A Spatio-Economic Logit Model for Aerocity and Optimizing Socio-Economic Infrastructure: A case of Navi Mumbai

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***Abstract*—The commissioning of the Navi Mumbai International Airport (NMIA) represents a paradigm shift for urban planning in the Mumbai Metropolitan Region (MMR), necessitating a transition from static municipal planning to dynamic, infrastructure-led spatial structuring. Positioned near critical regional assets—including the Jawaharlal Nehru Port (JNPT), Mumbai Trans Harbour Link (MTHL), and the Navi Mumbai Airport Influence Notified Area (NAINA)—the NMIA influence zone offers exceptional opportunities for developing an integrated Aerocity. However, conventional planning methodologies present significant limitations: first, the arbitrary use of political administrative boundaries to define the planning zone; and second, the structural inadequacy of traditional, resident-only infrastructure standards that fail to account for massive daily "floating population" surges. To address these systemic planning gaps, this research evaluates the development potential of the NMIA influence zone and formulates a strategic Aerocity development framework. The study employs a mixed-methods approach, combining qualitative expert and stakeholder surveys with Geographic Information Systems (GIS).**

To establish a scientifically justified development zone, the research introduces a Spatio-Economic Logit Model (SELM). This model replaces political boundaries with network-derived travel time probability contours, identifying the optimum, environmentally insulated planning boundary of seventy-nine square kilometers. This probability surface is calculated by standardizing travel times along the multi-modal transit network to predict airport-utilization probability. This dynamic accessibility matrix is triangulated with spatial variables representing economic land-use densities and human development indices to establish a highly resilient, non-arbitrary physical jurisdiction for the planning authority.

Furthermore, to future-proof the region's social services and prevent infrastructure clogging at critical transit interfaces, this study formulates the Socio-Economic Dynamic Capacity Index (SEDCI). By using a nodal peak modifier, the index adjusts allocations for specific high-pressure nodes, such as the central business district core and transit-oriented development capillaries. The resulting index is utilized to adjust spatial footprints, utility demands, and social programming, ensuring that the physical sizing of regional healthcare, education, and public plazas matches the actual functional human load. Synthesized into an integrated spatial strategy, the resulting planning framework aligns dynamic land-use intensity with infrastructure carrying capacity. This framework channels commercial and logistics densities along high-speed transportation corridors radiating from the airport core, while preserving vulnerable low-lying mangrove wetlands as protective eco-insulation buffers. Supported by prescriptive policy instruments—including infrastructure-linked floor space index premiums, green transferable development rights, and value capture financing—this research delivers a resilient, scalable, and highly replicable roadmap for greenfield, airport-oriented growth centers in developing economies.

I. INTRODUCTION

1.1 Introduction

Since the beginning of the Industrial Revolution, economic development characteristics have been associated with transportation modes. The transportation mode features generate different types and spatial forms of regional economic development activities. Since the industrial revolution, we can distinguish five major economic waves associated with different transportation modes [1].

The first wave of economic expansion, from the 16th through the 18th century was defined by the establishment of major commercial and industrial hubs around seaport which have grown in importance since it has enabled international trade and global supply chains [2]. The second wave, from the late 18th to the early 19th centuries, was characterized by development along rivers and canals, which formed the pillar of the industrial revolutions in Europe and the United States, the development of canal systems in the second wave was primarily to transport heavy goods which allowed the construction of primitive and limited inland distribution systems [1]. In the 19th century, the third development wave was shaped by railways transportation mode, allowing more flexible and high-capacity inland transportation systems. The railway mode has created significant economic and social potential through the connection of the fringe regions and the resource areas inside the countries, promoting rapid commercial, industrial, and urban development outward [2].

During the twentieth century, the fourth economic wave was based on the highway systems, which enhanced the accessibility inside the country and spawned an urban development boom. The fast growth of comprehensive road transportation networks leads to the creation of a new major economic sector such as vehicle manufacturing, as well as the occurrence of enormous economic prospects to serve industrial and commercial customers with dependable door-to-door delivery [1].

From the second half of the twentieth century to date, the fifth wave of development was characterized by information technology and rapid economic growth. The airport has become the distinguished transportation mode of this fifth wave [2]. Figure 1, shows the associated transportation modes for the

1.2 Transportation and Economic Development Waves

development waves and their spatial development forms.

Airports have become significant components of production and projects on a worldwide scale with speed and ease of movement and access, playing a major part in the fundamental expansion and the urban shape [3]. International airports are widely acknowledged as vital tools for local and regional economic growth since they improve competitiveness at the continental and global levels and attract international investment and job creation in a wide range of new urban activities, the airport's function has expanded beyond simply carrying passengers to the establishment of the new economic region paradigm around the airport known as Aerotropolis [4].

International investment is crucial for developing countries to realizing the future goals of sustainable development and economic growth. The evidence shows that airport exploit in developing countries can generate not only capital and revenue, but also jobs, knowledge, technology, innovation, upgrading and especially inclusive, sustainable and responsible growth [4].

The research attempts to introduce the fifth development wave of airport economic zone in the developing countries and use the airport region potentials for the development of new country global economic poles and join the worldwide airports" economy network.

The aim of the research is to approve the applicability of the of the new paradigm of airport economic zone, Aerotropolis, in developing countries to escalate the country's economic level from local economic development to regional/global economic development and associate the country to the global worldwide economic network.

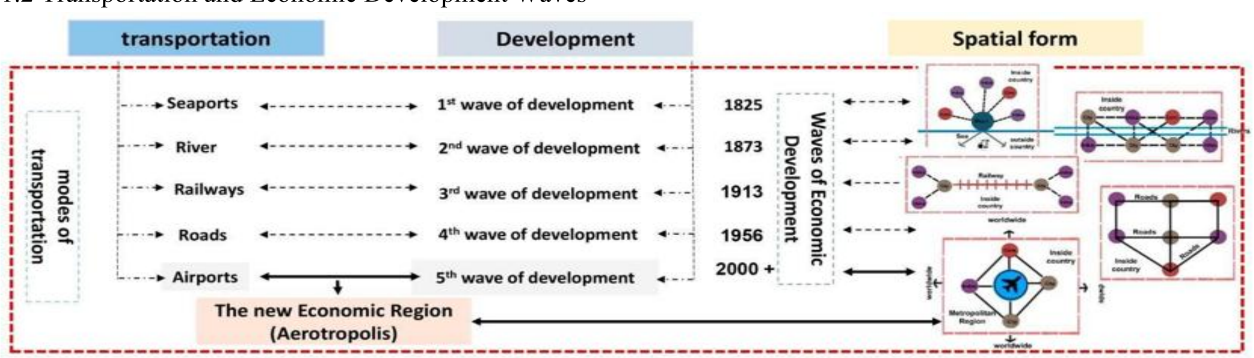


Figure 1:1The mutual interaction between modes of transportation and development waves

1.3 Airport-led Urban Development

1.3.1 Airport as an Economic Growth Pole

Airports have evolved from being transportation facilities into economic growth poles that drive regional development, investment, and global competitiveness. Beyond facilitating passenger and cargo movement, modern international airports stimulate commercial activities, logistics, trade, tourism, and employment, making them key catalysts for metropolitan growth. Their strategic connectivity attracts aviation-dependent industries, business parks, logistics hubs, hotels, convention centres, and technology-based enterprises, creating strong economic linkages that extend beyond airport boundaries.

With the expansion of global trade, e-commerce, and time-sensitive supply chains, airports have become critical nodes in **multimodal logistics networks**, integrating air, road, rail, and maritime transport to enhance accessibility and reduce supply chain costs. This has led to the emergence of the **Aerotropolis** concept, where the airport functions as the nucleus of a larger urban-economic region, supporting commercial, industrial, institutional, and residential development.

In India, airport-led development is increasingly recognized as a strategy for regional economic transformation. The Navi Mumbai International Airport (NMIA), strategically connected to JNPT, the Mumbai Trans Harbour Link (MTHL), metro corridors, and national highways, has the potential to emerge as a major economic growth pole for the Mumbai Metropolitan Region. By integrating airport infrastructure with logistics, business districts, and sustainable urban planning, NMIA can enhance investment, generate employment, improve regional competitiveness, and support the development of a globally connected **Aerocity**.

1.3.2 Evolution of the Aerotropolis Concept

The Aerotropolis concept emerged from the transformation of airports from transportation facilities into drivers of economic and urban development. Traditionally, airports were designed to facilitate passenger travel and cargo movement. However, globalization, increasing international trade, technological advancements, and the growth of time-sensitive industries have expanded their role beyond aviation, making airports strategic centres for commerce, logistics, investment, and innovation.

The evolution of airport-led development can be understood in four stages: Airport → Airport City → Aerocity → Aerotropolis. Initially, airports functioned solely as transport hubs. With growing commercial demand, they evolved into Airport Cities, incorporating hotels, retail, offices, and business services within the airport precinct. This further expanded into Aerocities, where commercial, logistics, institutional, and mixed-use developments extended into the surrounding areas. Finally, the Aerotropolis, conceptualized by John D. Kasarda, represents a metropolitan-scale urban model where the airport acts as the economic core, supported by logistics parks, business districts, industrial clusters, residential communities, and multimodal transport networks.

Unlike conventional cities that developed around ports or central business districts, an Aerotropolis is organized around airport accessibility, connectivity, and logistics efficiency. Successful examples such as Amsterdam Schiphol, Incheon International Airport, Dallas–Fort Worth, and Delhi Aerocity demonstrate how airport-led development enhances regional competitiveness, attracts investment, creates employment, and promotes sustainable urban growth.

In India, the development of Navi Mumbai International Airport (NMIA) presents a significant opportunity to adopt this model, integrating aviation, logistics, commerce, and urban planning to create a globally competitive airport-oriented urban region.

1.3.3 Airports and Global Competitiveness

Airports have evolved from being transportation infrastructure to becoming strategic economic assets that enhance the global competitiveness of cities and regions. In an increasingly interconnected economy, airports facilitate the efficient movement of people, goods, and services, enabling international trade, tourism, investment, and business activities. Well-connected airports attract multinational corporations, logistics industries, knowledge-based sectors, and high-value manufacturing by providing seamless access to global markets. Their role extends beyond aviation, influencing urban development through the creation of airport-linked business districts, logistics hubs, convention centers, hotels, and commercial developments. As competition among global cities intensifies, airports serve as critical gateways that shape a city's accessibility, economic attractiveness, and investment potential. Consequently, nations are increasingly integrating airport development with regional planning strategies, using airports as catalysts for economic growth, innovation, and global integration, thereby strengthening their position in the international urban and economic hierarchy. 1.3.4 Airport Economic Zones

Airport Economic Zones (AEZs) are specialized development areas planned around major airports to maximize the economic benefits of aviation infrastructure. They integrate airport operations with commercial, industrial, logistics, and service activities, creating a business ecosystem that supports trade, investment, and employment. By leveraging global connectivity, AEZs facilitate the efficient movement of people, goods, and services, making them attractive locations for both domestic and international businesses.

Typically, Airport Economic Zones include logistics parks, freight terminals, free trade zones, warehousing, business parks, convention centres, hotels, research and innovation hubs, and mixed-use developments. These zones encourage the growth of aviation-dependent industries such as e-commerce, pharmaceuticals, electronics, high-value manufacturing, and cold-chain logistics. The integration of multimodal transport networks—including airports, ports, highways, railways, and metro systems—enhances supply chain efficiency and regional competitiveness.

