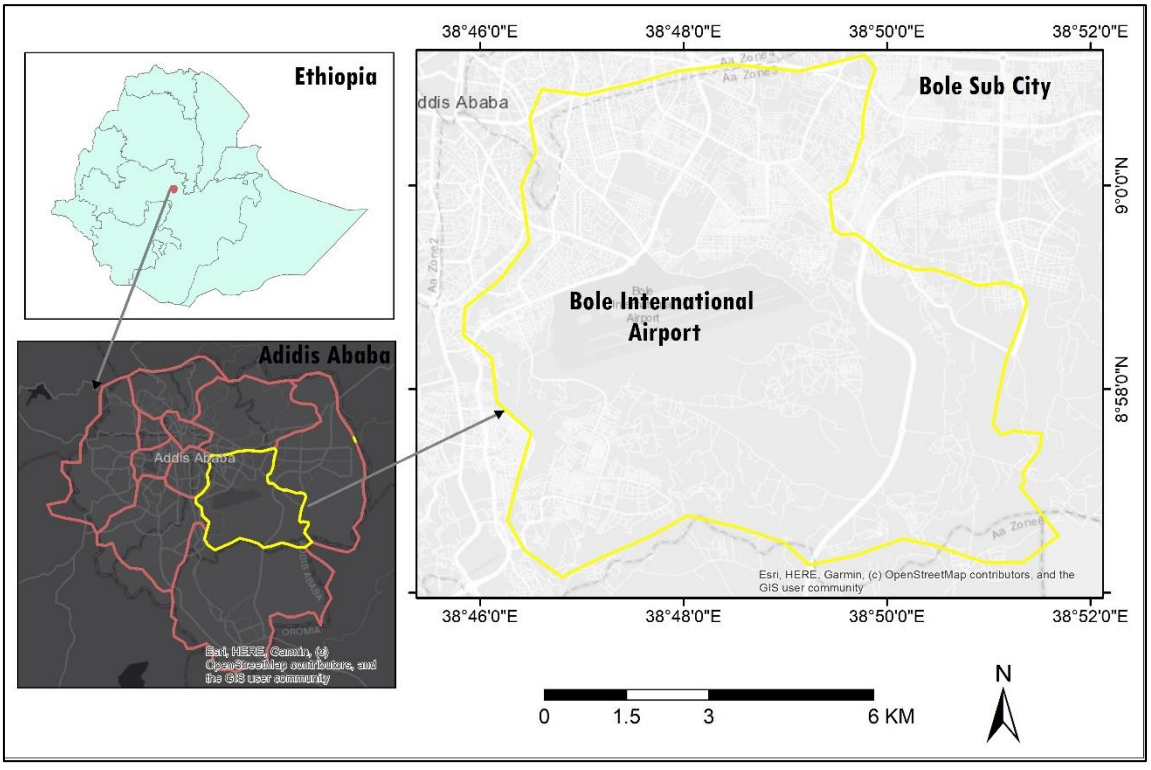


Fig 3.1: The study area map

3.2. Research Approach

The type of research approach that will be used is a mixed research approach. Both the quantitative and qualitative data collection will be implemented. The qualitative approach will be used on the subjective assessment of opinions, perceptions, and attitudes of the community on the airport and its outcome to the city. In addition, this approach will be used to describe the demographic and socioeconomic conditions of a sample population and also to show the reality of the linkage between the city and the airport from subjective and objective surveys. The quantitative one will be used for the evaluation and listing of the existing economic, social, and environmental linkages created between the city and the airport.

3.2.1 Source of Data

Data Type

The data that will be collected from both primary and secondary data sources. The primary data has been collected from all the selected sample areas using subjective and objectives surveys. The subjective survey comprises of questions asked to the people to express how they perceive the synergy between the city and the airport.

The objective survey will be done by the researcher answering standardized questions to evaluate the linkage and co-dependency.

In addition to the primary source, secondary data from government and non-government offices will be collected to have reliable information. Review policies, principles, theories, and definitions of the airport city and relate this to the city of Addis Ababa and Bole International Airport as a source of secondary data. In addition, previous and present planning and policy approaches on the airport planning and design of Ethiopia is going to be presented.

3.2.2 Sampling Techniques and Sample Size

Sampling

Once the study areas are selected, the residents, different service-providing individuals or companies, and different governmental and non-governmental institutions count will be done to select a sound sample size for the research. The count will be done manually not only to create a

sample size but also to differentiate which sections of the study area have high, medium, and low interaction with the airport and manifest itself explicitly.

Target Population

In this research, the sampling techniques of purposive sampling will be combined with systematic sampling. The sites of interest in this case are around bole on the vicinity of the airport but it will also include people who work in and outside of the airport and this helps us to map out the linkage between the airport and the residents of the city.

3.2.3 Data Collection Instrument

Questionnaire

This study will employ a set of questions to gather a respondent's perception. The questionnaire elicits answers to questions concerning economic, environmental, social, technological, and cultural linkage between bole international airport and the city of Addis Ababa and based on this the interviewees will be asked to point out the constraints of creating synergy between the airport and the city.

The questionnaire will have different sections that covers information from respondents shaving of different gender, age, monthly income, frequency of flying, and purpose of the trip. All the questions are under the subjective or the objective questionnaire category.

Interview

In addition to questionnaires, direct form of interview will be conducted among different peoples with random selection in order to understand their perception about the airports and their wishes on areas where improvements are needed.

Observation

The other data collection instrument will be on site observation. The observation will be conducted around the vicinity of the airport. Observations to visualize the linkage between the airport and the area, and also to get a good mental picture of the actual co-dependency and limiting factor between the airport and the city and other related issues that generally affect the mutual benefit between them.

3.2.4 Method of Data Analysis

In general, both descriptive and analytic methods of data analysis are used. For the first objective, the study used mapping and document analysis is used. For the second objective the pedestrian perception and the challenge of the connection of the city roads and the airport is assessed and presented using descriptive statistics and frequency tables are used. The third objective is addressed by using document analysis and various design processes and mapping is used

CHAPTER FOUR: RESULT AND DISCUSSION

4.1 Results

4.1.1 Integration Status of Bole International Airport and Addis Ababa City

This study analyzes the land use configuration of the surrounding neighborhood and reviews the regulatory frameworks related to airport activities. Accordingly, the selected site runs from Bole International Airport in different three directions. The streets are distinguished by their diverse urban land uses, which include commercial, mixed-use, residential, and administrative offices, but commercial activities are predominant (see Figure 4.1).

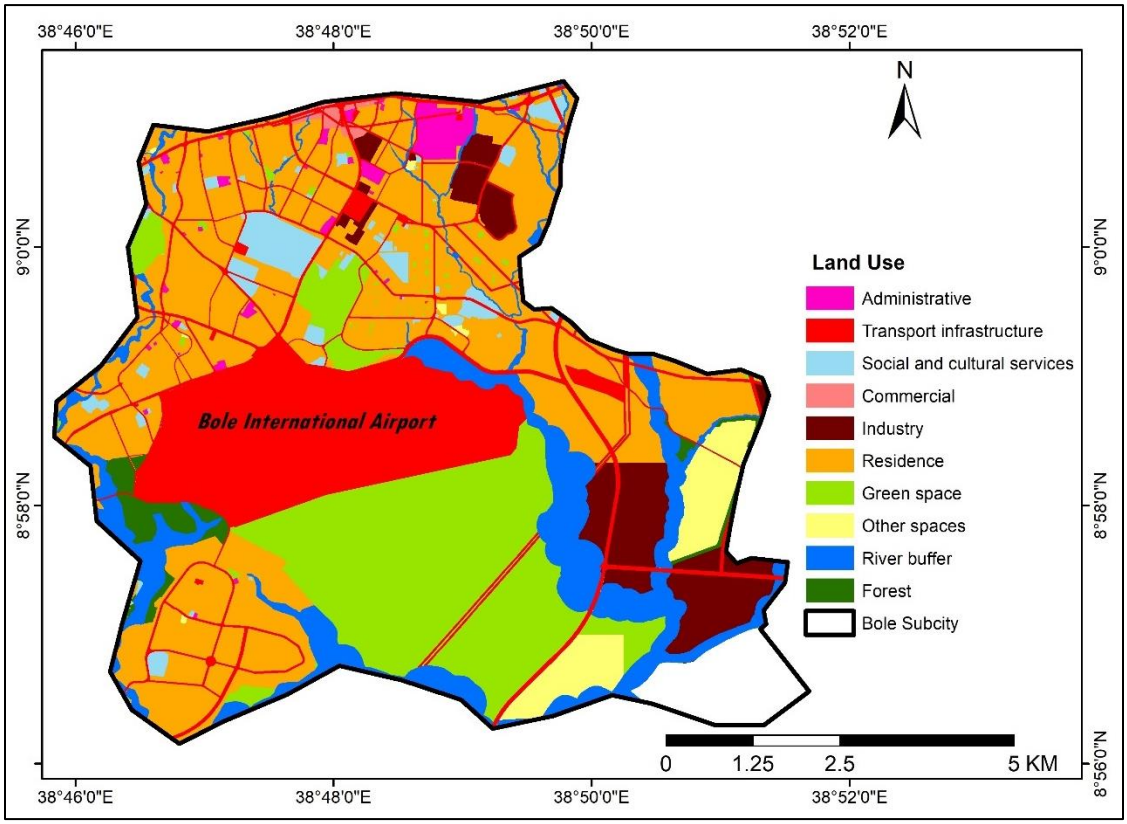


Fig 4.1: land use map of the study area

When evaluating the necessary building height regulations for the area, several important aspects must be considered. To maintain the safety of planned operations in aerodromes and airports, the

International Civil Aviation Organization (ICAO) defines a series of 3D obstacle limitation surfaces (OLS)

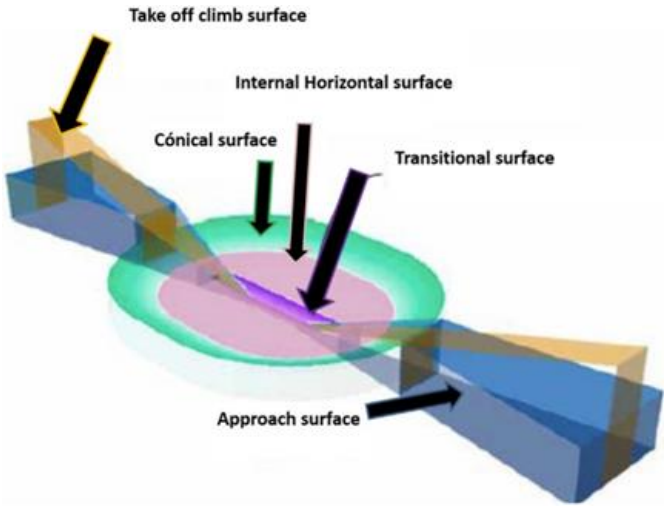


Fig 4.2: ICAO obstacle limitation surfaces(OLS)

The Ethiopian Civil Aviation Regulation Categorizes the aviation area into A, B, C1, C2, and D zones as indicated in Figure. The stipulations of the Ethiopian Civil Aviation Regulation override all provisions under this Building Height Regulation in the aviation area A, B, C1, C2 and D.

Color Code	Zone	Floor Area Ratio (FAR)			Building Height (meters)	
		Minimum	Maximum		Minimum	Maximum
	One	10	Free		70	Free
	Two	5	Free	≥CS		70
		5	5	LS		35
	Three	2	Free	≥CS		35
		2	5	LS		35
	Four	0.5	Free	≥CS		35
		0.5	3.5	LS		35
	Historical Site	0.5				21
	Green Frame		0.05			6
	Aviation Restriction Line (A, B, D, C1 and C2)					

Fig 4.3: Ethiopian Civil Aviation Regulation Categories

***Aviation Zone*:** Compatibility and land use are crucial to the discussion of airport and regional planning. There is a need to match the objectives of the airport operator; the municipal government and importantly the community, by acknowledging that the future growth and prosperity of each is a result of the other (Schalk & Ward 2010). Within the literature (AOPA 1999; DoT 2002; Schalk & Ward 2010; WSDOT 1999) compatible land uses are considered to be:

- Most commercial industrial uses, particularly those associated with the air transport industry;
- Land use, where the airport creates the demand; motels, warehouses, logistics firms, and any aviation support industry; and
- Open space utilization through parks, golf courses, plant nurseries, forestry and agriculture

Population Density: Due to the rising global population, urbanization is one of the 21st century's most transformative trends. Even though the concentration of population, economic activities, and social and cultural interactions in the cities have most likely a potential positive implication on the growth and development of air transport, it might also equally cause major sustainability challenges unless appropriately addressed in a coordinated and effective management system. (Africa Infrastructure Country Diagnostic: Air Transport Challenges to Growth, June 2009).