Globally, successful Airport Economic Zones such as Amsterdam Schiphol, Incheon, Dubai South, and Zhengzhou Airport Economy Zone have demonstrated their ability to attract foreign direct investment (FDI), generate employment, increase exports, and stimulate sustainable urban growth. In India, the Navi Mumbai International Airport (NMIA), with its strategic proximity to JNPT, the Mumbai Trans Harbour Link (MTHL), metro corridors, and the NAINA planning area, offers significant potential to develop an Airport Economic Zone that integrates logistics, commerce, and urban development, strengthening the economic competitiveness of the Mumbai Metropolitan Region.

1.4 Airports and Global Competitiveness

In an increasingly globalized economy, airports have become strategic assets that enhance the competitiveness of cities, regions, and nations. Beyond facilitating passenger and cargo movement, modern airports improve international connectivity, attract foreign direct investment (FDI), support trade, tourism, and business expansion, and strengthen integration with global markets. Efficient airport infrastructure reduces travel time, improves supply chain performance, and enables the rapid movement of high-value and time-sensitive goods, making regions more attractive to investors and multinational companies.

Global competitiveness is closely linked to an airport's accessibility, multimodal connectivity, logistics efficiency, and surrounding economic activities. Well-planned airport regions foster the development of logistics hubs, business parks, innovation districts, hospitality, and commercial centres, generating employment and stimulating regional economic growth. Successful airport-led developments such as Singapore Changi, Amsterdam Schiphol, Incheon International Airport, and Delhi Aerocity demonstrate how airports can function as engines of innovation and economic transformation.

For the Navi Mumbai International Airport (NMIA), its strategic location alongside JNPT, the Mumbai Trans Harbour Link (MTHL), metro corridors, and national highways offers a unique opportunity to enhance the global competitiveness of the Mumbai Metropolitan Region (MMR). By integrating aviation, logistics, commerce, and sustainable urban planning, NMIA has the potential to emerge as a globally connected Aerocity, strengthening India's position in international trade and investment while supporting long-term regional economic development.

1.5 Problem Statement

The Navi Mumbai International Airport (NMIA) is expected to become a major economic gateway for the Mumbai Metropolitan Region (MMR), driving urbanization, investment, and logistics-led growth. Its strategic connectivity with JNPT, MTHL, metro corridors, and national highways creates significant potential for developing a globally competitive Aerocity. However, the absence of an integrated planning framework may result in fragmented land use, inefficient logistics, infrastructure gaps, environmental degradation, and unplanned urban expansion.

While international Aerotropolis models demonstrate the benefits of airport-led development, there is limited research adapting these principles to the greenfield context of NMIA. Existing studies rarely integrate airport-led development, multimodal logistics, GIS-based spatial analysis, and sustainable land-use planning into a comprehensive planning framework.

Therefore, there is a need to formulate integrated Aerocity development strategies that guide sustainable airport-oriented growth, optimize logistics and infrastructure, and support the preparation of an Aerocity Master Plan for the NMIA influence zone.

1.6 Aim of the Research

To develop a GIS-based Spatio-Economic Logit Model for delineating the Aerocity by integrating accessibility, economic land-use, and socio-economic indicators, and to optimize socio-economic infrastructure

1.7 Research Objectives

1.Assess accessibility, economic land use, and socio-economic characteristics influencing Aerocity development.

2.Develop a GIS-based Spatio-Economic Logit Model to delineate Aerocity boundaries.

3.Evaluate existing socio-economic infrastructure and identify service gaps.

4.Optimize infrastructure distribution using spatial suitability and probability analysis.

5.To propose planning strategies and policy recommendations for sustainable Aerocity development and infrastructure investment.

II. LITERATURE REVIEW

In 1939, New York commercial architect Nicholas de Santis proposed a hypothetical airport in the city to establish an economic growth pole by merging the airport with the surrounding metropolis based on time competitiveness and connection to the global economic network. Nowadays, global entrepreneurship has shifted the dimension of speed connectivity to the main principles of development and competitiveness in addition to the traditional dimensions such as efficiency, connectivity, and mobility [4]. The significance of these principles leads to the development of a new geo-economic development form based on air transport networks in the twenty-first century, similar to highways in the twentieth century, railways in the nineteenth century, and seaports in the eighteenth [1, 2].

Currently, airports act as regional and local exchange hubs for the other modes of transportation. On the other hand, the highly competitive potential in the airports‟ air transport services leads airports to propose future growth in their extension areas or comprises regions near airports for their growth where these services represent a great opportunity and potential for economic development in air transport-related industries of logistics, commercial and large economic projects. The international airports have attracted manufacturing, distribution, entertainment, tourism, and other industries that require rapid access to suppliers, consumers, customers, and remote partners nationally and globally which in turn has led to the expansion of international economic interaction and cooperation as well as the growth of domestic industrial production and connected economic networks worldwide [3, 4].

Table 2. 1 Table showing Literature reviews

Sr .no.	Title	Author	Year	Key Themes	Relevance to thesis objectives
1	A Novel Approach For Planning An Aerocity (Aerotropolis) In Negombo-Katunayake Peri-Urban Region	Dineth J. Perera, P.K.S. Mahanama, and Prasanna Gamage	2019	Mitigating Spatial Disconnection, Contextual Sustainability, Peri-Urban	Provides framework to balance high-end airport commercial zoning with the realities of informal

				Transformation	settlements and local community integration.
2	Creating an Effective Aerotropolis Master Plan	John D. Kasarda , Michael H. Canon	201 6	Land-Use Integration, Economic Clustering, Multimodal Surface Connectivity	Strategies integrate an airport with its surrounding urban development.
3	The Incheon Aerotropolis: An Exemplar of 21st-century Airport-centric Development	John D. Kasarda, Michael I. Chen.	202 1	Multi-Nodal Spatial Development	Execute aerocity development by combining state-backed Free Economic Zones (FEZs) with specialized, multi-nodal smart city planning
4	The Implementation of Aerotropolis Concept on New Town Planning and Design in Mebidangro, Sumatera Utara	Achmad Delianur Nasution, Devin Defriza Harisdani, Putri Pandasari Napitupulu	201 7	Controlled Spatial Zoning, Environmental and Buffer Planning, Regional Economic Synergy	Framework for developing metropolitan can integrate an airport into new town planning to stimulate local economic growth
5	Formulation Strategy of PT. Bandara Internasional Jawa Barat Bandung Indonesia, Kertajati in Business Aerocity	Afriapollo Syafarudin, Bambang Mulyana	201 9	The Six-Cluster Zoning System, Intermodal Regional Integration,	Positions the aerocity as a regional economic anchor through mandatory integration with deep-sea ports and highway networks.
6	An Analysis of the Growth Patterns and Future Development of Navi Mumbai	S. R. Waghmare, S. D. Mahadale	200 8	Development trends, land use, regional planning in Navi Mumbai	Provides essential data for assessing current growth patterns and projecting future development in Navi Mumbai.
7	A Vision for Mumbai: A Case for a	Brinda Somaya	201 4	Urban revitalization,	Useful for envisioning a

	New Urban Agenda			environmental planning, sustainability in Mumbai's growth	comprehensive urban agenda for Mumbai and its new towns.
8	The Urban Social Pattern of Navi Mumbai, India	Malathi Ananthakrishnan	1998	Urban social patterns, planned decentralization, socioeconomic distribution in Navi Mumbai	Directly relevant to understanding social patterns in planned cities like Navi Mumbai
9	The Planning of New Towns in Developing Countries: The Gap Between Aims and Achievements	Hala Malandi	2006	Challenges in new town development, population distribution	Provides insights into the challenges of new town development.
10	A Future Study on the Role of New Towns in Establishing Balance in the Spatial-Physical Structure of Metropolitan Regions	Mostafa Javaheri Taghados,Mahin Nastaran	2021	Role of new towns in balancing spatial structures	Directly relevant to assessing the role of new towns in creating balanced spatial-physical development in MMR.

The literature establishes that successful aerocities rely on spatial integration, economic clustering, and robust multi-modal connectivity. Case studies—including Incheon, Negombo-Katunayake, and Kertajati—demonstrate the need to position airports as regional economic anchors, supported by state-backed policies and environmental buffers.

Foundational models like Kasarda's emphasize strict, time-cost zoning tailored for a "speed economy.Ultimately, the review rejects isolated airport planning, advocating instead for unified, governance-driven, and contextually adaptable regional approaches—essential for the sustainable development of emerging Aerocities.

2.1 Evolution of the Aerotropolis Concept

What is the Aerotropolis Approach?

During studying and analyzing the economic development in major airports, Professor John Kasarda introduced the term 'Aerotropolis' to highlight the importance of airports in the process of aviation-driven economic development and urban growth. He explained that large international airports become ideal centers and economic catalysts for global production and industries. They have been recognized as one of the essential tools for the development of local and regional economies, as well as a key of competitiveness of international airport regions at the continental and global levels and their ability to attract investments and jobs in a variety of activities [2]. Several scholars and researchers have defined the Aerotropolis approach as a city with a dynamic economy, advanced infrastructure, and adjacent land uses related to aviation, technology, and air freight [2, 5, 6]. The Aerotropolis approach is also defined by the airport air transport mode which has a direct impact on investments and business in its sphere of influence which include a group of components and factors in one geographical area that facilitates integration processes, increases competitiveness and productivity, improves economic performance, and accelerates growth rate [7]. According to Baofeng Huo and Mengqiu Guo, the term Aerotropolis is a multi-transport hub, an economic gateway for logistics, time-sensitive companies, and technology-intensive industries [8]. Dr. John Kasarda has argued the Aerotropolis region is one of the 21 major drivers of urban economic growth in the cases of China Zhengzhou airport, Amsterdam Schiphol, Paris Charles de Gaulle, Dubai, Incheon, and Memphis [9]. John Wiley characterized the airport region by groups of aviation-related companies and infrastructure that facilitate the airport access for fast delivery and receipt of goods (air freight). Wiley debates that time has replaced land and distance and become a critical planning criterion and physical internet to facilitate speedy delivery and cost optimization which are significant factors for developers, companies, suppliers, customers, and industry sponsors on a local, national, and global basis [10]. On the other hand, John Roosevelt Hubbard realizes that one of the success factors of Aerotropolis' is the number of residents and employees who can be reached near the airport with high economic, educational and social level who are able to adapt the approach of evolving economic territories and technological development, which will help in the development progress and success of the new Aerotropolis region approach [19].

Why the Aerotropolis approach in developing countries?

The application of the Aerotropolis approach in developing countries will shift the local economic development (LED) of the countries to regional economic development (RED) and will help change the structure of traditional activities and professions to value-added activities in all industries, providing job opportunities, enhancing rates of development and urbanization [3,10]. Aerotropolis will encourage foreign direct investment and improve the production, efficiency, and competitiveness of developing countries. The Aerotropolis will establish effective and trustworthy airfreight links with distant markets and global supply chains within the global economic networks. [8, 9, 10]. The following figure 2 shows the development functions of Aerotropolis.

The Aerotropolis concept evolved as airports transformed from transportation hubs into engines of economic and urban development. Traditionally, airports were designed to facilitate passenger travel and cargo movement. However, globalization, rapid urbanization, technological advancements, and the growth of time-sensitive industries have expanded their role, making airports centres for commerce, logistics, investment, and innovation.