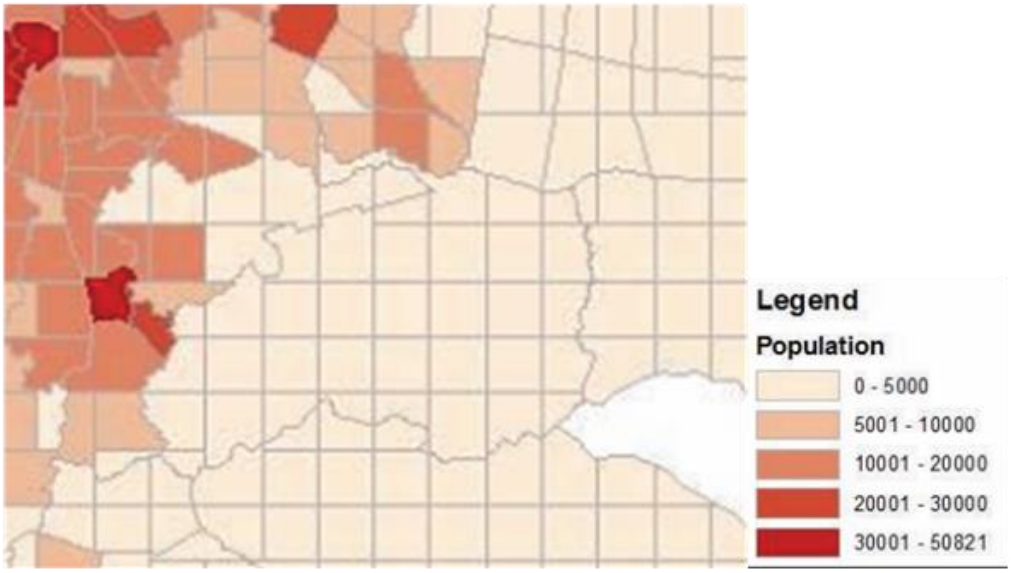


Fig 4.4: Population density around the Bole

Industry Development: The role of airports as transport hubs is not the dominant mechanism that drives industries to locate in airport areas. Rather, the local urban context is a dominant driver for development in and around airports. Based on the survey and interview results, urbanization economies have the highest significance on landside industrial location decisions, with a mean of 3.53 in terms of importance level. The findings provide a reference for policymakers regarding investment in airport expansion or construction, as well as a refinement of the understanding of the local economic impact of airports (Bilotkach, **2015**:*52*, 1577–1593.]

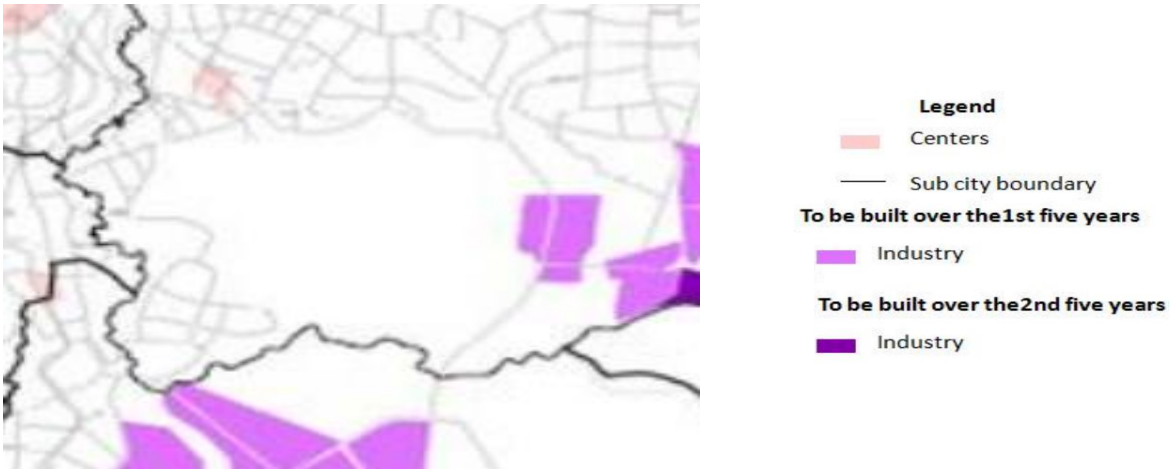


Fig 4.5: Industry Development Around Bole

Required finance for industry land preparation at Bole is also presented in Table 4.1. the known industrial sites in this neighborhood are the Bole Lemi site and ICT park which require about 6.03 and 1.6 respectively.

Table 4.1: required finance for industry land preparation at Bole

Location	The 1st five years		The 2nd five years		Total Land in hectare	Total Finance in billion birr
	Land in hectare	Finance in billion birr	Land in hectare	Finance in billion birr		
IT Park Bole Woreda 11 (Bole-Arabsa /Bole Lemi)	180	1.62	-		180	1.62
Bole Woreda 11 (Bole-Arabsa /Bole Lemi)	293.2	2.64	377.09	3.39	670.29	6.03

Environmental protection and development: It is clear that the changing role of airports will ultimately involve their continued expansion as both aviation transport hubs and retail and commercial destinations (AAL 2009; BAC 2009; CA 2009). It is also evident that surrounding urban and regional commercial and residential development will continue to increase and densify (BRC 2010; May & Hill 2006). This mutual escalation of development is associated with an array of reciprocal social and biophysical environmental impacts. There isn't well integrated framework that deals with the multiplicity of environmental issues for the airport and the region, there are linkages everywhere and they are not necessarily coordinated.

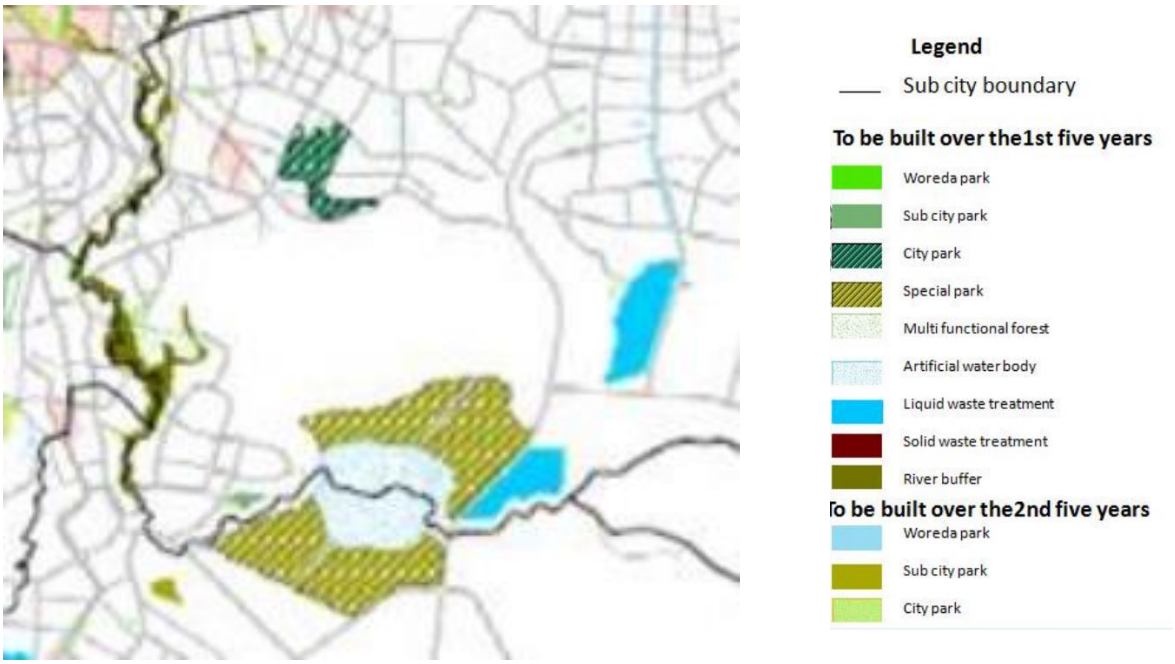


Fig 4.6: Environmental protection and development around the Bole

Centrality Development: Cities with major airports play key roles as points of exchange in the global economy. With a considerable proportion of airline passengers traveling for business, 'a close relationship exists between business activity on the ground and airline networks in the skies' (Debbage and Delk 2001). This has triggered potential land use changes in favor of hotels and convention centers on airport land and within the region, attracting international, national, and local consumers.

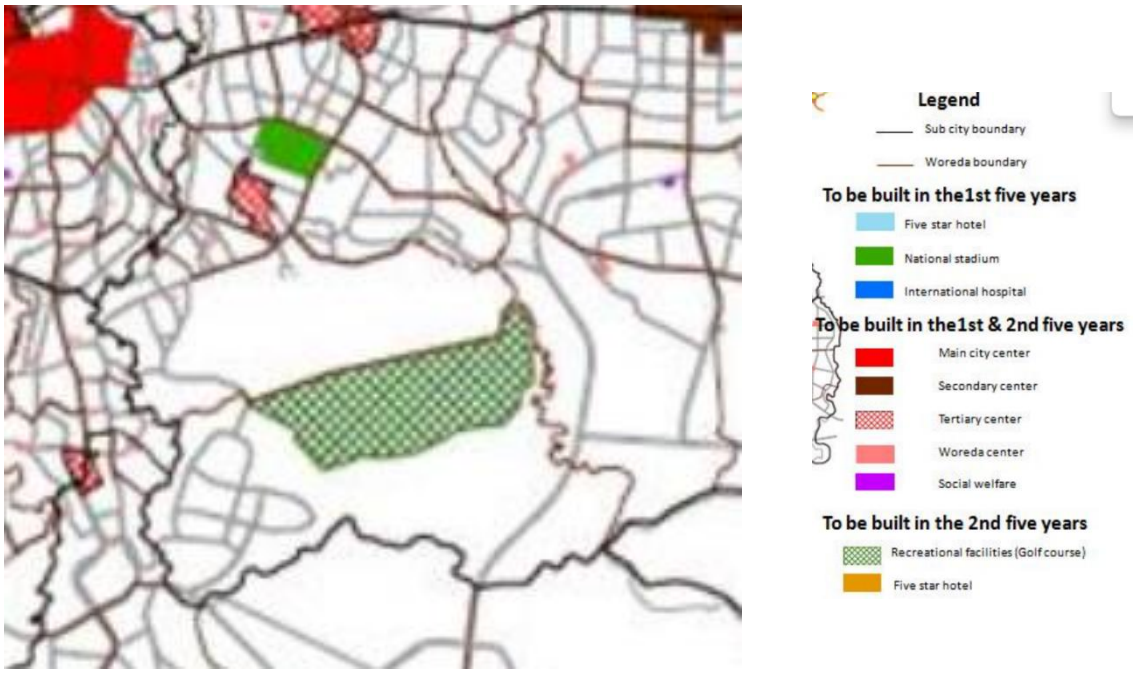


Fig 4.7: centrality development projects around the bole

Housing Development: The best practice is to remove and prevent from development of residential areas in critical noise areas by locating other facilities instead (e.g. industries or road transport systems). Residential housing refers to single-family dwellings, multifamily dwellings, and estates. Sound insulation and ventilation should be incorporated in the construction of commercial structures to the extent necessary to reduce exterior noise to a level acceptable for conducting business inside the building. Institutional housing refers to community facilities such as schools, hospitals, and churches. All these facilities should be planned and situated with thorough consideration of airport noise and the potential risk of aircraft accidents (UN-Habitat, 2018).

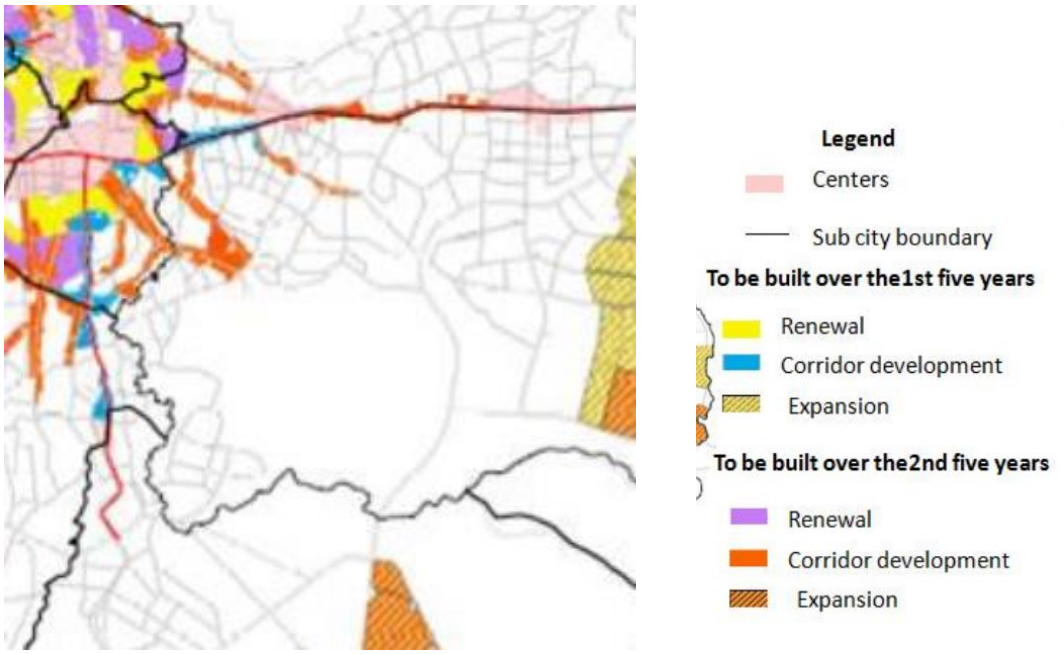


Fig 4.8: housing development around Bole

Transport Network: Transport is an indispensable tool in facilitating the creation of a socioeconomic space that would lead to the free movement of goods and persons around the world. An integrated transport system ensures that there are links between airports and other modes of transport for seamless movement of passengers and cargo. [UN Habitat, promoting synergy between cities and airports for sustainable development, 2018]

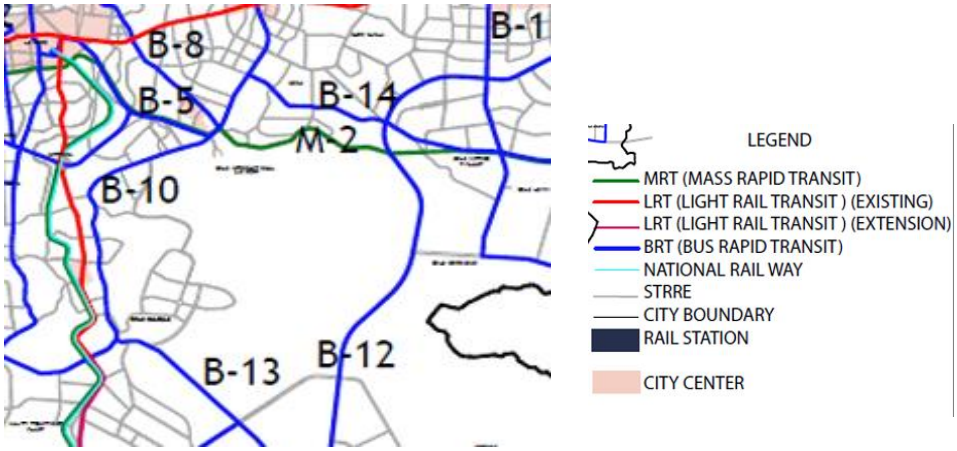


Fig 4.9: Transport network around Bole

According to the researcher's observation: The initial data collection approach was a direct and controlled observation, in which the physical qualities and characters of the collector streets from the airport to different sides of the city. Those checklists were prepared based on general streetscape elements, urban utilities, street connectivity, and mobility, and a checklist for existing urban fabric. Depending on those criteria the physical character of the streets was documented. This is helpful to understand how the physical form of the street influenced the proximity of the airport compared to other parts of the city.

Table 4.2: The checklist results about streetscape elements and utilities and services

Site Observation checklist	**Availability**		
Check List for Streetscape Elements	Available on selected site	Less available	Not available at all
□ Street lights,	x	-	-
□ Trash cans	_	×	_
□ Public art	×	_	_
□ Public toilets	_	×	_
□ Traffic signs & signals,	×	_	_
□ Street trees and other horticultural elements,	×	_	_
□ General public furniture,	×	_	_
□ Advertising signs, & decorations	×	_	_
□ Bicycle facilities (bikeway, racks)	×	_	_
□ Iconic buildings and heritage values	_	×	_
□ public transport infrastructure	×	_	_
Check List for street Utilities and services running for pedestrian activities			
□ sidewalks/footpaths	×	_	_
□ Pedestrian Pavements	×	_	_
□ Ditches (M)	×	_	_
□ Crossings	×	_	_
□ Disability ways	×	_	_
□ Frontage cafes	×	_	_
□ Vending activities	×	_	_

The first part of the checklists was used on the observation date of Aug 5,6 and 7 for three consecutive days. this checklist has two parts, the first part of the checklist contained elements of the streetscape and the second part contains general street utilities and services running across the selected street. From the site observation, 85 Percent have been found in the Available section 15 percent have been found in the less available section and 0 percent were found in the Not available at all section.

This result explores that the street from bole airport to Meskel Adebabai almost have proper streetscape elements and street utilities and services compared to other streets in Addis. There are street lights, signs, and street trees were found in some of the areas inside the site. There are manmade statues which have been built recently and become the attraction point of the street and a good element of the streetscape. Available ones like street vending are found in the streets and they are disrupting the movement or the mobility of the people who have using this street. Especially on Bus stop streets there is a street vending activity take place by blocking the pedestrian ways.

Table 4.3: Observation Checklist for street connectivity and mobility

Checklist for street connectivity and mobility	**Highly obtainable**	**Less obtainable**	**No at all**
□ Transport options (Bajaj, bus, motorbike,	_	×	_
□ Vehicular stops	_	×	_
□ Waiting areas	_	×	_
□ Car parking	_	×	_
□ lanes,	×	_	_
□ junctions	×	_	_
□ Squares	×		_

According to the site survey, most elements that are helpful for street mobility and connectivity are available. As observed from the site there are different modes of public transport. Vehicular stops, waiting areas, and parking areas are available as well. This makes it easy for society in

terms of getting appropriate services at appropriate places in this streetscape. Ther are appropriate alleys, managed street lanes and junctions with appropriate traffic signs are the characteristics of this street. There are squares along this street which are the new future or landmark for the area. This makes this street more attractive and usable by many users recently and the researcher also observed.

Table 4.4: Observation Checklist for the existing urban fabric

Check List for the existing urban fabric	**Descriptions**
The character of the built mass	Buildings mass along the street characterized as a mix of grain, fine grain, and fine mass which are modern and old deteriorated buildings along the street.
The architectural style	There is no defined architectural style as a city but in this street, there are some modern buildings for hotels, mixed-use, and offices for banking purposes (headquarters of banks) by demolishing known traditional architectural styles
The heights, massing volumes, materials,	There are ongoing constructions with high volume, medium volume, and other small-scaled buildings that are also observed.
Projections onto the street	Some Buildings along this street created some shadows on the streets which is good but they have also created difficulties on the pedestrian walkways because they don't have parking spaces in their buildings rather the users of those buildings use sidewalks to park their vehicles and this has created difficulties on pedestrians.
Adjacent land use(s)	Adjacent land use is predominantly dominated by commercial types and mixed-use land-use types. The rest are a mix of different types of land use
Interaction with the Public Domain	The majority of the buildings are highly interactive with their public domain because the dominant activities along the street are commercial and mixed-use this created those urban fabrics are highly attached to the public or the society
Kind of life accommodated within the built fabric	The type of life is most of the built fabrics accommodated permanent life because they are used for a purpose of living, there are a lot of people permanently using those built fabrics. Kids, young and old people are using those built fabric

4.1.2 Factors impeding the integration of Bole International Airport with the city

Response rate and respondents' characteristics

This section begins by presenting the response rate and the characteristics of the respondents, based on the survey results. Table 4.5 provides an overview of the respondents and the corresponding response rate from the interviews.

Table 4.5: Number of selected respondents.

No	Street users	Questionnaire	Interview	Responses
1	Pedestrians	384	None	253
2	Vehicular drivers	None	35	25
3	Professional	None	3	3
Total				281

The community uses the Street as being a pedestrian and driver. Many respondents were selected concerning the types of street users and professionals who are directly related to the design and planning of streetscapes. The sample size determined for the questionnaires was 384 samples but from those, the valid respondents were 253. After examining and analyzing the collected data the researcher found 281 valid data samples and 245 data only were encoded and analyzed in different means. The rest of the questionnaire responses were removed because they were invalid in different ways.

Vehicular drivers participated in the means interview but the researcher found it difficult to obtain relevant data from them when they were on their way, therefore, judgmentally addressed 35 Taxi, motorbike, and car drivers, instead of asking questions away from the study area on other streets, these individuals were asked questions right in the middle of the street and 25 of responses were analyzed because it saturated at this level. different professionals were also purposefully interviewed, all of whom had an understanding of streets and streetscapes. Within Addis Ababa city, they are architects, urban planners, and urban designers.

The age and sex characteristics of the respondents are presented in Table 4.6. Of the total respondents, 13% of them were under the age of 18, 73.5 % were between the ages of 19 and 47, 9.5% were between 48 and 63, and the remaining 4 % of the respondents were in the age of 64 and above. rewrite: The table also shows that most of the participants or respondents were

found on the streets at the time of data. Most of them are males whereas females are lower than males. When we see it in percentage 60.9 % of respondents were males and 39.1% of respondents were females

The table above indicates that most participants or respondents encountered on the streets at the time of data collection were male, representing 60.9% of the respondents, while 39.1% were female.

Table 4.6: Age and sex of categories of respondents

	measures	Frequency	Percent
Age	Under 18	33	13
	19-47	186	73.5
	48-63	24	9.5
	64 and older	10	4
	Total	253	100
Sex	Male	154	60.9
	Female	99	39.1
	Total	253	100

Respondents' experience in the street towers the airport

It is also here assessed that the street's perceived walkability and comfort for pedestrians who were under this investigation using various related yardsticks. Table 4.7 gives details about why the respondents were on that selected street at the time of the survey. 35.6 % were there because they reside around those areas 29.6 % of the respondents were on the street due to work, 17.0% of respondents were there for marketing purposes, 9.5 % of the total respondents were there because they are going to school and finally 8.3 % of the respondents were there for relaxing and to have fun

Table 4.7: Respondent's reason to be on the street

Reason	Frequency	Percent
For Work	75	29.6
I am a resident of this area	90	35.6
For a picnic	21	8.3
For Shopping	43	17
For Education	24	9.5
Total	253	100

The graph above illustrates how time is spent on activities such as relaxing, walking, working, going to school, and resting. According to the data, 52.57% of street respondents use this street every day. Additionally, 26.01% of respondents use the street between 1 to 4 days a week, 13.04% use it 2 days a week, and 8.3% are on this street once every two weeks. This indicates that over half of the respondents use the sidewalks daily, suggesting that these sidewalks are very vibrant and frequently utilized for various roadside activities.