The evolution of airport-led development can be classified into four stages: Airport → Airport City → Aerocity → Aerotropolis. Initially, airports functioned only as transport facilities. They later developed into Airport Cities, integrating commercial activities such as hotels, offices, retail, and convention centres within the airport precinct. The concept further expanded into Aerocities, where mixed-use developments, logistics parks, and business districts grew around the airport. Finally, the **Aerotropolis**, introduced by John D. Kasarda, emerged as a metropolitan-scale development model in which the airport serves as the economic core, supported by multimodal transport networks, logistics hubs, commercial centres, industrial clusters, residential communities, and green infrastructure.

Today, successful Aerotropolises such as Amsterdam Schiphol, Incheon International Airport, Dubai South, and Delhi Aerocity demonstrate how airport-led development enhances regional competitiveness, attracts investment, generates employment, and promotes sustainable urban growth. This evolution highlights the shift from viewing airports as transport infrastructure to recognizing them as integrated centres of economic development and metropolitan expansion.

2.2 Definitions and Planning Principles

An Aerotropolis is an airport-oriented urban region in which the airport serves as the primary economic and transportation hub, supporting commercial, logistics, industrial, institutional, and residential development. Unlike conventional urban centres that evolve around ports or central business districts, an Aerotropolis is organized around airport accessibility and global connectivity, enabling the efficient movement of people, goods, services, and capital. The airport acts as a catalyst for regional economic development by attracting aviation-related industries, business parks, logistics centres, hospitality, and knowledge-based activities, thereby strengthening metropolitan competitiveness.

The planning principles of an Aerotropolis are based on creating an integrated, accessible, and economically competitive urban region. According to the study, successful Aerotropolis development requires high accessibility, appropriate economic land-use distribution, and strong socio-economic potential, which together determine the readiness of a region for airport-oriented development. These principles are supported by multimodal transportation networks, efficient logistics infrastructure, mixed-use development, environmental sustainability, and coordinated land-use planning. The study further highlights the importance of using GIS-based spatial analysis, statistical modelling, and weighted spatial evaluation to identify suitable development areas and formulate strategic planning policies.

For the Navi Mumbai International Airport (NMIA), these principles provide a foundation for planning an **Aerocity** that integrates airport infrastructure with multimodal logistics, commercial districts, transit-oriented development, residential neighbourhoods, and green infrastructure. Such an approach can enhance regional competitiveness, improve logistics efficiency, attract investment, and promote sustainable airport-led urban growth within the Mumbai Metropolitan Region.

2.3 Airport-led Economic Development

Airport-led Economic Development (AED) is an urban development approach in which airports act as catalysts for regional economic growth by stimulating investment, employment, trade, logistics, and commercial activities. As global economies increasingly rely on speed, connectivity, and efficient supply chains, airports have evolved beyond transportation infrastructure to become strategic economic assets that support business expansion and metropolitan competitiveness.

The Aerotropolis study highlights that international airports generate economic growth by attracting aviation-related industries, logistics and distribution centres, business parks, hotels, convention facilities, technology parks, free trade zones, and commercial developments. These activities create direct, indirect, and induced employment while improving regional accessibility and attracting domestic and foreign investment. Airport-led development also strengthens integration with global production networks by facilitating the rapid movement of passengers, high-value goods, and time-sensitive cargo.

According to the study, successful airport-led development depends on three key factors: high accessibility**,** appropriate economic land-use planning**,** and strong socio-economic conditions**.** These factors should be integrated with multimodal transportation networks and strategic land-use planning to maximize the economic benefits of the airport.

For the Navi Mumbai International Airport (NMIA)**,** airport-led economic development presents an opportunity to establish an integrated **Aerocity** supported by JNPT**, the** Mumbai Trans Harbour Link (MTHL), metro corridors, highways, and logistics infrastructure. By promoting commercial districts, logistics hubs, innovation centres, and mixed-use developments, NMIA can emerge as a major economic growth pole, enhancing regional competitiveness, attracting investment, generating employment, and supporting sustainable urban development in the Mumbai Metropolitan Region (MMR)**.**

2.4 Aerotropolis in Developing Countries

The **Aerotropolis** concept has gained increasing importance in developing countries as a strategy to accelerate economic growth, attract investment, and improve global competitiveness. Rapid urbanization, expanding aviation markets, and growing participation in international trade have created opportunities for airports to function as economic growth poles rather than merely transportation facilities. The Aerotropolis approach enables developing nations to transform airport regions into integrated centres of commerce, logistics, manufacturing, and innovation, thereby strengthening their position within global supply chains.

The attached study emphasizes that implementing the Aerotropolis concept in developing countries can shift economies from local economic development (LED) to regional and global economic development (RED)**.** It facilitates foreign direct investment (FDI)**,** promotes value-added industries, generates employment, enhances productivity, and improves connectivity with international markets through efficient air freight and multimodal transport systems. The study further highlights that airports in developing countries can stimulate technology transfer, innovation, industrial diversification, and sustainable urbanization when supported by appropriate planning policies and infrastructure.

However, the successful implementation of an Aerotropolis requires more than airport infrastructure alone. According to the study, it depends on the integration of accessibility, economic land use, socio-economic development, multimodal connectivity, and strategic spatial planning. In many developing countries, challenges such as fragmented land use, inadequate infrastructure, institutional constraints, and limited planning coordination can hinder airport-oriented development. Therefore, adopting a comprehensive planning framework supported by GIS-based analysis and evidence-based decision-making is essential to maximize the economic potential of airport regions.

In the Indian context, the Navi Mumbai International Airport (NMIA) presents a significant opportunity to implement the Aerotropolis concept. Its strategic location within the Mumbai Metropolitan Region (MMR)**,** combined with connectivity to JNPT, the Mumbai Trans Harbour Link (MTHL)**,** metro corridors, and national highways, provides a strong foundation for developing an integrated Aerocity. Through coordinated land-use planning, logistics integration, and sustainable urban development, NMIA has the potential to emerge as a globally competitive airport region and a major driver of regional economic growth

2.5 Global -Indian Aerotropolis Case Studies

2.5.1 Cairo International Airport

The literature argues that there are two pre-requests or thresholds to form an Aerotropolis region for an airport, the airport must be an international airport and the airport must include air cargo terminals for international freights [4.5.6].

If the two pre-requests have been satisfied for an airport, the Aerotropolis region has no threshold and can be formed. The processes to form the Aerotropolis depend mainly on the region aerotropolis potentials current status which might need a long-term region development strategy or a short term towards the realization of the Aerotropolis region.

In Egypt, the largest international airport is the capital Cairo International Airport with the largest international air cargo terminal. CIA satisfies the two Aerotropolis pre-requests and the Cairo region has a high development potential which leads the research to choose as a case study for applying the Aerotropolis region approach.

CIA is located on northeast of the Greater metropolitan region and has an area of approximately 37 square kilometers. Cairo International is the second airport in Africa after Tambo International Airport in Johannesburg, South Africa in terms of the number of passengers and cargo annually. Over 45 scheduled and charter airlines use Cairo airport and 9 cargo airlines. The airport has three runways and four terminals, it has been placed within a global classification that suits the Egyptian state, its geographical distribution, and its position in the world, as well as the development of its system, to become one of the largest air traffic centers of the Middle East and Africa, distinguished as the safest, the easiest to use and the luxurious in 2030 [11]. CIA has an international role of main station for the Egyptian state's capital and its destination for all transport and air traffic activities from and to various parts of the world, and it collaborates with multiple governmental and security agencies, airlines, and business sectors to achieve integrated performance governed by a set of international and local laws and standards, The airport contains 5-star hotel, which contributes to increased transit tourism and the transformation of Cairo Airport into a worldwide transit center, a large hall for celebrations, conferences, and events, and a business center that includes four halls equipped for meetings of businessmen, companies, and bodies, as well as four main restaurants, as well as many services and entertainment sites, green spaces, swimming pools, and a health club, and the general site includes a garage and a train to transport passengers between the airport's three terminals, and the project was implemented to serve passengers travelling by train, and there's the major commercial village[11].

2.5.2 Incheon International Airport,South Korea

Incheon International Airport is one of the world's most successful examples of an **Aerotropolis** and airport-led economic development. Developed on reclaimed land near Seoul, the airport serves as a major international aviation hub and one of Asia's largest air cargo gateways. Its strategic location, world-class airport infrastructure, and extensive cargo handling facilities have enabled the development of a globally competitive airport economic region.

The Incheon Aerotropolis integrates Airport City developments, logistics parks, free economic zones, business districts, convention centres, hotels, research institutions, tourism facilities, and smart urban infrastructure. High-speed rail, expressways, metro services, and port connectivity provide seamless multimodal transportation, allowing efficient movement of passengers and freight across domestic and international markets.

The airport has become a catalyst for regional economic growth by attracting multinational corporations, technology industries, logistics providers, and foreign direct investment. Its success is attributed to integrated land-use planning, strong government support, phased infrastructure development, and efficient multimodal logistics. The Incheon model demonstrates how airports can evolve into globally connected economic centres that promote innovation, employment generation, and sustainable metropolitan development.

2.5.3 Amsterdam Schiphol Airport,Netherlands

Amsterdam Schiphol Airport is one of the world's earliest and most successful examples of airport-led urban development. As one of Europe's busiest international airports and a major air cargo hub, Schiphol has evolved into an integrated Airport City and forms the economic core of the Amsterdam Metropolitan Area. Its strategic location, international connectivity, and multimodal transportation network have enabled the airport to become a catalyst for regional economic growth and global competitiveness.

The Schiphol Airport region integrates business parks, logistics centres, office complexes, hotels, convention facilities, retail developments, and aviation-related industries within a well-planned airport economic zone. The airport is seamlessly connected through high-speed rail, national highways, metro services, and inland waterways, ensuring efficient passenger and freight movement. This multimodal accessibility has attracted multinational corporations, financial institutions, and logistics companies, making Schiphol a preferred location for international business.

A key planning principle of Schiphol is the integration of land-use planning, transportation infrastructure, environmental management, and economic development. The airport region emphasizes compact mixed-use development, efficient logistics operations, and sustainable mobility while maintaining strong environmental controls. Schiphol demonstrates how coordinated planning and multimodal connectivity can transform an airport into a globally competitive economic hub, offering valuable lessons for the development of the **Navi** Mumbai International Airport (NMIA) Aerocity.

2.5.4 Zhengzhou Airport Economy Zone,China

The Zhengzhou Airport Economy Zone (ZAEZ) is one of China's largest and fastest-growing Aerotropolis developments, established around Zhengzhou Xinzheng International Airport. Developed as a national-level economic zone, it was planned to strengthen China's position in global manufacturing, logistics, and international trade through airport-oriented development.

The Airport Economy Zone integrates international logistics parks, free trade zones, advanced manufacturing industries, e-commerce hubs, research institutions, commercial centres, residential communities, and business districts. Supported by high-speed rail, expressways, inland dry ports, and multimodal freight networks, the airport has become a major gateway connecting domestic production with global markets.

A distinctive feature of the Zhengzhou model is the close integration of aviation logistics with high-value manufacturing, particularly electronics, pharmaceuticals, and e-commerce industries. The development has attracted significant foreign direct investment (FDI), created large-scale employment opportunities, and accelerated regional economic transformation. Strong government support, phased infrastructure development, and coordinated land-use planning have enabled the Airport Economy Zone to emerge as one of the world's leading Aerotropolis models.