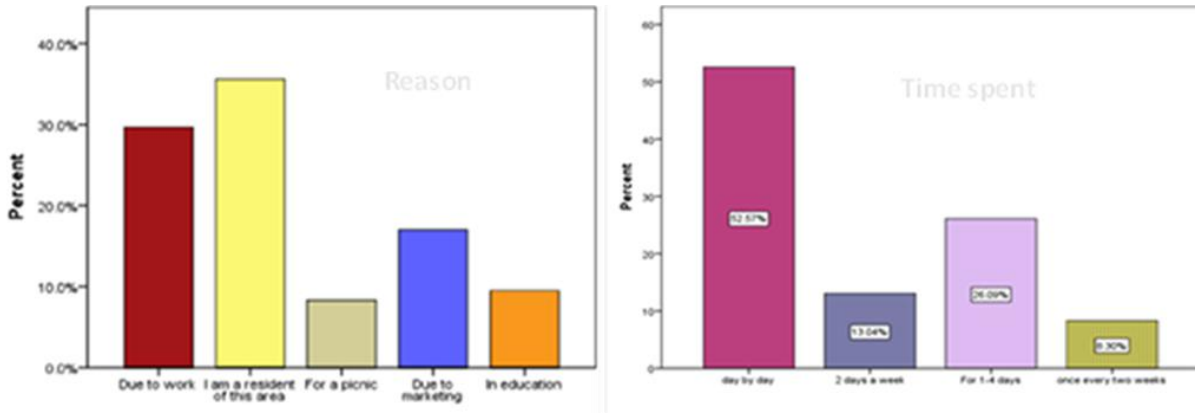


Fig 4.10: Reason and time spent relaxing, walking, working, and resting on the street

The above table cross-tabulates the respondents' reasons for using the sidewalks with how often they use them, providing a clearer understanding of the relationship between these two variables. For work purposes, 46 respondents use the sidewalk daily, 8 use it two days a week, 16 use it 1-4 days a week, and 5 use it once a week. This high number of respondents indicates that those going to work use the street frequently. For residential purposes, 40 respondents use the sidewalk daily, 9 use it two days a week, 30 use it 1-4 days a week, and 8 use it once a week. This shows that those living around the selected street are highly connected to the sidewalks, using them daily for various purposes and representing the highest number of respondents overall.

Table 4.8: Reason and time spent cross-tabulation

Reason to be in the street	time you spend				Total
	day today	2 days a week	For 1 to 4 days	once every two weeks	
Due to work	46	8	16	5	75
I am a resident of this area	40	9	30	8	87
For a picnic	9	12	0	3	24

Due to marketing	10	17	11	5	43
For schooling	11	3	6	4	24
Total	133	59	66	21	253

For picnics or recreational activities, 9 respondents use the sidewalk daily, 12 use it two days a week, none use it 1-4 days a week, and 3 use it once a week. This low number suggests that the existing streetscapes are not particularly attractive for leisure and enjoyment. For marketing purposes, 10 respondents use the sidewalk daily, 17 use it two days a week, 11 use it 1-4 days a week, and 5 use it once a week. Finally, for schooling purposes, 11 respondents use the sidewalk daily, 3 use it two days a week, 6 use it 1-4 days a week, and 4 use it once a week.

Table 4.10 presents respondents' perceptions of the safety and security of the street walkways, focusing on aspects such as the availability of street lights and the incidence of robbery. According to the survey, 66, or 30 % of total respondents, did not observe sufficient street night lights. They believed and observed that there were street light lines, but some of them didn't work well. The rest of 70 % of respondents think that there is enough street light for pedestrians along the street. They have given shop lights and car lights as a source of night light for pedestrians, but they did not want to say there is night light.

Table 4.9: perceptions to availability of night street lights incidence of robbery

		Frequency	Percent
street lights	Yes	177	70
	No	66	30
	Total	253	100
Incidence of robbery	Yes	140	55.3
	No	113	44.7
	Total	253	100

The above table explains the respondent's experience of being robbed day or night in the streets. Of the total 253 respondents 55.3 or 140 respondents, yes and have been challenged by the robbing in one and another way 113 or 44.7 respondents said No and they don't have such kinds of danger in this street. This result clearly shows us that there are robbing activities are increasing day and night on this street, therefore, taking safety measures is mandatory. To see

how safe is the street cross tabulating the sex of the respondents with the above result is presented below

Problems identified by professionals Interview Result

This phase of interviews was conducted with professionals who work in Addis Ababa, and they are Key stakeholders in streetscape design and implementation. Their identities will be kept hidden. This interview included one urban planner, one urban designer, and one architect. Each professional was questioned by both academics and user-driven questions to clarify livability and streetscape design concepts. They gave their opinions on the aspects of each streetscape they thought contributed to higher levels of urban livability due to the provision of airport in the city. They also shared insight into variables that they believe influence the constructed forms of our cities.

In general, those professionals acknowledged that the existing street and street facility needs improvement they explained that the look of what we see today in the built environment is not planned and follows rules and regulations which makes the place more attractive and livable.

All professionals commented that having unconventional streets and streetscapes can cause problems when they see from a professional angle. First of all, the streets is functionally are relatively good, and aesthetically pleasing and their physical form is convenient for users, and the streets or the sidewalks is compatible with the land use.

From a professional perspective, a strong line within a streetscape is essential to the retail success of a street special in commercially active areas. They noted that if there are significant setbacks from the sidewalk either horizontally or vertically then pedestrians are less likely to enter the shops and services which are given along that street. To their knowledge, the most successful streets have very little to no setback variation.

4.1.3 Methods and tools scheming synergistic connection of the airport and the surrounding neighborhoods of the city

Enhancing the existing streetscape connectivity from the professional's perspective

To enhance the connectivity and livability of urban facilities, interviewed professionals suggest that providing all basic urban amenities will greatly improve Addis Ababa. They emphasize the importance of implementing well-planned land use, street designs, and various street facilities. Creating abundant job opportunities and fostering a more human-centric environment will contribute to making the city more enjoyable and livable. Moreover, many professionals believe that the streets have the potential to accommodate these essential urban facilities.

To make the designated street more appealing, here are some ideas for improvements. The street improvement and characteristics that the professionals identified as being a common way to make the street more attractive. architect's urban planners and designers saw upgrading the physical form and structure of the existing street creating a unified cohesive look of the street, by designing a good streetscape particularly architects suggested and indicated that building facades should be no more than 7.62 in width which is described in time saver book. They stated that when buildings exceed these widths the facades are no longer visually interesting and tend to lower the vitality of the street. And all professionals agreed implementing good streetscape design as a good and effective way to enhance the livability of the city.

Policy and planning level instruments

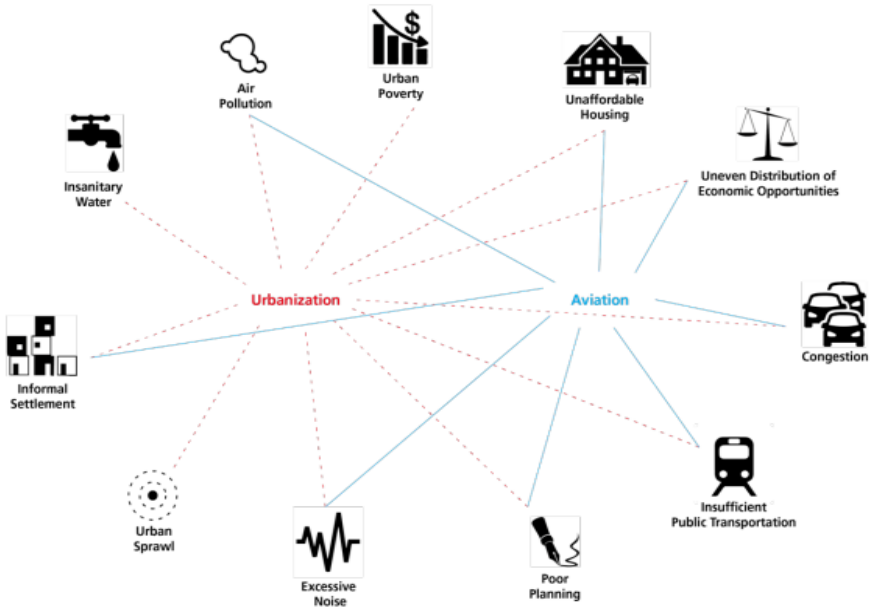
To create an interface between the airport and the city, various tools and methods have also been recommended. The aviation industry has expanded to suit the need for efficient and fast travel. As we know that air transport has a significant role in shaping urban structures, settlement patterns, and economic activity. Aviation infrastructure is evolving to meet the worldwide need for connection and mobility, as air travel becomes more popular. Airports have evolved from simple grassy airfields to large infrastructure for passenger and cargo traffic, aviation services, and non-aviation activities like conference centers. Modern airports require a diverse range of land uses to function. (Bai Yangmin, 2021)

Airports have a significant role in urban and regional development. The region of location. Airports are strategically positioned near major cities, tourism areas, and economic zones to provide faster and more convenient transportation options for nearby users. (Ravetz, 2013)

Someone can use the airport as a regional and worldwide transportation hub, facilitating intermodal transfers of passengers, commodities, and services between flights. The area around is developing around Bole. This development comprises not just hotels and restaurants, but also transportation-related enterprises. So, whenever we bring the idea of Sustainable Development which is making cities and human settlements inclusive, safe resilient, and sustainable. So, a clear framework is needed for engaging local authorities and people in sustainable settlement management. Effective urbanization management is crucial for addressing the negative impacts of development and promoting sustainability in human settlement. Aviation has a significant economic influence, accounting for 3.5% of GDP (2.4 trillion US dollars) and employing 58.1 million people due to its interconnectedness with other industries. Aviation contributes to long-term prosperity and positively impacts individuals' lives. (: Runze Wang (UN-Habitat), 2018)

Airports' closeness to large cities has resulted in the establishment of corridors that assist the flow of people, commodities, and services. So By Connecting bole international airport to other land uses will creates new centers of activity in the area, resulting in varying degrees of activity. These linkages provide varying levels of interdependence and interrelationships, impacting activities and settlements across the metropolis. Airport infrastructure serves as a focal point for managing land use in the city and surrounding region. This notion encompasses both urban and rural growth corridors. It has a key role in linking individuals to opportunities both locally and globally, as well as promoting social integration (Stangel, 2019).

Interplaying land uses between airports and urban regions creates growth synergies and informs urban land use planning. Effective management of corridor infrastructure and its environmental effect is crucial for sustainable urban expansion.

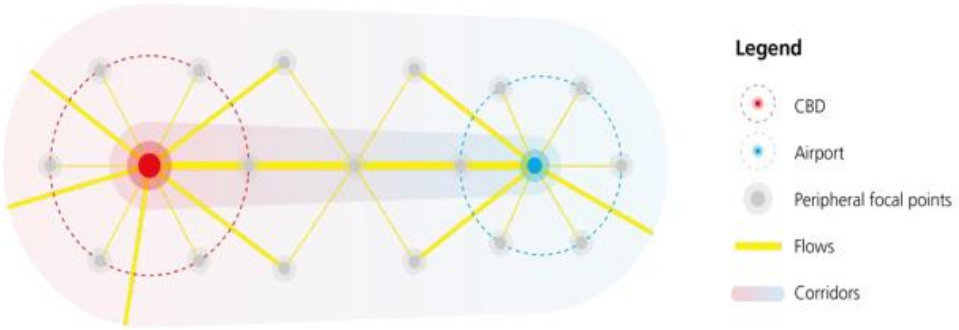


Source: UPP data extracted from United Nations Environment Programme Global Environment Outlook, GEO Data Portal, Human Development Index (HDI) (2010)

Fig 4.11: Relations between aviation and urban growth

In the connectivity analysis, the City-Airport transport corridor should also considered. Airports play a crucial role in urban planning by enabling transportation and distribution networks. Airports significantly contribute to the growth of urban regions. Airports were first established outside metropolitan areas, but as towns grow, they are increasingly encroaching on airports, necessitating good land use planning between the two (UN-Habitat, 2018).

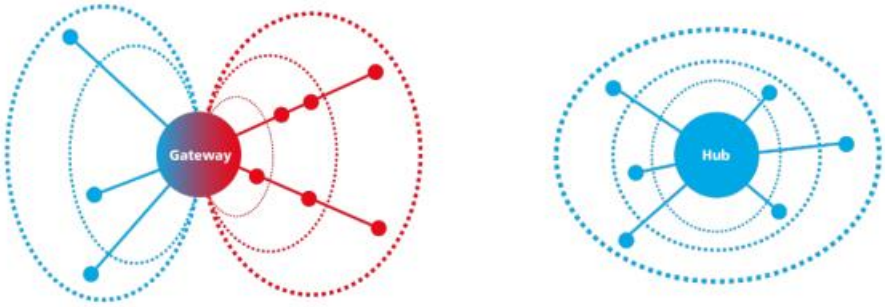
Airports serve as transportation centers in cities. Transport corridors connect the city with rural areas, allowing for efficient movement of people, commodities, and services. The airport is connected to various locations, including the city center and rural hinterlands, by transit links. Transportation linkages can include roadways, trains, and waterways. Transportation linkages play a significant role in facilitating transportation of goods, people, and services between land uses and airports. The transportation network can promote economic growth and development along the corridor and surrounding metropolitan areas (UN-Habitat, 2018).



Adapted from Rodriquez, J.P (2007) Gateways, Corridors and Global Freight Distribution: Transpacific Issues

Fig 4.12: Transport Corridors in metropolitan development

Airports serve as gates to neighboring nations and regions, facilitating the movement of people, commodities, and services across the supply and distribution chain. Airports incorporate a range of facilities, including terminals, warehouses, distribution centers, banking, and hotels, as part of its ecosystem. These measures make it easier to move products, services, and people from the airport's catchment region to other areas. These locations serve as transportation hubs. They gather, classify, transport, and distribute people, products, and services (Stevens, 2012).



Source: Rodriquez, J.P (2007) Gateways, Corridors and Global Freight Distribution: Transpacific Issues

Fig 4. 13: Airports as gateways and hubs

Transport is essential for creating a global socioeconomic environment that allows for the movement of commodities and people. An integrated transportation system connects airports and

other means of transportation, allowing for smooth flow of passengers and goods. (Ravetz, 2013) To effectively contribute to sustainable development, transportation requires physical integration of networks, operational integration, user-service provider interface, policy convergence, joint planning and development of facilities and systems, harmonization of standards across modes, and cross-border investments (Bai Yangmin, 2021).

So, Addis Ababa city administration should create a city-airport corridor which is an important economic link owing to the value provided by land users connecting the city and airport. To maximize the economic prospects along this corridor, the city may reroute services and infrastructure to share the advantages of transportation. Link roads and corridor infrastructure, including water, sanitation, power, and fiber optics, are ideal for achieving this goal. The corridor may accommodate many land uses, including residential, business, warehousing, education, and recreation. City authorities control these properties to maximize their worth, including the use of value capture for municipal tax collection.

Another alternative to make the surrounding area more active using the airport as a commercial hub. Airports have developed from government infrastructure to sophisticated corporate services during the last 30 years. Efficient operation is a continual strain in any sector, driven by consumers and stakeholders alike. Local law often fails to address infrastructure funding, resulting in capacity pressures and outmoded infrastructure, making air travel unpleasant and unsustainable. Airports provide reliable infrastructural assets, even in tough industries. Airports and airlines rely on one other to function smoothly, yet their economic models differ. Airlines can swiftly adjust to changes in traffic patterns by leasing or retiring capacity. Airports require long-term planning to ensure capacity, often years in advance. Airports have maintained a constant user charge of 4% of airline operating expenses for over 20 years by improving efficiency, personnel productivity, and diversifying income streams (UN-Habitat, 2018).

Initially, airport profits were mostly derived from aviation fees. Commercial concessions, or non-aeronautical revenues, currently account for almost 40% of overall income. The increase in passenger and cargo traffic has necessitated changes to airport business models and structures.

Recently, several airports have adopted the airport city idea, which involves planning and operations outside the airport's boundaries (UN-Habitat, 2018).

John D Kasarda defines the Aeropolis as a new urban form that uses an airport and integrated surface transportation infrastructure to connect time-sensitive enterprises with distant suppliers, consumers, and partners. The area includes an airport-based commercial center (Airport City), as well as peripheral corridors and clusters of aviation-related firms and mixed-use commercial/residential complexes that complement each other and are easily accessible from the airport.

Aerotropolis prioritizes quick and low-cost connectivity over long distances. Businesses and travelers should have easy access to the airport, even if they are not necessarily located nearby. Surface routes including roads, trains, and canals play a crucial role in the development of aerotropolis. Aeropolis zones are often located 20-30 minutes from airports. High-tech enterprises often rely on remote suppliers, distributors, and customers. Access to an aerotropolis boosts efficiency by decreasing costs and delays. E-commerce thrives in an aerotropolis due to its convenient transportation options.

Airports invest in infrastructure, facilities, and equipment to guarantee safe and secure operations as air traffic grows. At the same time, it expanded its business activity by providing additional products and services to passengers. The options have expanded beyond coffee, magazines, and duty-free to include specialized apparel, jewelry, electronics, restaurants, entertainment, accommodations, business centers, and parking. (Stevens, 2012)

Another important consideration is land-use planning aspect. The Airport Planning Manual – Part 2 – Land Use and Environmental Management, Doc9184 “states that airport planning is an integral part of an area-wide comprehensive planning program. The location, size, and configuration of the airport need to be coordinated with patterns of residential, industrial, commercial, agricultural, and other land uses of the area, taking into account the effects of the airport on people, flora, fauna, the atmosphere, water courses, air quality, soil pollution, rural areas (such as deserts) and other facets of the environment (UN-Habitat, 2018).

Within the comprehensive planning framework, airport development and operations should be coordinated with the planning, policies, and programs for the area where the airport is located and vice versa. In this way, the social and economic impact, along with the environmental effects of the airport, can be evaluated to ensure to the greatest extent possible that the airport environs are compatible with the airport and, conversely, that the physical development and use of the airport is compatible with the existing and proposed land use (Stevens, 2012). Appropriate planning and infrastructure decisions at airports help to facilitate good environmental management. By planning for intended growth and development, estimations can be made about the type and extent of potential future environmental impacts to allow for a more integrated approach to environmental management (Stevens, 2012).

Land use planning and management is an effective means to ensure that activities near airports are compatible with aviation. Its main goal is to minimize the population affected by aircraft noise by introducing land-use zoning around airports. Compatible land use planning and management is also a vital instrument in ensuring that the gains achieved by reduced noise of the latest generation of aircraft are not offset by encroachment and further residential development closer to airports" The comprehensive planning framework is necessary to achieve the synergies between airports and communities towards sustainable development (Stevens, 2012).

Addressing the zoning around the airport is essential to revitalizing the area and boosting its activity. Airport zones serve as the hub of air traffic in the transportation system. Its proximity is exposed to noise, air pollution, and potential aviation accidents. Increasing airport capacity sometimes necessitates modifications to runway layouts, route structures, traffic distributions, and infrastructure, which can impact risk and noise levels. Considering third-party risk is crucial when making airport development decisions. Major airport development plans, such as adding runways, typically entail government decision-making and public inquiry (Stevens, 2012).

The public's understanding of the local impact of development is crucial. Effective land-use planning and restrictions, based on objective criteria like noise maps, aim to reduce noise-sensitive growth near airports while allowing for beneficial land use (Stevens, 2012). There are several strategies available to limit land usage around airports. The success of these strategies for existing and future airports should be evaluated individually. An assessment of land-use

regulations and policies in examined nations found that no particular technique is more effective than others in addressing this issue. Land-use control measures can be classified as follows: (Stangel, 2019)

a) Planning tools (e.g., zoning ordinances, site-specific noise contours, subdivision regulations)
b) Mitigating tools (e.g., building codes, noise insulation programmers, land acquisition and relocation guidelines)
c) Financial tools (e.g., capital improvements, tax incentives, and airport noise charges). (Stangel, 2019)

To ensure airport compatibility, land use planning should include at least two zones (see Table 2). The airport and nearby towns should collaborate to create zones based on noise exposure levels. Enforce tight land use rules to avoid incompatible development in noise-sensitive zones. Due to excessive noise levels in Zone A, it is recommended to restrict sensitive land uses and prevent most projects. In Zone B, moderate noise levels may necessitate restrictions on land use and construction. Noise exposure indices should follow a logical evolution based on land-use planning zones (UN-Habitat, 2018).

Zones			
	A	B	OUTSIDE
Land-uses or developments	**Most are not permitted**	**Some restriction**	Unrestricted
Agricultural	Restricted or prohibited	unrestricted	
Industrial	Restricted or prohibited	unrestricted	
Commercial	Restricted	Unrestricted or restricted	
Residential	Restricted or prohibited	restricted	
Public facilities	restricted	restricted	

Source: ICAO

Fig 4.14: land use planning

To reduce noise at an airport, four main elements are explored: source reduction (quieter aircraft), land use planning and management, noise abatement procedures, and operating restrictions.

Privately held property near airports can be utilized for farming, provided it does not attract birds.
Crop cultivation may lead to increased bird populations. Additionally, the area can be used for future industrial, commercial, recreational, or public purposes (UN-Habitat, 2018).

The issue of the environment is one of the important considerations. The government and civil aviation should create a variety of standards, regulations, and procedures to help enhance the environmental performance of aviation.Providing instructions for applying integrated strategies to reduce aircraft noise and emissions, including technological advancements, operational procedures, correct management of aviation traffic, appropriate airport land-use planning, the use of market-based solutions, and environmental management (UN-Habitat, 2018). The government should adopt ICAO's three major environmental goals, those are:

a) Limit or reduce the number of people affected by significant aircraft noise;
b) Limit or reduce the impact of aviation emissions on local air quality; and
c) Limit or reduce the impact of aviation greenhouse gas emissions on the global climate

It is also necessary to consider the Convergence of Airport and Metropolitan Planning Policies. To achieve a sustainable airport and city mutual integration metropolitan authorities must collaborate to develop infrastructure to meet the growing urban population and air traffic demands. To achieve these aims, a framework highlighting the role of airports and cities in infrastructure and service development is necessary, as well as research of synergistic interactions for sustainable growth. Infrastructure development is crucial for adequate service delivery. Land use changes around airports can affect air traffic capacity and operations. Land use should correspond with urban planning standards, the Airport Planning Manual, socioeconomic development plans, and ecological programs to ensure sustainable urban expansion (Ravetz, 2013).

This study examines how cities integrate airports and urban areas, with varying approaches. Airports adhere to national civil aviation laws, including ICAO SARPs, infrastructure development strategies, and land use planning. Urban rules and processes, as well as national and

regional planning requirements, drive city development. The existing synergy between airports and urban growth involves stand-alone strategies for infrastructure development, making cooperative control difficult at both municipal and national levels.

So stakeholders should develop guidelines to coordinate airports and metropolitan policies for convergence. This will help States establish sustainable approaches for new airport infrastructure and urban development. The national common policy plays a crucial role in ensuring sustainable infrastructure development. The standards might include airport and metropolitan infrastructure development, land-use planning and management, environmental and capacity building, and community participation.

Future Airport, sustainable urban and airport development

When planning a sustainable airport and city, it is crucial to consider the social, economic, and environmental pillars. Implementing these three pillars at the local, regional, and national levels will facilitate synergies between the airport and neighboring communities. Urbanization has driven growth across the continent, creating opportunities to meet fundamental needs and provide essential services to urban residents in Addis Ababa at affordable prices. The majority of nations' GDPs are generated in metropolitan areas, where interactions between various forces create positive growth synergies that can promote sustainable urban expansion. Supporting changes in urban and territorial planning and development requires data, appropriate legal and policy frameworks, encouragement of implementable institutional transformations, and accountability (UN-Habitat, 2018). Promoting sustainable expansion of the urban and aviation sectors begins with the integration of airport infrastructure development and aviation development. A coordinated effort must be made to harmonize national and local urban expansion rules, policies, and programs at both the national and local levels (Stevens, 2012).
Airport planning should align with the airport's long-term strategy. Airports may either become Aerotropolis centers or airport cities. To optimize aviation advantages, decrease costs, and increase user efficiency, airports should incorporate stakeholders in planning processes. The airport should plan ahead of time to meet the changing demands of its consumers and stakeholders.