For Navi Mumbai International Airport (NMIA), the Zhengzhou case demonstrates the importance of integrating multimodal logistics, industrial development, free trade activities, and airport-oriented land-use planning to create a globally competitive Aerocity capable of supporting long-term economic growth.

2.5.5 Delhi Aerocity, India

The development of Delhi Aerocity was initiated as an airport-oriented business district around the Indira Gandhi International Airport (IGIA) to strengthen Delhi's position as a global aviation and commercial hub. As India's busiest international airport with one of the country's largest air cargo terminals, IGIA satisfies the essential prerequisites for Aerocity development through its extensive international connectivity and cargo handling capabilities.

Located adjacent to Terminal 3, Delhi Aerocity has been planned as a mixed-use urban district comprising hotels, corporate offices, convention centres, retail, commercial spaces, hospitality, and business parks. The area benefits from excellent multimodal connectivity through the Delhi Metro Airport Express Line**,** National Highway-48, the Delhi Ring Road, and the Dedicated Freight Corridor, providing seamless accessibility for passengers and freight movement.

The Aerocity has successfully attracted multinational companies, premium hospitality brands, commercial developments, and aviation-related businesses, contributing significantly to employment generation and investment. However, challenges such as traffic congestion, increasing land values, and pressure on supporting infrastructure highlight the need for integrated land-use planning and phased development. Delhi Aerocity demonstrates how airport-led commercial development can strengthen metropolitan competitiveness while emphasizing the importance of coordinated transportation, logistics, and urban planning.

2.5.6 Hyderabad Airport City, India

Rajiv Gandhi International Airport (RGIA) at Hyderabad is India's first integrated Airport City developed around a greenfield international airport. Strategically located on the southern outskirts of Hyderabad, the airport functions as a major aviation, logistics, and business gateway for southern India. RGIA satisfies the prerequisites for Aerocity development through its international passenger services, dedicated cargo terminals, and strong multimodal connectivity.

The airport city is planned around a comprehensive development strategy integrating logistics parks, aerospace and aviation industries, business parks, commercial offices, hotels, convention facilities, retail centres, and recreational spaces**.** The airport is supported by the Outer Ring Road (ORR)**,** national highways, metro connectivity proposals, and proximity to pharmaceutical, biotechnology, and information technology clusters, making it an important logistics and innovation hub.

A key feature of Hyderabad Airport City is the integration of aviation infrastructure with industrial development, warehousing, and export-oriented logistics. The development has attracted significant private investment and generated employment while strengthening Hyderabad's role in global trade and air cargo operations. The project illustrates the importance of integrating airport infrastructure, logistics, and land-use planning to create a sustainable airport-oriented urban region.

2.6 Research Gap

The review of literature and case studies reveals that most research on Aerotropolis **and** airport-led development focuses on economic growth, airport infrastructure, logistics, or land-use planning as individual components. While international and Indian case studies demonstrate the benefits of integrated airport development, limited research addresses the greenfield context of the Navi Mumbai International Airport (NMIA)**.**

Existing studies lack an integrated planning framework that combines GIS-based spatial analysis, AHP–MCDA, multimodal logistics, sustainable land-use planning, and airport-led urban development**.**

III. RESEARCH METHODOLOGY

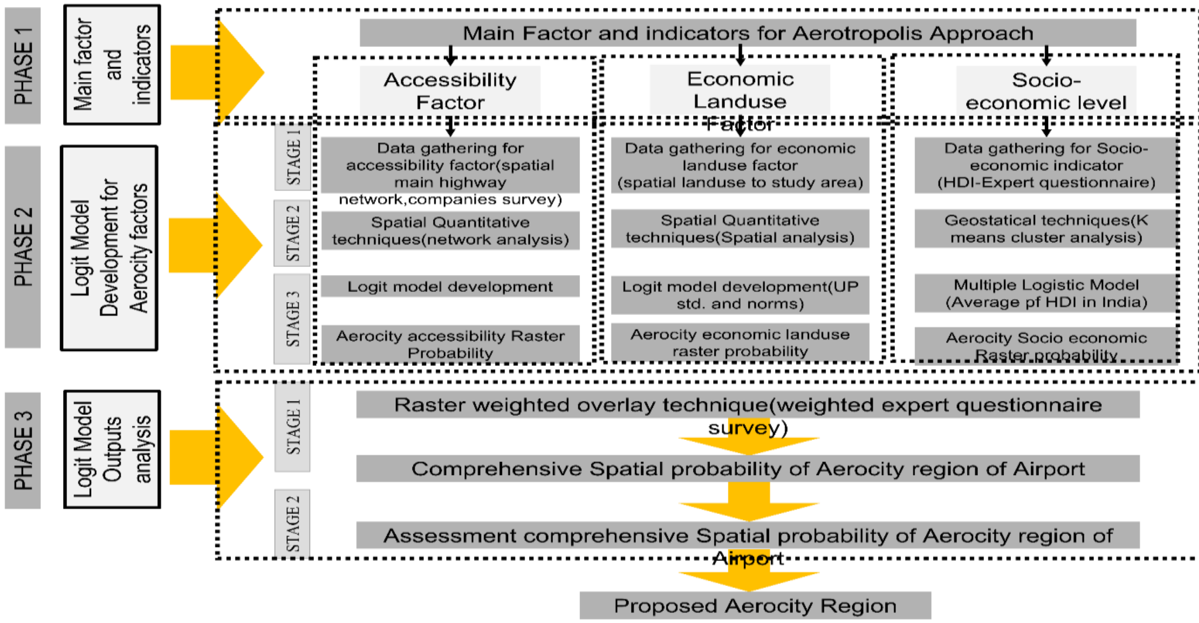


Figure 3. 1 Flowchart of Analytical framwork for Aerocity

3.1 Methodological Framework

The research attempts the application of the Aerotropolis approach to developing countries by a proposed spatio-economic logit model. To achieve the proposed model, the research has followed three phases.

Phase 1: The research studied the literature review on the Aerotropolis approach and its applications in case studies in developed countries to highlight the main factors and the indicators used to be assessed for the application of Aerotropolis studies in developing countries.

Phase 2: The development of logit models for the three factors of phase one. This phase has been conducted in three stages as follows:

Stage 1: For each factor, the study will collect spatial and tabular data required for the computation of the existing values of indicators. The data gathering contains experts in the fields of urban planning, logistics, social and economic.

Stage 2: Spatial and statistical quantitative techniques will be used for the computations for the selected indicators for the case study. The results of the stage are spatial maps of the indicators for the surrounding region.

Stage 3: the third stage is concerned with the implementation of the logit statistical model for the using the data gathering of expert survey and the results of stage 2 as well as the adjustment and adaptation of the indicators threshold for the \ Aerotropolis developing country case study. The proposed logit model used the results of experts‟ judgment face to face questionnaire, the regulations, and norms, and companies‟ field surveys for logit data input. The final output of the stage is the development of the logit model and the spatial probability raster map for each factor indicator.

Phase 3: In this phase, the logit model outputs of phase 2 will be analyzed in two stages:

Stage 1: A spatial weighted overlay analysis will be applied from the results of phase 2 for the indicators of each factor. The expert's questionnaire will be conducted to determine statistically the average weight which will be used for the \ case study. The results of the stage are spatial probability maps for the \ Aerotropolis region of the surrounding area. The spatial probability Aerotropolis region results will be assessed to determine the probability threshold which will realize the Aerotropolis requirements.

Stage 2: The assessment process has used a literature review for assessing the existence of Aerotropolis requirement components on each region alternative. The selected Aerotropolis region will be adapted for the realization of the vision and the national development strategy in general.

The structure of the remaining research will discuss the methodology's three phases in detail

The suitability model is validated by comparing the analysis results with existing planning proposals, infrastructure projects, and development trends within the NMIA influence zone. The identified development zones are assessed against planning policies, accessibility patterns, and field observations to ensure the reliability and practical applicability of the proposed Aerocity development framework.

3.2 Phase I – Identification of Main Factors

3.2.1 Phase 1: Main Factors and Indicators of the Aerotropolis Region

According to the analysis of the literature review and previous studies, the studies have cited three main factors, figure 4, for the success of the Aerotropolis approach as follows:

- Accessibility to airport
- Economic land use
- Socio-economic level

The majority of Aerotropolis application case studies considered accessibility factors and rarely use other factors during the application of the Aerotropolis approach in developed countries. In the research, the proposed model has considered the three factors together during the application of the Aerotropolis approach, and the results will be assessed and adjusted by the development vision and the national strategy as a fourth factor added by the research to determine the Aerotropolis region.

Table 1 gives case studies and literature analysis for the factors considered during their studies and the used indicators to denote each factor during the Aerotropolis approach implementation around the case studies airports. In the next sections, the three main factors: accessibility, economic land use, and socio-economic level will be discussed.

Figure 3. 2 Aerotropolis main factor

Table 3.2 1 Aerotropolis case studies analysis for considered factors and indicators

Aerotropols Case studies	The main factors of Aerotropolis					
	Accessibility		Economic Land use		Social and economic level	
	Factor Considered	Used Indicator	Factor Considered	Used Indicator	Factor Considered	Used Indicator
Incheon Airport]12[	□	tatic/theoretica l distance				
the Durban airport]3[	□	Drive time	□	Dichotomous (exist – not exist)		
The Zhengzhou Airport Economy Zone]8[	□	tatic/theoretica l distance	□	Dichotomous (exist – not exist		

Amsterdam Airport]11[	□	tatic/theoretica l distance	□	Dichotomous (exist – not exist		
ong Kong International Airport]11[	□	tatic/theoretica l distance			□	Social and economic indicators for population
Memphis Aerotropolis]11[	□	Drive time	□	Dichotomous (exist – not exist		
Los Anglos. airport]11[	□	Drive time			□	Social and economic indicators for population

3.2.2 Phase II – Development of Spatio-economic Logit Model

The second phase evaluates the development potential of the Navi Mumbai International Airport (NMIA) influence zone through GIS-based spatial analysis and Multi-Criteria Decision Analysis (MCDA). Spatial and non-spatial datasets are integrated to assess the suitability of the study area for Aerocity development. The identified planning factors are analysed individually and combined using the Analytical Hierarchy Process (AHP) to generate a composite suitability model that supports strategic land-use planning and airport-oriented development.

3.2.2.1 Data Collection

Relevant spatial and non-spatial data are collected from government agencies, satellite imagery, planning documents, and published reports. The datasets include existing land use, transportation networks, logistics infrastructure, environmental features, demographic information, and development proposals. These data form the basis for GIS analysis and suitability assessment.

3.2.2.2 Spatial Analysis

Spatial analysis is carried out using GIS to evaluate the accessibility, land-use characteristics, logistics potential, environmental constraints, and development patterns within the study area. The analysis identifies opportunities and constraints for Aerocity development through thematic mapping, overlay analysis, proximity analysis, and network analysis.

3.2.2.3 Statistical Analysis

The identified planning factors are weighted using the Analytical Hierarchy Process (AHP) based on their relative importance in Aerocity development. These weighted criteria are integrated using Multi-Criteria Decision Analysis (MCDA) to generate a spatial suitability map that identifies areas with high, moderate, and low development potential.

3.2.2.4 Logit Model Development

The weighted spatial layers are combined using GIS-based weighted overlay techniques to develop a comprehensive **Spatial Suitability Model** for the NMIA influence zone. The model identifies suitable locations for commercial districts, logistics hubs, mixed-use development, residential neighborhoods, and supporting infrastructure.