To meet rising air traffic demand, it's crucial to provide adequate capacity, prioritize safety and security, and minimize environmental effects. Aeronautical customers' costs must align with the services they receive and be cost-effective (Stangel, 2019).

The airport should be well-integrated with its surroundings, including the city and its surrounding region. Sustainable development requires integrated planning that includes airport, environmental, urban, and regional planning, as well as site planning. The airport's master plan should align with the master plans of surrounding towns. Each plan's goals and objectives should be clearly defined and mutually respectful (Stangel, 2019).

Community participation helps the airport address local issues and communicate effectively about airport development. This allows for better management of current and future challenges including noise, environmental impact, and airport growth. Airport master planning should align with urban and regional planning requirements, and vice versa. The master plan aims to provide quick and simple access to the airport for neighborhoods and companies. This comprises prospective clients of the aerotropolis (Stangel, 2019). Airport users and stakeholders, such as airlines, general aviation, border security, customs, immigration authorities, suppliers, and operators, should be consulted and involved in the planning process. Consult with infrastructure and surface transportation authorities, including highway and railway officials, as well as potential customers. Airport representatives should assist in urban and regional planning and ensure airport requirements are considered. Engaging the community is crucial for ensuring consistency in sustainable development practices. There may be constraints on airport development depending on whether the airport is an existing or a green field one, and on the availability of space around it. In most cases, it is possible to improve airport access thereby reducing time and cost to users. This could be achieved through urban planning and business site planning, as well as the planning and implementation of surface transportation (Stevens, 2012).

The design instruments

The fundamental layout of modern airports needs to be improved because their technologies are changing so swiftly. The comparison of airport development to Central Station development highlights the importance of airports. However, planning for an airport goes beyond "technical airport planning." It goes beyond basic urban planning and interdependently integrates transportation and land-use planning. As a result, the term "Airport City" designates a place

where people meet, conduct business, and go shopping. It powerfully illustrates the difficult process of managing the design of an airport city. The basic layout of modern airports needs to be improved because their technologies are changing so quickly.

In fact, It's not practical for every airport to evolve into an airport city.. It is important to consider not only whether a city should have an airport or become an Airport City, but also the spatial quality of the area that will be formed with an airport development. The corridor that runs parallel to Airport City and the actual city center is among the sections of the metropolitan region that have grown at the highest rate in recent years. There is a noticeable increase in traffic congestion on the line between Airport City and the main city.

This concentration of transportation infrastructure, despite the fact that there is only one airport, does allow for the establishment of multiple parallel roads and railway lines. It's important to look into prominent Airport Cities scenarios to fully understand these complex systems. Owing to the scarcity of research on these concepts in terms of space design and quality, it is critical to recognize certain categories that will facilitate comprehension of the situation as it stands today and the necessity of these systems going forward.

What purpose does Airport City fulfill? Why was it decided to be built under these specific conditions, and what expectations were there? The creators of the airport now had to consider the techniques and concepts they came up with. The connection between the main city center and the airport city center is crucial for incorporating these technologies into the existing city structure. Developing better living and working environments requires careful planning. As a result, the land uses around airports and Airport City assume significant importance. Under the guidelines of aviation laws and regulations, land uses around airports should be carefully regulated to create more sustainable and livable areas.

To analyze land uses and spatial forms in and out of Airport City structures, a number of sub-headings have been determined, including form and function, composition and configuration, parking facilities, entrances and transfer points, pedestrian circulation and permeability, connections, concentration, buffers, and border connections.

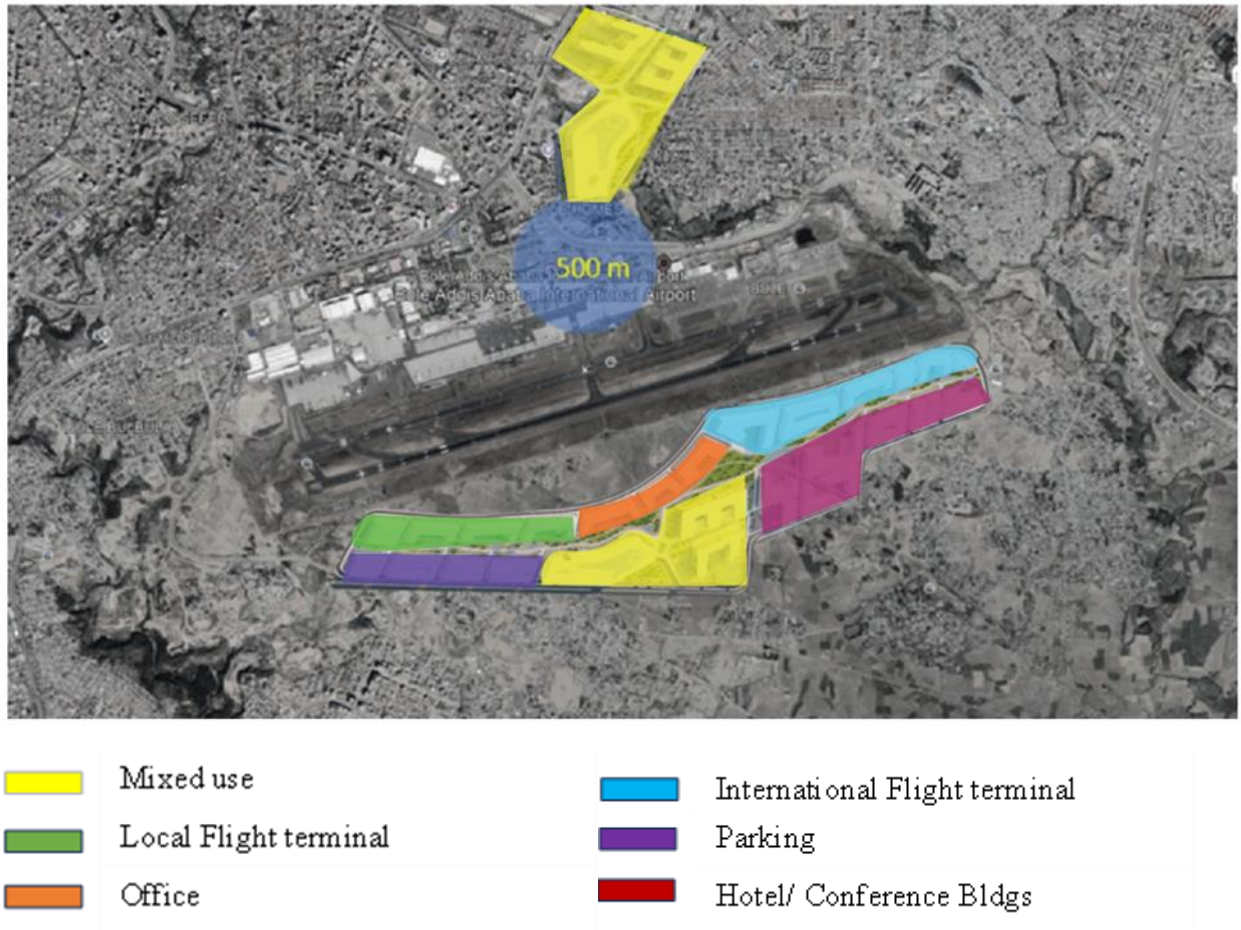


Fig 4.15: Schematic design of proposed site

Regarding the scale & design structure of airport-to-city linkage, Cities need to be governed since they are always growing. Determining the extent to which the municipal limits may be expanded or contracted requires planning. The most important phase in the growth process is the size of a city. Scale ratios have a significant impact on humans because the continuity of experience across scales demonstrates the significance of perceiving continuity. An airport city needs to be proportionately in line with urban design principles since it is ultimately a part of the metropolis.

We are able to offer a Technopark as well as a few more offices, hotels, conference centers, and residential areas on the north side of Bole International Airport. Airport City's proposed physical integration zone is shown in Figure as the yellow zone. It is evident that the authorized zone and

the airport terminal are accessible by foot. There are many additional modes of transportation included.

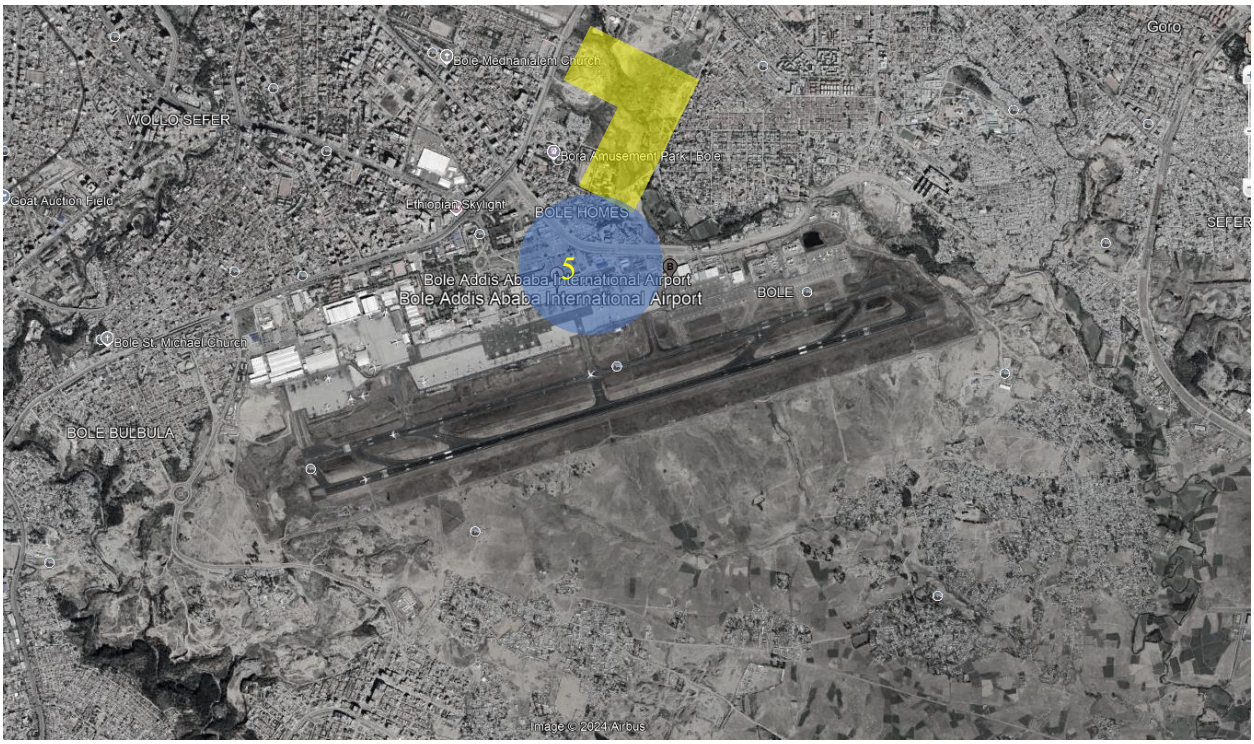


Fig 4.16: Circle with a radius of 500 meters, center: Bole international airport

The proposed design offers a wide range of on-airport and airport-related businesses, such as hotels, retail establishments, conference rooms, and parking lots. Despite the recent sharp increase in the development of Airport Cities, the availability of free land surrounding the airport has always been a problem. These are the factors that, in my opinion, motivated the plan to build Airport City closer to the main terminal, which is beneficial in terms of size considerations (Figure 4.16). Almost all of Airport City's significant features will be built in a 500-meter radius around the main terminal. Larger structures with spaces set aside for retail, offices, and meeting rooms ought to surround the passenger terminals and be connected to them. A multi-story parking structure on the other side of the street can solve the problem of parking places.