3.2.3 Phase III – Spatial Probability Analysis

The third phase integrates the weighted spatial layers to identify the most suitable areas for Aerocity development within the NMIA influence zone. Based on the results of the GIS-based Multi-Criteria Decision Analysis (MCDA), areas are classified according to their development suitability. The analysis supports the delineation of Aerocity development zones, identification of strategic growth corridors, and preparation of an integrated spatial framework for sustainable airport-oriented development.

3.2.3.1 Weighted Overlay Analysis

The weighted overlay analysis combines all thematic layers, including accessibility, economic land use, socio-economic characteristics, logistics infrastructure, and environmental constraints, using the weights derived through the Analytical Hierarchy Process (AHP)**.** The resulting suitability map classifies the study area into different suitability categories, providing a scientific basis for identifying priority development areas for commercial, logistics, industrial, and mixed-use activities.

3.2.3.2 Aerotropolis Region Delineation

Based on the spatial suitability assessment, the most suitable areas are delineated as Aerocity Development Zones**.** The delineation considers airport accessibility, multimodal connectivity, logistics potential, existing land use, environmental sensitivity, and future growth corridors. The identified zones form the foundation for the Urban Pipe-based Spatial Development Framework**.**

3.2.3.3 Model Validation

Figure 3. 2 Table 3.2 2Economic land use requirements for Aerotropolis region zones

Aerotropolis Region		Land use for passengers	Land use for goods
Iub airport Core (Tier one)	Passenger and cargo terminal	• Retail and boutiques • Restaurants (higher-end and fast-food areas) Leisure (spa, fitness, Gym, Cinema, theaters, etc.) • Culture (museums, regional art)	Air express and courier Cold storage and cool chain General air cargo Aircraft maintenance, repair
Direct airport zone (Tier two)	Airport City	• Hotels and residential high level • Office and retail complexes • Business and technology parks Regional entertainment, Sports centers, and Clubs	Logistics and distribution Wholesale merchandise marts
Indirect airport zone (Tier three)	Aerotropolis airport Region	• Settlement and exhibition • Producer services (finance, • Auditing, consulting, etc.) • Corporate headquarters • Information and communication • technology firms • Wellness and medical facilities • Large mixed-use residential • Developments	Free trade zones, special economic zones Logistics parks and distribution centers Accuracy and time-critical • Manufacturing • Pharmaceuticals industries High-tech electronics repair High-value agricultural and • food products Medical instruments aviation-related industries

The suitability model is validated by comparing the analysis results with existing planning proposals, infrastructure projects, and development trends within the NMIA influence zone. The identified development zones are assessed against planning policies, accessibility patterns, and field observations to ensure the reliability and practical applicability of the proposed Aerocity development framework.

IV. STUDY AREA PROFILE

4.1 Case Study Selection

The Navi Mumbai International Airport (NMIA) Influence Zone has been selected as the study area due to its strategic importance as one of India's largest greenfield airport developments. Located within the Mumbai Metropolitan Region (MMR), NMIA is envisioned as a major aviation, logistics, and economic gateway that will complement the existing Chhatrapati Shivaji Maharaj International Airport. The airport's proximity to the Jawaharlal Nehru Port (JNPT), Mumbai Trans Harbour Link (MTHL), national highways, suburban rail, metro corridors, and the Navi Mumbai Airport Influence Notified Area (NAINA) provides significant potential for integrated airport-led development.

The study area covers approximately 79 sq.km, representing the primary airport influence zone where rapid urbanization and infrastructure investment are expected to drive commercial, logistics, industrial, and residential growth. The area was selected because it offers a unique opportunity to evaluate the readiness of a greenfield airport region for Aerocity development and formulate sustainable planning strategies.

4.2 Navi Mumbai International Airport Profile

The Navi Mumbai International Airport (NMIA) is a greenfield international airport being developed by **Navi** Mumbai International Airport Limited (NMIAL**)** at Ulwe, Navi Mumbai, to serve the rapidly growing aviation demand of the Mumbai Metropolitan Region. Planned as one of India's largest airports, NMIA is designed to complement Chhatrapati Shivaji Maharaj International Airport (CSMIA) and strengthen Mumbai's position as a global aviation and logistics hub.

The airport is planned with two parallel runways, modern passenger terminals, dedicated cargo facilities, maintenance zones, and multimodal transport integration. It is strategically connected to the Mumbai Trans Harbour Link (MTHL), JNPT Port, Navi Mumbai Metro, suburban rail, NH-348, and the Virar–Alibaug Multimodal Corridor, enabling seamless passenger and freight movement. The airport is expected to significantly enhance regional connectivity, stimulate investment, generate employment, and act as the catalyst for the development of an integrated Aerocity.

4.3 Existing Development Characteristics

The study area is characterized by a combination of emerging urban settlements, transportation infrastructure, industrial activities, logistics corridors, environmentally sensitive areas, and undeveloped land parcels, making it suitable for airport-oriented urban expansion.

4.3.1 Regional Connectivity

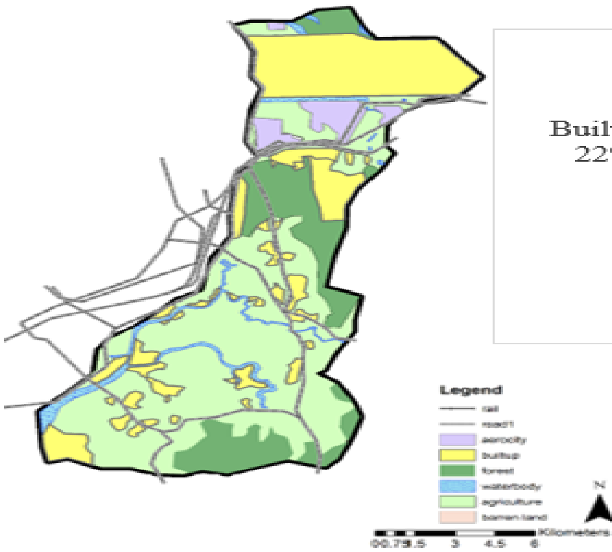
The study area possesses excellent regional connectivity through road, rail, metro, port, and air transportation networks. Its strategic location within the Mumbai Metropolitan Region provides seamless connectivity with Mumbai, Pune, JNPT Port, and surrounding industrial corridors, making it highly suitable for Aerocity development.

Table 4. 1 Regional Connectivity

Mode	Existing Infrastructure	Influence on Aerocity
Airport	NMIA	Primary Growth Pole
Port	JNPT	International Logistics
Highway	NH-348, NH-48	Regional Connectivity
Metro	Navi Mumbai Metro	TOD Potential
Railway	Panvel–Uran Corridor	Passenger Mobility
MTHL	Mumbai Trans Harbour Link	Direct Mumbai Access

4.3.2 Existing Land use Plan

4.3.3 Transportation Network



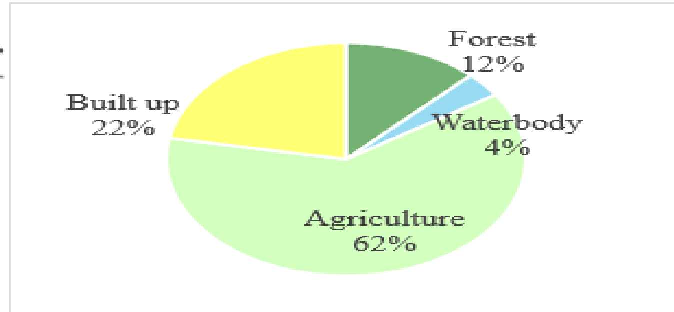


Table 4. 2 Transport Infrastructure

Infrastructure	Existing	Proposed	Importance
NH-348	✓	-	High
MTHL	✓	-	Very High
Metro	Under Construction	✓	High
Railway	Existing	Expansion	High
Airport	Under Construction	✓	Very High

4.3.4 Logistics and Economic Activities

Table 4. 3 Existing Economic Drivers

Activity	Existing Status	Growth Potential
Port Logistics	High	Very High
Warehousing	Moderate	High
Manufacturing	High	High
Commercial	Moderate	Very High
Tourism	Low	Moderate
Aviation Services	Low	Very High

4.3.5 Existing Infrastructure

Table 4. 4 Existing Infrastructure

Infrastructure	Existing	Adequacy
Roads	Good	High
Water Supply	Moderate	Medium
Sewerage	Moderate	Medium
Electricity	Good	High
Social Infrastructure	Moderate	Medium
Logistics Infrastructure	High	High

4.5 Key Planning Opportunities

Following Aerotropolis framework, the NMIA region demonstrates high potential in terms of:

- High accessibility through multimodal transport corridors.
- Availability of economic land uses for logistics, business parks, commercial centres, and industrial activities.
- Strong integration with the Mumbai Metropolitan Region's economic network.
- Opportunity to attract Foreign Direct Investment (FDI) and global logistics operators.
- Scope for creating Airport City, Logistics Parks, Free Trade Zones, Technology Parks, Innovation Districts, and Transit-Oriented Development (TOD).
- Potential to become a regional economic growth pole and strengthen India's participation in global supply chains.

V. DATA COLLECTION & ANALYSIS

5.1 Data Collection

Table 5. 1 Data collection Outputs

Phase	Objective	Data Collection	Data Source	Tools	Techniques	Output
Phase I	Identification of Aerotropolis Factors	Literature, airport case studies, planning reports, international guidelines	Research articles, Kasarda Model, Airport Case Studies	Literature Review	Comparative Analysis	Identification of major Aerotropolis factors
		Airport development indicators	Previous Aerotropolis studies	MS Excel	Indicator Screening	Final indicator list
		Expert opinions	Urban planners, transport experts	Questionnaire	Expert Judgment	Indicator validation

Table 5. 2 Table showing Accessibility Factor

Component	Data Collection	Source	Tool	Technique	Output
Road Network	Highways	Transport Ministry	ArcGIS Pro	Network Dataset Creation	Road Network Database
Design Speed	Road speed	Highway Authority	ArcGIS	Impedance Assignment	Travel Time Network
Company Locations	Industries	Ministry of Trade & Industry	ArcGIS	Spatial Mapping	Company Database
Export Survey	Company Questionnaire	Industries	Survey Form	Primary Survey	Export Behaviour
Drive Time	Road Network	GIS	ArcGIS Network Analyst	Service Area Analysis	15–150 minute Drive Time Zones
Accessibility Model	Survey + Drive Time	Primary + GIS	SPSS	Binary Logistic Regression	Accessibility Probability Raster

Table 5. 3 Table showing Economic Land Use Factor

Component	Data Collection	Source	Tool	Technique	Output
Existing Land Use	Official Land Use Map	General Organization for Physical Planning (GOPP)	ArcGIS	GIS Mapping	Existing Land Use Map
Economic Land Uses	Commercial, Industrial, Logistics, Entertainment, High-end Residential	Planning Maps	ArcGIS	Land Use Classification	Economic Land Use Layer
Percentage Calculation	Area Statistics	GIS	ArcGIS	Spatial Analysis	Percentage of Economic Land Use
Threshold Selection	Planning Standards	Egyptian Planning Standards	MS Excel	Threshold Analysis	Binary Classification

Component	Data Collection	Source	Tool	Technique	Output
Statistical Model	Economic Land Use Percentage	GIS + Survey	SPSS	Binary Logistic Regression	Economic Probability Map

Table 5. 4 Table showing Socio-Economic Factor

Component	Data Collection	Source	Tool	Technique	Output
Population	Census	Government Census	Excel	Statistical Analysis	Population Database
Education	Human Development Reports	Government Reports	Excel	Indicator Analysis	Education Index
Income	Economic Reports	Government	Excel	Indicator Analysis	Income Level
Employment	Labour Statistics	Government	Excel	Indicator Analysis	Employment Database
Human Development Indicators	HDI Variables	Government Reports	SPSS	K-Means Cluster Analysis	Socio-economic Classes
Expert Survey	Questionnaire	Experts	SPSS	Multiple Logistic Regression	Socio-economic Probability Raster

Table 5. 5 Table showing Integration Analysis

Component	Data Collection	Tool	Technique	Output
Accessibility Raster	Phase II Output	ArcGIS	Raster Processing	Accessibility Probability
Economic Raster	Phase II Output	ArcGIS	Raster Processing	Economic Probability
Socio-economic Raster	Phase II Output	ArcGIS	Raster Processing	Socio-economic Probability
Expert Weight Survey	Experts	Questionnaire	Weighted Average	Criteria Weights
Overlay Analysis	Three Probability Layers	ArcGIS	Weighted Overlay	Comprehensive Aerotropolis Probability
Validation	National Development Strategy	Planning Documents	Comparative Assessment	Final Aerotropolis Boundary

Table 5. 6 Tools Used for analysis

Tool	Purpose
ArcGIS Pro	Spatial database preparation, mapping, network analysis, service area analysis, raster analysis, weighted overlay
ArcGIS Network Analyst	Drive-time accessibility analysis
SPSS	Binary Logistic Regression, Multiple Logistic Regression, K-Means Cluster Analysis
Microsoft Excel	Data preparation, coding, indicator calculation
Questionnaire Survey	Expert judgment and company surveys
Literature Review	Identification of factors and indicators
Field Survey	Validation of company export behavior and airport usage

Table 5. 7 Table showing Sample Size collected

Survey	Sample Size
Household Survey	100
Business Survey	30
Logistics Operators	20
Planning Experts (AHP)	10
Government Officials	5
Transport Experts	10
Total	175

5.2 Analysis
Phase 2: Logit Model Development
Due to the difficulties, scarce, and low accuracy of the data for the required aerotropolis indicators of the three factors in developing countries, the proposed model of the study is based on the predictive statistical analysis of logit regression family.
The logit model analyzes the relationship between the independent variable/variables and the logit dependent variable [20]. The logit dependent variable, the response, is a binary variable (true 1 /false 0) which denotes the probability of the given value for the independent variable to contribute in the achievement of the economic goals for the CIA Aerotropolis region.
The logit dependent variable, the probability of Aerotropolis economic goal achievements, was determined in the study using Egyptian experts‟ opinions, field visits questionnaire, benchmarks and norms from the Egyptian regulations, and previous statistical studies of the different factors.
The research proposed statistical analysis approaches for each of the three factors of the Aerotropolis region success as follows:
The first factor of the accessibility, the study applied the spatial logit model using the GIS network spatial analysis for drive time independent variable computation.

For the second factor of economic land use, the study applied the binary logit model for the independent variable of the economic percentage of land use in each neighborhood.

Third Factor the socio-economic level, the study applied the k-means cluster to identify five homogenous classes of the neighborhood socio-economic level using six independent human development index variables. The classification of the neighborhoods has been done to select random class sample during the questionnaire of the logit model. These classes have support and facilitate the response of the experts about the neighborhood socio-economic level status. The statistical approach continues with the application of the multiple logistic models for the six human index independent variables and the expert's logit dependent response of experts.

The applied statistical approached for the three factors processes will be discussed in details in the next sections.

First Factor: Accessibility to the airport
The research applied the logit model process, four stages will be followed to obtain the raster probability for the accessibility factor.

Stage 1: Data Gathering
Assuming that the cargo uses the highways by traffic laws, the research will use the GIS spatial data of main highways and their design speed produced by the transportation ministry 2018 as the input for drive time computational techniques using the design speed of each highway.

To develop the logit model, the research used the ministry of trade and industry records, including contact information, of 2021 and identify around 380 large companies of different good types within the region.

The companies‟ locations were spatially mapped within the ARCGIS software. A grid of 10*10 km was constructed and 15% of the companies in each cell were randomly selected as the spatial random sample for the drive time independent variable for the logit model.

Fifty companies were contacted by phone or/and a visit for participation in the questionnaire and seven companies refused to participate or failed to be contacted.

The fifty spatial random companies‟ sample were of different good types with different distances and directions from region, as shown in figure, and they have participated in the field questionnaire survey for the spatial logit model development which has been conducted by a phone call and/or field visit.

The survey consists of an introduction for the objectives of the study, then survey the company is responsible to answer the following main two questions, and the result is shown in figure.

- Do you export your products (YES/NO)
- Do the company use the road for the cargo (YES/NO)
- How much time for goods to achieve the airport?

Stage 2: Spatial Network Analysis technique

The study used ARCGIS PRO software of ESRI for applying the network analysis technique to the transportation network of Greater Cairo. The study starts by spatial editing of the highway network feature class of cutting each component into small sectors to (junction – endpoint) [22], followed by geometry topology, giving the design speed as impedance then creating a network dataset and using the service area tool of ArcGIS PRO for the different time interval [23, 24]. The results were spatial time drive zones for 15 minutes time intervals of 15, 30, 45, 60, 75, 90, 120, and 150 minutes as shown in figure.

The results of the analysis for the accessibility factor The logit model is given as follows, table.

show that the surrounding neighborhoods of the airport which are located 15 minutes.

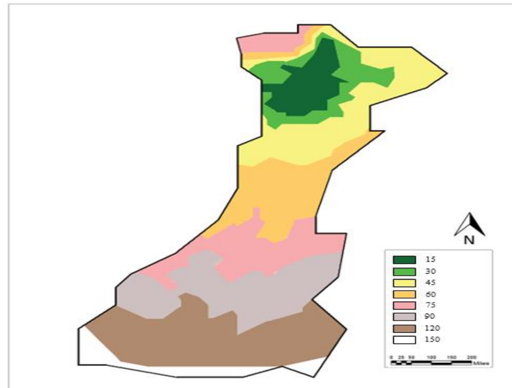


Figure 5.2. 1 Analysis of accessibility factor (Drive time)

Stage 3: Accessibility Spatial Logit model development

The research builds the spatial logit model for the accessibility factor using the drive time indicator. The spatial logit model has developed within the SPSS using the results of data gathering survey response of using the airport to export (YES= 1/ NO =0) as a dependent dichotomous variable and the drive time zone of the company as an independent variable from the spatial results of network analysis.

The logit model predicts the probability P(t) of an object with a drive time (t) to use the airport (accessibility factor).

Table 5.2. 1 SPSS accessibility spatial logit model output

Variables in the Equation							
		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1	drive_time	-9.490	.073	1.967	1	.032	.000
	Constant	.118	4.948	1.936	1	.045	1.125

After applying the three steps 3, the proposed logit model has been applied to the spatial raster

$$P(t) = \frac{1}{1 + e\ (0.118 - 9.49\ t)}$$

Significance Level 0.05

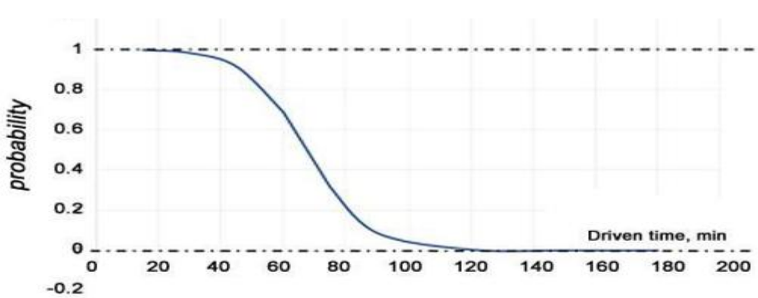


Figure 5.2. 2 Logit Model of Drive time

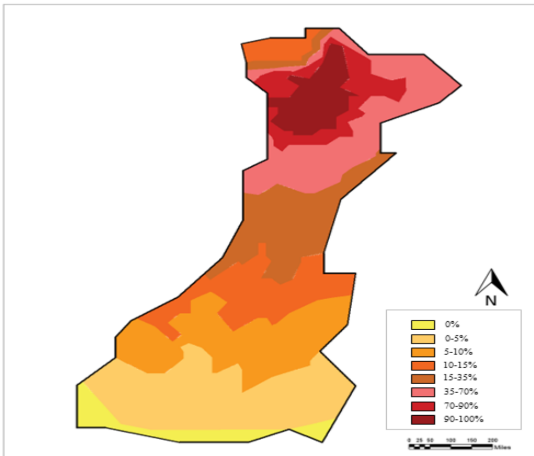


Figure 5.2. 2 Accessibility raster probability

Time drive service area map to get the final output of a spatial raster probability Aerotropolis region map for accessibility factor as shown in figure.

The research found that the new cities and communities surrounding Airport are highly valued due to the existence of the ring road that connects the new suburbs and cities to the airport, in addition to the major highways that are implemented throughout the nation. From the analysis of the developed spatial logit model, the threshold metrics for drive time of Aerotropolis region success Aerotropolis region was 90 minutes corresponding to an average distance of 100 km from region.

Second Factor: Economic Land Use

The four stages will be repeated for the economic land-use indicator to obtain the raster probability for the Economic land-use factor.

Stage 1: Data Gathering

The economic land use analysis will be applied to spatial neighborhoods unit. The land uses spatial data was based on the official institution's land use for the study region from the General Organization for Physical Planning [25].

Stage 2: Spatial analysis technique

A spatial analysis tool of a Geographic information system was employed as a technique in the research to compute the economic land-use indicator of the percentage of economic land-use area in neighborhoods. Consider the following land use allocation: The indicator was computed by the presence of economic land-use parcels supporting the success of the Aerotropolis approach such as:

- High level residential
- Commercial and Industries
- Logistics services
- Entertainment areas

Based on planning guidelines and standards, the analysis results of the percentage of economic land-use indicator, required for the Aerotropolis approach, distinguish that the distribution of economic land use around the airport is concentrated in the south/east south towards the new cities with a high economic land-use percentage, as shown in figure. On the other hand, the residents are the dominant land use for the north neighborhoods of the airport which are unplanned areas and need development intervention to participate in the success of the airport's Aerotropolis system.

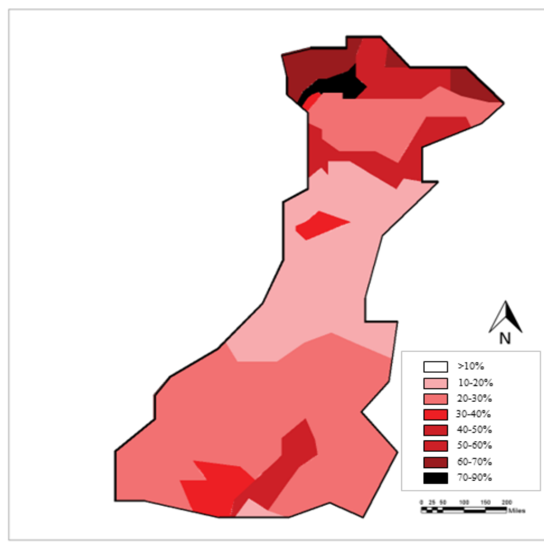


Figure 5.2. 3 Analysis of economic land-use factor

Stage 3: Economic land use binary Logit model development

The binary logit model has been constructed based on the land use budget of each neighborhood for the independent variable computation of the percentages for economic land uses variable. Based on service and activity evidence reports, guidelines, and urban planning standards, the research settled the threshold value of 50% for the percentage of economic land use independent variable. The neighborhood with value of 50% and higher for economic land use percentage has assigned a value of (True =1) for the response dependent variable while a response dependent value of (False =0) has assigned for neighborhood response binary variable for less than 50% value for economic land use percentage values.