Regarding the movement and mobility within the airport city, Bole International Airport is centrally located in an already densely populated center so having such a strategic location, and strong rail and motorway connections will make the airport ultimately reachable and significant. Constructing Long-distance trains which has a connection with this terminal will create

significant mobility and connection between the airport and the city. A good example is Frankfurt Airport is located Southwest of central Frankfurt where two of the densest motorways intersect. Since long-distance railway station has a direct connection with the airport, it can be said that all those trains that are coming from other cities, or even from other countries, serve directly for the airport as well.

PROPOSED INFRASTRUCTURE IMPLEMENTATION

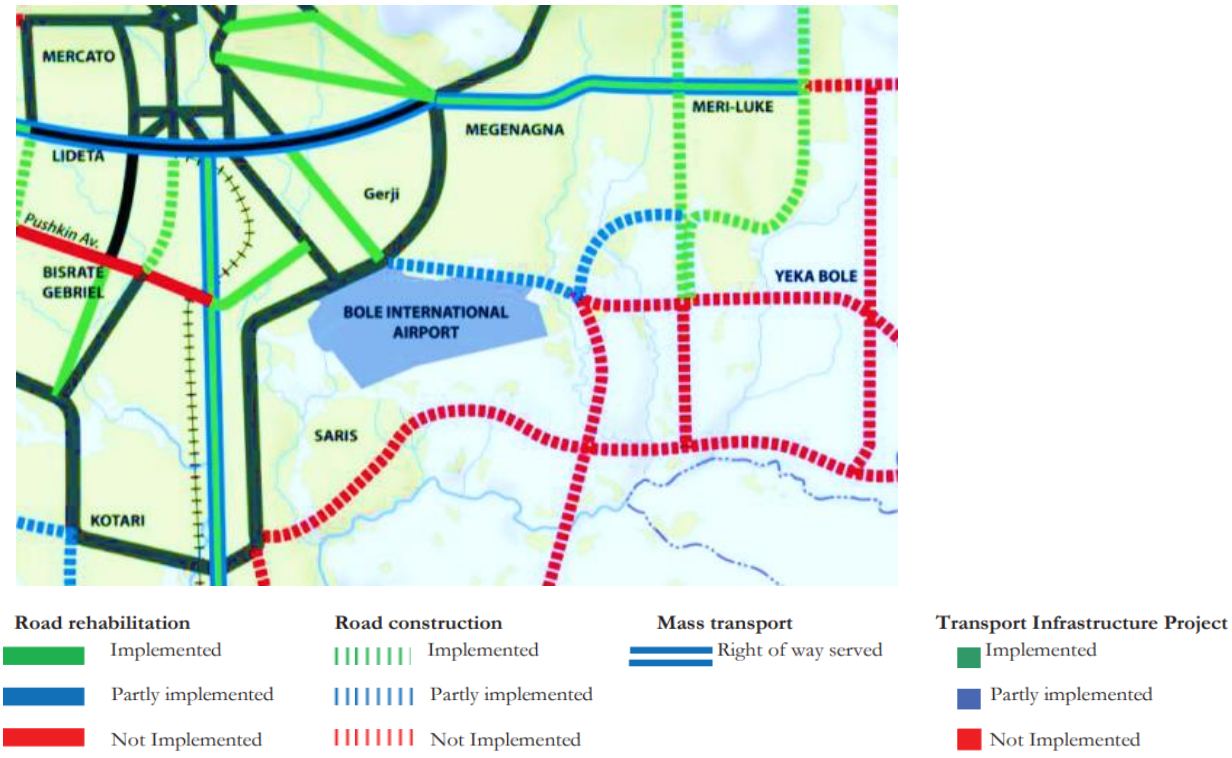


Fig 4.17: Proposed Infrastructure Implementation

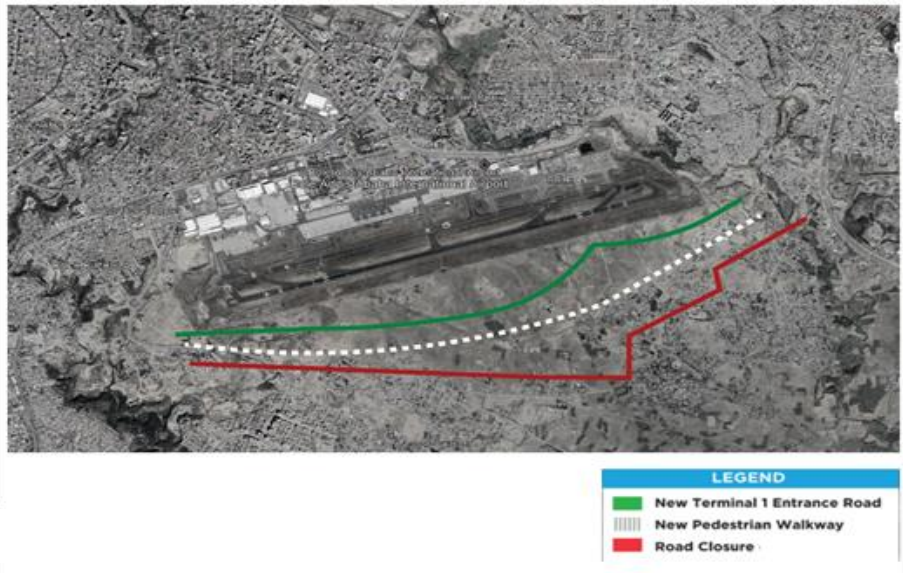


Fig 4.18: Proposed Mobility

ILLUSTRATION OF PROPOSED PLAN

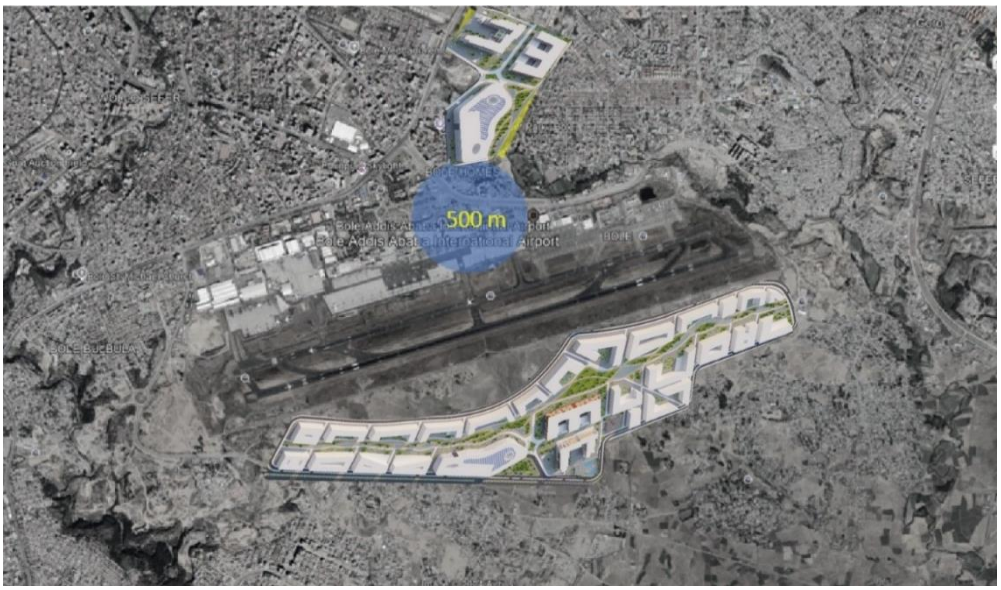


Fig 4.19: Proposed Site Plan

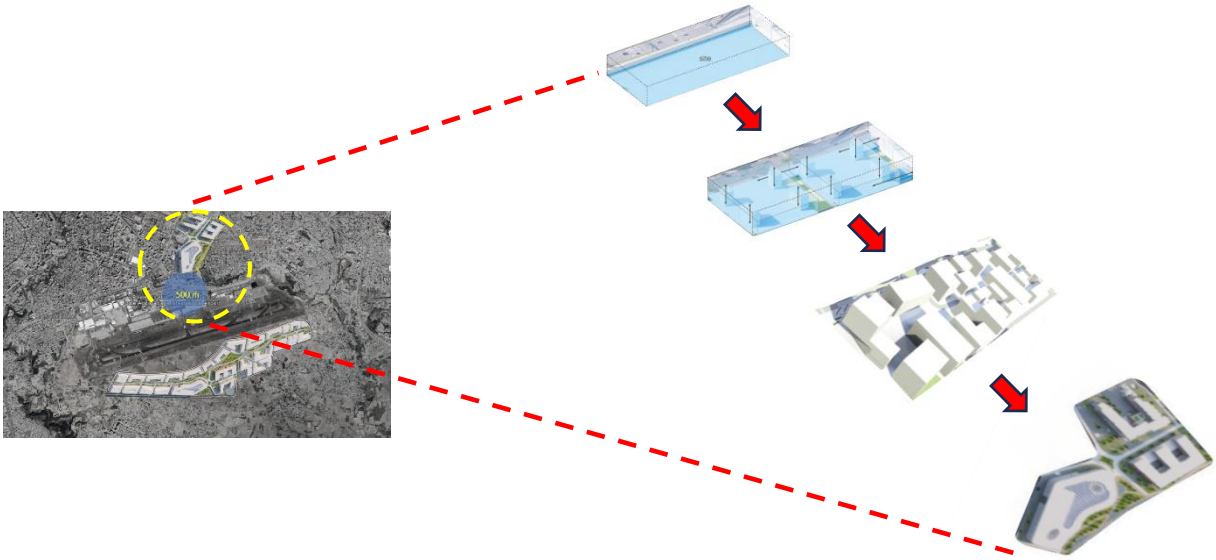


Fig 4.20 Design Developnent

PROPOSED DESIGN RENDERS

Fig 4. 21: Proposed design rendered pictures

4.2 discussions

Result and discussion of direct observation

Direct observations were made on selected streets. In this direct observation, the researcher noted the comportments, comfort, liveliness, and social engagements that took place in the streets during this observation. The usage and form of the street were also examined, as well as how it influenced the users' activities and livability.

Observations within the street were carried in different days. During those days of observation and many workers, students, commuters, and street sellers, merchants were visible. Within this one hour in different areas of observations, there are a number of peoples walked in the street in the morning afternoon and in the night. There were a lot of different activities occurring on this street, people are going somewhere individually as well as a group, elderly people were walking, using street-side coffee houses, commercial activities, and people going for walk. All most all people were moving at a faster speed because the walkways are comfortable and wide.

There are several different types of commercial, and governmental buildings and utilities found within the street. a large proportion of commercial and mixed buildings with different activities there are hotels, some retail shops, cafes, clothing stores, shoe shiners, small food businesses, bakeries, supermarkets, groceries, and gas stations. There are also several hotels and governmental offices. Overall, there is a combination of commercial and economical activities are there for shoppers. The physical design of the street is appealingly attractive, comfortable, and inclusive.

Figure 4.22: overall status of the street during the site survey

Discussion of interview responses.

Through interviews with professionals, the researcher used four basic questions which is helpful to achieve the general objective of this study. The first question is a general question which is ‘’What is your perspective about Addis Ababa cities streets as a whole? This question is meant to fully understand and compare the qualities of the street that is found in the city and around the airport to understand the impact of the airport's contribution to the city. it was determined by all three professionals that the existing cities' street is more problematic than their usefulness.in general, they explained the built environment like street, street facilities need improvement and convenience to use this is because they are built as planned or they have planned ways to implement them into the ground.

The second question applied in this interview is their perception of the problems they observe from their professional background they explained the street in terms of function aesthetics, and physical form as they mentioned in the time of interview. This study also identified those listed problems in different meanness and the researcher understands that such missing some of those urban elements made the street not to be fully convenient for users, like pedestrians and vehicular drivers and the land use application is also needs improvement.