The binary logit model SPSS output was as follows, table :

Table 5.2. 2 SPSS Economic Land use binary Logit model Output

Variables in the Equation							
		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1	Eco_Luse	-1.479	1.148	1.660	1	.019	.859
	Constant	5.198	4.080	1.623	1	.029	633.969

$$P(t) = \frac{1}{1 + e^{(-0.152 + 6.452\, t)}}$$

Significance Level 0.05

Figure 5.2. 5 Probability-Spatial landuses

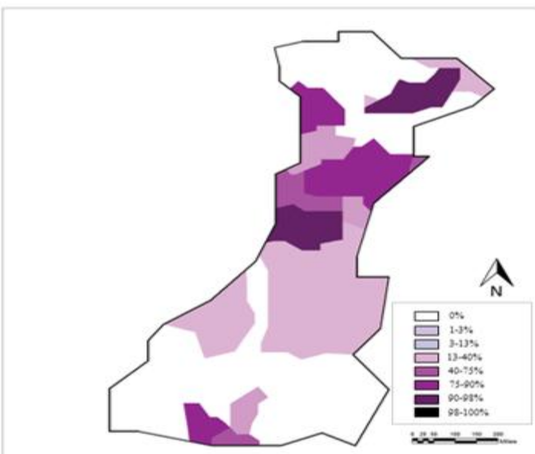


Figure 5.2. 4 Aerotropolis probability of economic land-use factor

After applying the three stages for the economic land-use factor, the spatial raster probability Aerotropolis region map for the economic land-use factor was created using the logit model outputs as shown in figure.

The researcher found that the new cities play a role in determining the limits of the Aerotropolis because the state directs investments and financial and economic hubs, as well as the planned new administrative capital.

Third Factor: Socio-Economic Level

Finally, the three stages of the methodology will be applied to the socio-economic level factor.

Stage 1: Data Gathering

Six indicators for socio-economic have been selected after a literature review and the social and economic reports. The six indicators data have been collected for 197 neighborhoods within the study area from secondary data of the Human development index 2019 [20], as shown in Table .

Table 5.2. 3 Human development index variables

Za	GDP is equivalent to purchasing power in dollars
Zb	human development indicator
Zc	a higher qualification %
Zd	Employees in scientific and technical professions %
Ze	of doctors in the Ministry of Health per 10,000 people
Zf	Annual population growth rate

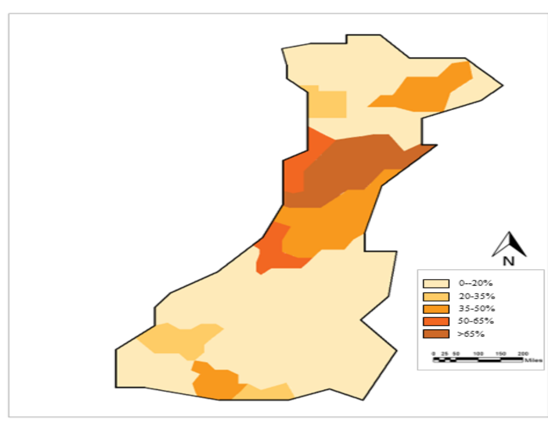


Figure 5.2. 5 Analysis of higher qualification indicator

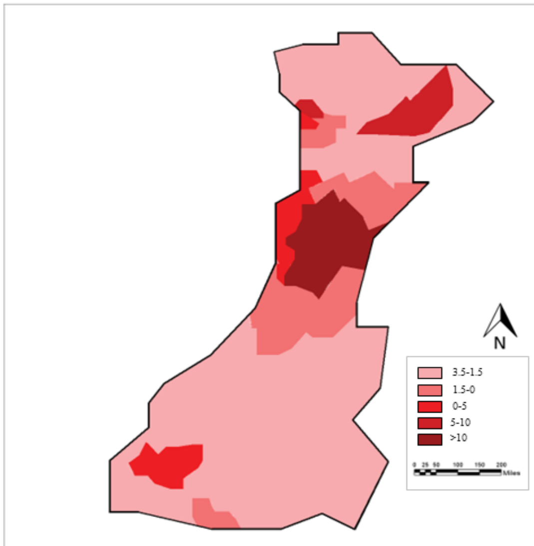


Figure 5.2. 6 Analysis of Annual population growth rate indicator

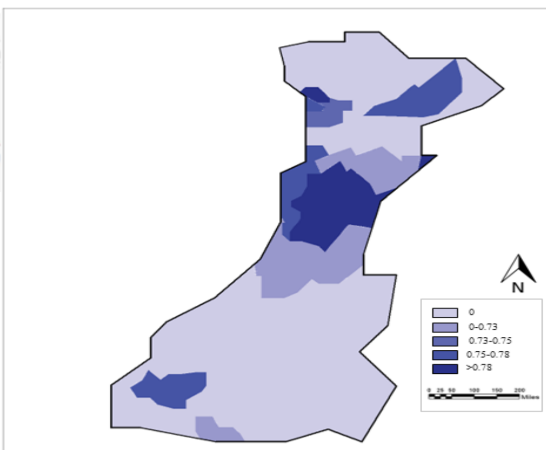


Figure 5.2. 7 Analysis *of Human*

Development indicator

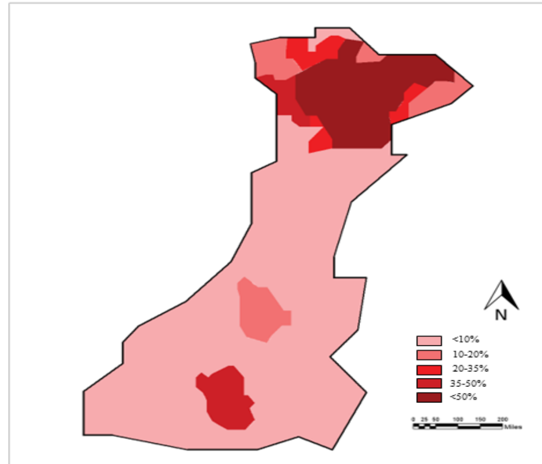


Figure 5.2. 8 Analysis of Socio-economic level factor indicators

The model starts with standardizing the variables data which is the process of converting the variables on the same scale to statistically analyze and compare scores between the variables.

Table 5.2. 4 ANOVA analysis

	Cluster Mean square	Cluster df	Error Mean square	Error df	F
Z score A	39.8	4	0.1	187	216
Z score B	29.8	4	0.4	187	74
Z score E	30.6	4	0.3	187	80
Z score H	29	4	0.4	187	72
Z score C	24	4	0.4	187	51
Z score D	18.5	4	0.6	187	30

Table 5.2. 5 Number of cases in each Cluster

Cluster 1	1
2	3
3	49
4	5
5	134
Variables	192
Missing	0.0005

Stage 3: Multiple Logistic regression for Socio-Economic Factor

The research surveys 25 academics and experts to classify the cluster members (Socio-economic indicators). The expert survey has been conducted for a random neighborhood member of each cluster. The number of random neighborhoods selected for each class was proportional to the total number of members in each cluster group. Experts have been asked from their social and economic background and their previous studies to give their opinion (YES/NO) for each selected neighborhood with its socio-economic characteristics have a human development potential to support the success of Aerotropolis.

Multiple logistic regression has been developed for the expertise opinion (0/1) and the six standardized indicators as the dependent variable to formulate the probability of neighborhood to rise the success of the Aerotropolis region.

The multiple regression SPSS outputs were significant at a level of 0.1 as shown in the table .Figure shows the raster probability to contribute to the success of the Aerotropolis region, the map was produced by the application of the multiple logistic regression model on the neighborhood's unit.

Social and economic factors are essential in determining the Aerotropolis because of considerable differences in economic and social standards of living within area, as shown in the previous map. The map also highlighted the extreme contrasts between the new cities and the areas north of the airport.

Table 5.2. 6 Variables in Equations

	B	SE	WALD	DF	Sig.	Exp.(B)
ZA	2.2	0.6	8.2	1	0.004	11
ZB	8.7	2.4	9	1	0.001	6133
ZE	3.3	1	5	1	0.100	0.034
ZH	1	0.5	6	1	0.009	0.14
ZC	10	4	6	1	0.110	38.7
ZD	2	1	1	1	0.100	0.1
CONSTANT	10	3.2	9	1	0.002	0

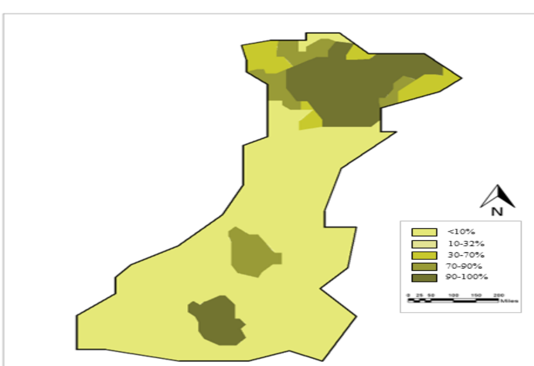


Figure 5.2. 9 Analysis of socio-economic level Probabiity raster

Phase 3: The logit model analysis for Aerotropolis factors

Stage 1: Determination of comprehensive Aerotropolis region from the three factors

After the implementation of phase 2 and the development of the logit model and the probability raster maps output of each factor, the research continued by using the raster weighted overlay technique of GIS to produce the comprehensive Aerotropolis region.

The stage starts with the identification of the factor's weight by surveying 25 academics and professionals to determine the relative weight of the three factors.

The survey response analysis gives the average weight for accessibility at 45 %, economic land use at 35%, and 20% for the socio-economic level which will be used within the spatially weighted overlay process of the three probability maps of each factor.

The final probability raster map of the Aerotropolis region was computed by ArcGIS Pro using the weighted overlay tools as shown in figure.

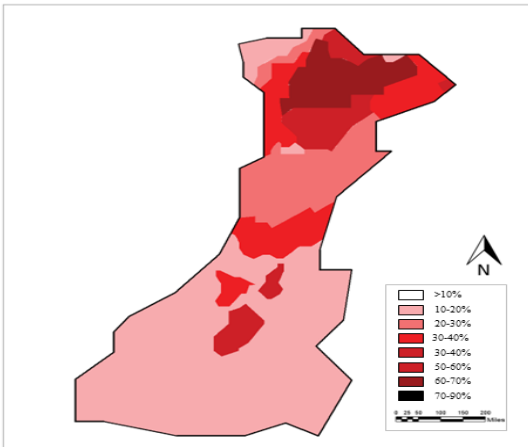


Figure 5.2. 10 Logit model analysis

Stage 2: the objective of the stage is the determination of the proposed Aerotropolis region.