4.4 Study Findings on challenges which affect City-Airport synergetic linkage between bole international airport and Addis Ababa city

A) Government Policies and Strategies

Aviation is facilitated by the national government and supported by the local authority governments in terms of legislation, policies and programs. This helps to protect the aviation space and boost aviation related activities.

However, some policies work against the aviation industry and impair its growth. In Ethiopia heavy taxation as one of the major impediments to the growth of aviation. Governments heavily rely on taxing aviation goods and services to get money to develop other sectors of the economy, leaving the aviation sector heavily underfunded. Taxation costs are eventually passed down to the consumers who pay heavily for tickets and freight charges. This eventually leads to low passenger numbers (due to cost access barriers) and mostly, there are insufficient numbers to

bolster a higher demand of goods and passengers. Thus, air transport remains an expensive mode of travel.

B) Incompatible/Unregulated Land Uses Around Airports and Other Aviation Facilities

Land usage near airports may hinder aviation. Airports require low-rise constructions that do not hinder flight routes. In Ethiopia airport neighborhoods are safeguarded under rigorous land use regulations.

C) Diminishing Land Resources around airports and other aviation facilities

Airports expand to meet increasing demand, necessitating an increase in its plinth area. Expansion necessitates acquiring additional land. In metropolitan areas with strong demand for space, limited land resources make it difficult to expand airports. Lack of support infrastructure and operations would restrict aviation expansion. Airport master planning, national, regional, and urban plans should address recognized obstacles and possibilities. Consultation with nearby communities is necessary for successful communication and coordination of the plans. Bole International Airport. The Ethiopian Airports Enterprise is planning to build a new airport at a location outside the city to ease the congestion challenges facing the airport.

D) Rapid and Unplanned Urbanization

Urban growth has a significant impact on airport space. Urban land users encroach on airport amenities, creating a crowded environment. Airports require space for aircraft routes with minimum traffic. As cities expand, their populations tend to settle near flight lanes. Land use around airports can affect operational safety, community safety, and environmental impact. Therefore, airport master plans, as well as urban and regional land use plans, must include these concerns. Community participation helps communities understand the impact of land changes.

E) Connectivity

Addis Ababa has a problem accessing the airport due to traffic congestion on the routes leading to the airport, slowing down the access periods.

Discussions on the Impact of Aviation on Socioeconomic Activities of Addis Ababa City

The vast majority of Ethiopia's air passenger traffic flows through Addis Ababa Bole International Airport. In 2011, nearly 5.2 million total passengers passed through the airport – 4.6 million international passengers and 0.5 million domestic passengers. Approximately three-quarters of international traffic at the airport is intra-African. It is the main hub of Ethiopian Airlines, the flag carrier that serves destinations in Ethiopia and throughout the African continent, as well as non-stop service to Asia, Europe, and North America. (: Runze Wang (UN-Habitat), 2018)

Urbanization is a transforming trend in the 21st century, driven by worldwide population growth. While the concentration of population, economic activities, and social interactions in cities can positively impact air transport, it can also pose significant sustainability challenges if not managed effectively. (Runze Wang (UN-Habitat), 2018)

Discussions environmental impact of airports

A) Aircraft Noise

Aircraft noise is the leading source of negative community reactions to airport operations and growth. This trend is projected to continue in most places of the world for the foreseeable future. ICAO prioritizes limiting exposure to airplane noise as one of its core environmental goals. The Balanced Approach to Aircraft Noise Management is the major ICAO strategy for reducing aircraft noise. It outlines many methods for achieving this goal. ICAO Doc 9829 provides guidance on the balanced approach to aircraft noise management. (: Runze Wang (UN-Habitat), 2018) A set of activities can be characterized as compatible with different degrees of noise exposure. Industrial development is typically associated with greater levels of noise exposure. Noise maps and zoning rules are crucial for successful urban growth near airports. Planners and developers should include these tools into municipal master plans.

Mitigation techniques include construction regulations, noise insulation, property acquisition/relocation, transaction aid, and real estate transparency. This Guidance Document includes ideas for heritage conservation and climate change adaptation. Noise abatement procedures: Day-to-day airplane activities can affect noise levels on the ground. The International Civil Aviation Organization (ICAO) promotes safe and cost-effective low-noise

operations. Possible solutions include noise-preferential runways and routes, as well as noise-reducing techniques for takeoff and landing. The suitability of these solutions relies on the airport's physical layout and surroundings. However, safety must always be prioritized. ICAO recommends operational procedures in many documents. (: Runze Wang (UN-Habitat), 2018)

Study Findings on Air Quality in The Vicinity of Airports

Air quality at airports is impacted by pollutants from aircraft engines, motor vehicles, and access traffic, as well as other sources including power plants and incinerators. Since the late 1970s, ICAO has developed strategies to mitigate the impact of aircraft emissions on Local Air Quality (LAQ). These regulations target aircraft engine emissions below 3,000 feet (915 meters) and emissions from airports, including traffic, ground service equipment, and de-icing activities. ICAO's work has resulted in the development of the ICAO Standards and Recommended Practices (SARPs) on aircraft engine emissions, which can be found in Volume II of Annex 16 to the Convention on International Civil Aviation (the "Chicago Convention"), as well as related guidance and technical documents. These requirements cover liquid fuel venting, smoke, and gaseous exhaust emissions from jet engines, including hydrocarbons and oxides. (Runze Wang (UN-Habitat), 2018)

A) CO2 Emissions from International Aviation

The international aviation sector aims to improve fuel economy by 2% year and stabilize CO2 emissions at 2020 levels, resulting in carbon neutral growth. ICAO has made significant progress towards attaining global goals and a sustainable future for international aviation by developing and implementing a "basket of mitigation measures" to cut CO2 emissions. The "basket" encompasses developments in aviation technology, operational improvements, sustainable alternative fuels, and market-based solutions. (Runze Wang (UN-Habitat), 2018)

CHAPTER FIVE: 5, CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

The principal aim of this study was to analyze the design structure of one of the most trending concepts in urban planning, which is Airport City, and to understand design guidelines of current examples to give further contribution in terms of spatial quality for future developments. The lack of research in this field was the most important motivation to get deep into this study. The process of this study has been started with an overview of airports. Important factors that led airport development to become part of a city have been discussed from planning and design perspectives. After analyzing the history, development of airports, and theoretical background, which includes both 'Aerotropolis' and 'Airport City' terms, case analysis has been evaluated under the design framework of Airport City. As a consequence, the research presented an idea about the design guidelines of the Airport City to encourage further studies in this field. The main focus of this study is to understand the benefits of the Airport City concept for the city and airport itself in terms of both strategic and spatial planning. It is aimed at understanding how important an airport area can be for a city to create good virtual images for passengers in a certain limited space. Most particularly, the spatial relationship between Airport City borders and the airport terminal aimed to be clearly understood by analyzing certain cases. To understand how to design a better Airport City concept in terms of space and place, certain criteria that were analyzed for Istanbul, Frankfurt, Amsterdam, Paris, and Incheon cases has been compared and interpreted from both descriptive and prescriptive perspectives.

4.2 RECOMMENDATIONS

- Ethiopian civil Aviation and Addis Ababa city administration should collaborate to create guidelines for sustainable airport infrastructure and urban development, taking into account existing international standards and expertise.
- Develop a combined capacity-building program for airport and city planners. Consider launching a tailored airport and urban planning course in collaboration with ICAO.
- City planners and urban policymakers should be aware of the land use and operational needs of aerodromes, airports, and civil aviation infrastructure in fast-growing cities, taking into account ICAO policies, standards, and recommended practices for environmental management.
- To measure the economic impact of aviation on urbanization, the city administration and civil aviation should develop tools and mechanisms to assess and quantify the socio-economic contribution of airports to cities and national development, using case studies.
- The city administration and civil aviation should collaborate with academic institutions to conduct evidence-based research on the spatial linkages between airports and cities, taking into account ICAO policies, standards, and recommendations.
- Use existing tools and regulations, as well as comprehensive environmental impact assessments, to identify and assess risks outside airports (e.g. settlements, buildings, waste, landfills, smoke) and in cities. This will help eliminate or mitigate negative impacts on future developments and maximize benefits. Land use and environmental management challenges and opportunities might promote sustainable development synergy.
- Guidelines for collaboration between airports and local administrations should include institutional coordination and governance frameworks. Promote integrated multi-modal transportation between airports and cities. Encourage states to collaborate with airports and local authorities to review the State Aviation and Urban Development Initiative.

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APPENDIX

APPENDIX A - Observation checklist of streetscape elements and existing street Utilities and services

Site Observation checklist	**Availability**		
Check List for Streetscape Elements	Available on selected site	Less available	Not available at all
□ Street lights,			
□ Trash cans			
□ Public art			
□ Public toilets			
□ Traffic signs and signals,			
□ Street trees and other horticultural elements,			
□ General public furniture,			
□ Advertising signs, and decorations			
□ Bicycle facilities (bikeway, racks)			
□ Iconic buildings and heritage values			
□ public transport infrastructure			
Check List for street Utilities and services running for pedestrian activities			
□ sidewalks/footpaths			
□ Pedestrian Pavements			
□ Ditches (M)			
□ Crossings			
□ Disability ways			
□ Frontage cafes			
□ Vending activities			

APPENDIX B- Observation Checklist for street connectivity and mobility

Check List for street connectivity and mobility	**Highly obtainable**	**Less obtainable**	**No at all**
□ Transport options (Bajaj, bus, motorbike,			
□ Vehicular stops			
□ Waiting areas			
□ Car parking			
□ lanes,			
□ junctions			
□ Squares			

Check List for the existing urban fabric	**Descriptions**

□ The character of the built mass	
□ The architectural style	
□ The heights, massing volumes, materials,	
□ Projections onto the street	
□ Adjacent land use(s)	
□ Interaction with the public domain	
□ Kind of life accommodated within the built fabric	

APPENDIX C - Observation Checklist for the existing urban fabric

APPENDIX D – Number of total respondents in questionnaire and interview.

No	Street users/participants	By Questioners	By interview	Valid numbers
1	Pedestrians			
2	Vehicular drivers			
3	Professional			
	Total			

APPENDIX E - Respondent's reason to be on the street

Reason	Frequency	Percent
For Work I am a resident of this area For a picnic For Shopping For Education Total		

APPENDIX F - Problems perceived by professionals Interview Result,

Professionals frequency

Profession	Frequency	Percent
Urban Planner Urban Designer Architect Total		.

APPENDIX G - Airport compatibility, land use planning

Zones			
	A	B	OUTSIDE
Land-uses or developments	**Most are not permitted**	**Some restriction**	Unrestricted
Agricultural	Restricted or prohibited	unrestricted	
Industrial	Restricted or prohibited	unrestricted	
Commercial	Restricted	Unrestricted or restricted	
Residential	Restricted or prohibited	restricted	
Public facilities	restricted	restricted	

Source: ICAO

APPENDIX H - Questioner One

ADAMA SCIENCE AND TECHNOLOGY UNIVERSITY

COLLEGE OF CIVIL ENGINEERING AND ARCHITECTURE

DEPARTMENT OF URBAN PLANNING AND DESIGN MSC PROGRAM

Dear respondent, thank you in advance for your time. This questionnaire is designed to gather data for research purposes to the fulfillment of MSc in the field of Urban Planning and Design Accordingly, your genuine responses are extremely important for this research, so please be free and respond to all the open-ended and closed questions. Survey

1,Gender A) male B) female

2, Profession _____

3, Age A) Below 18 B) 18-50 C) above 50

4. What is your frequent transportation choice?

A. Taxi B. walking C. biking D. Train E. Private automobile

5. Which activities are destructive on pedestrian sidewalks?

A. Taxi and bus waiting area B. Street vending C. Street shoeshine D. Construction work and material leftover E. On pedestrian street parking

6, What are the most common problems that you face while you coming to the airport?

7, what do you think the importance of the provision of Bole international airport to the neighborhood ?

8, what do you think the side effect of the provision of Bole international airport to the neighborhood ?

9, what is your suggestion on how to create a mutual benefit between the airport and the city?