The research adopts an assessment methodology to evaluate each cell within the probability raster map output of stage 1 to select the most suitable probability value to determine the Aerotropolis region using the raster spatial logical tools. The assessment methodology is based on the minimum probability value for the success of the cell to be included in the Aerotropolis region over 50%, each value produces a Aerotropolis region alternative which will be evaluated by the existing minimum activities requirements for Aerotropolis success.

The research applied the assessment methodology five times for probability values of 90%, 80% to 50% as shown in table. Each assessment process produces a Aerotropolis region alternative, then it has been valued for the existence of the Aerotropolis approach. The assessment process shows that the optimum probability value was 60% which is the minimum probability value to realize an Aerotropolis region with the most requirements needed for the realization of Aerotropolis approach objectives to be achieved. Figure shows the proposed Aerotropolis region for based on the proposed spatio-economic logit model developed by the research.

Table 5.2. 7 Evaluation and requirements for each zone

Aerotropolis region probability Values	Existing Aerotropolis requirements	Missing Aerotropolis requirements	Aerotropolis region Success Evaluation
> 90%	airport terminal – cargo area - cargo villages – distribution zone - Aircraft maintenance, repair, and overhaul – airport hotels	–	□
80- 90 %	Hotels – entertainment – Mega malls retail -Leisure (spas, fitness, recreation, Cinema, etc.) in city	Business and technology parks	□
70-80%	R&D in and city – High education - high mixed-use Residential areas in new cities - Convention and exhibition	Information and communication technology firms -Free trade zones and special economic zones - Logistics parks and distribution centers	□

60-70%	Industrial areas in	High-tech electronics repair-High-value agricultural and food products- Medical instruments- Aviation related industries	□
50-60%	_		□

The vision in the national development strategy

The research proposed a fourth factor of national development strategy to adjust and adapt the proposed Aerotropolis region to satisfy the Aerotropolis region requirements. The research found that there are areas with high economic potential outside the proposed region and that the government strategy was relocating the mega industrial hubs outside of the border to new cities as shown in figure.

These mega industrials produce products with high economic value to be exported due to time-consuming values as shown in table. These cities have economic potential and it is expected a potential role in the success of the Aerotropolis system.

Table 5.2. 8 Cities industrial components

Regional Aerotropolis region	Industrial Components and potential
Vashi city	agricultural and food products and engineering and electrical industries
Taloja city	High-tech electronics (Samsung) - Investment areas
Turbhe-Taloja	Special economic zone – free trade zone – export processing zone – Ports
Belapur,Vashi City	Engineering and electrical industries – Investment areas
Vashi city	agricultural and food products

The research has developed the regional Aerotropolis region which is adjusted to the proposed Aerotropolis region in phase 3 by including the industrial hubs around to achieve the development vision.

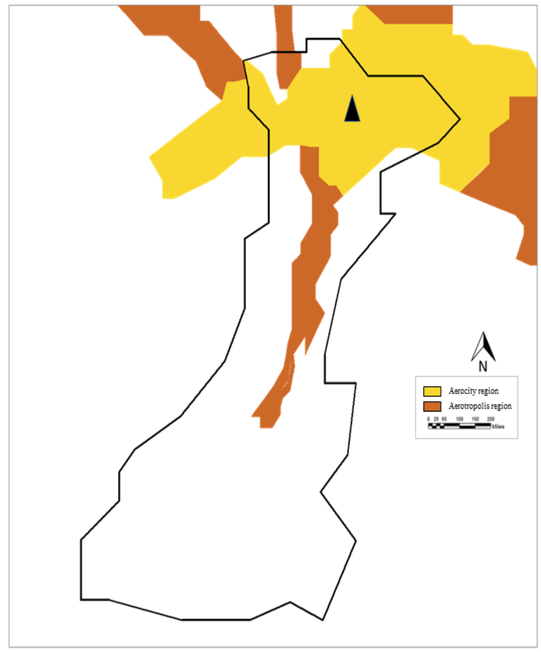


Figure 5.2. 11 Aerotropolis Probability raster map

VI. PROPOSALS & RECOMMENDATIONS

6.1 Integrated Airport Business and Socio-Economic District (IABSD)

Proposal Objective

Develop an Integrated Airport Business and Socio-Economic District within the Navi Mumbai Aerocity by creating a mixed-use airport district that combines commercial activities, public infrastructure, and social amenities. The location and sequencing of development should be guided by the Spatio-Economic Logit Model**,** ensuring infrastructure is provided in areas with the highest predicted growth potential. ensuring that socio-economic infrastructure is developed in locations with the highest predicted growth potential while promoting economic competitiveness and sustainable urban development.

Components

1. Airport Business District

2. Integrated Socio-Economic Infrastructure Zone
3. Transit-Oriented Mixed-Use Development

Role of the Spatio-Economic Logit Model

The Spatio-Economic Logit Model is embedded throughout implementation rather than being used only during analysis:

Phase I: Identify high-probability development zones to guide land reservation and trunk infrastructure.

Phase II: Prioritize locations for commercial centres, hospitals, schools, housing, and public amenities based on predicted demand.

Phase III: Update the model with new socio-economic and land-use data to optimize future investments and adjust development priorities.

Figure 6. 1 Major activities

Component	Scope of Work
Airport Business District	Grade-A offices, corporate headquarters, business hotels, retail streets
Convention Facilities	International convention & exhibition centre
Housing	Affordable housing (≈5,000 units), rental housing, mixed-income residential blocks
Healthcare	500-bed multi-speciality hospital, emergency trauma centre
Education	University campus, skill development centre, secondary schools
Public Transport	Metro interchange, multimodal transport hub
Open Space	Central urban park, public plazas

Figure 6. 2 Estimated Cost

Infrastructure	Cost (₹ Crore)
Airport Business District	5,000
Hotels & Convention Centre	2,000
Housing	2,500
Hospital	900
University & Schools	1,100
Public Transport	1,000
Parks & Public Realm	500
Total Phase II	13,000

Figure 6. 3 Phase-wise Implementation Framework

Phase	Objective	Role of the Spatio-Economic Logit Model	Major Physical Interventions	Expected Outcome
Phase I (2026–2030) Foundation	Establish planning framework and trunk infrastructure	Generate probability maps to identify priority growth zones for land reservation and infrastructure investment	Delineate Airport Influence Zones, prepare Aerocity Master Plan, construct arterial roads, metro integration, water supply, sewerage, power, digital infrastructure, reserve land for schools, hospitals, parks and affordable housing	Planned urban expansion with infrastructure-ready development zones
Phase II (2030–2035) Growth	Develop Airport Business and Socio-Economic District	Use predicted development hotspots to determine locations for commercial, institutional and social infrastructure	Airport Business District, business hotels, convention centre, mixed-use developments, hospitals, universities, affordable housing, logistics support facilities, public open spaces	Increased employment, improved accessibility and balanced socio-economic infrastructure provision

Phase	Objective	Role of the Spatio-Economic Logit Model	Major Physical Interventions	Expected Outcome
Phase III (2035–2040) Maturity	Expand and optimize infrastructure based on observed growth	Update the Logit Model with new demographic, land-use and transport data to re-prioritize future investments	Innovation districts, additional schools and hospitals, TOD expansion, green corridors, smart mobility systems, public amenities and infrastructure upgrades	Globally competitive, resilient and adaptive Aerocity with optimized infrastructure investment

Figure 6. 4 Phase-wise Budget and Financing

Phase	Estimated Cost (₹ Crore)	Primary Funding Source	PPP Opportunity
Phase I	7,600	Government, CIDCO, State Infrastructure Funds	Metro integration, utilities, smart infrastructure
Phase II	11,500	PPP + Private Investment + Land Value Capture	Business district, hotels, hospitals, convention centre, affordable housing
Phase III	8,200	PPP + Private Investment + User Revenue	Innovation district, TOD, smart mobility, green infrastructure
Total	27,300	Mixed Financing Model	Long-term concession agreements

Figure 6. 5 Major Activites

Component	Scope of Work
Innovation District	Research centres, start-up hub, technology park
Economic Clusters	Aviation services, logistics support, IT, finance, healthcare
TOD Expansion	High-density mixed-use development around metro stations
Social Infrastructure	Additional schools, hospitals, sports complexes, cultural centres
Smart Infrastructure	Integrated Command Centre, IoT-based utilities, digital governance
Environmental Systems	Urban forests, green corridors, recycled water network, solar infrastructure

Figure 6. 6 Estimated cost

Infrastructure	Cost (₹ Crore)
Innovation District	3,000
TOD Expansion	2,000
Social Infrastructure	1,500
Smart Infrastructure	700
Green Infrastructure	800
Economic Cluster Development	2,000
Total Phase III	10,000

Phase	Duration	Estimated Cost (₹ Crore)
Phase I	2026–2030	7,500
Phase II	2030–2035	13,000
Phase III	2035–2040	10,000
Total	15 Years	30,500

Figure 6. 7 Financial strategy

Component	Delivery Model
Airport Business District	DBFOT
Hotels & Convention Centre	BOT

Component	Delivery Model
University	PPP / Institutional Trust
Hospital	Design-Build-Operate
Affordable Housing	Viability Gap Funding + PPP
Smart Infrastructure	Performance-Based PPP
Public Parks	CSR + Municipal Funding

Figure 6. 8 Operation and maintenance

Infrastructure	Responsible Agency	Funding Source
Roads & Public Spaces	NMMC	Property tax & municipal revenue
Metro & Transit	MMRDA	Fare revenue & government support
Utilities	Utility Operators	User charges
Smart Systems	CIDCO / Special Purpose Vehicle	Annual O&M contracts
Hospitals & Universities	PPP Concessionaires	Service revenue & institutional funding

The phased implementation framework ensures a logical progression from foundational infrastructure and land reservation to commercial development, innovation, and long-term urban optimization. By integrating governance, financing, Public–Private Partnerships (PPP), operation and maintenance strategies, and circular economy principles, the proposal establishes a comprehensive roadmap for sustainable aerocity development. Furthermore, the incorporation of periodic monitoring and model updates allows the planning framework to adapt to changing socio-economic and spatial conditions, ensuring resilience and long-term competitiveness.

6.2 Planning Policy Proposal

Stage 1: Immediate Phase – Set the Foundation
Establish a strong planning and governance framework for airport-led urban development.

Policy 1: Delineate Airport Influence Zones using GIS-based accessibility and the Spatio-Economic Logit Model.
Identify Airport Influence Zones (AIZ) based on travel time, accessibility, land suitability, and future development probability to guide land use planning, infrastructure prioritization, and phased aerocity development around Navi Mumbai International Airport.

Policy 2: Prepare an Integrated Aerocity Master Plan with reserved land for essential socio-economic infrastructure.
Develop a comprehensive master plan integrating land use, transport, environmental conservation, and economic development while reserving land for healthcare, education, affordable housing, public utilities, and green spaces to ensure balanced and sustainable urban growth.

Stage 2: Short-Term Phase – Formal Launch
Initiate planned urban growth through targeted infrastructure and investment.

Policy 1: Prioritize socio-economic infrastructure based on development probability.
Allocate schools, healthcare facilities, affordable housing, and public amenities in areas identified by the Spatio-Economic Logit Model as having the highest development potential, ensuring timely infrastructure provision and efficient public investment.

Policy 2: Promote mixed-use and transit-oriented development around airport corridors.
Encourage integrated residential, commercial, institutional, and business developments supported by multimodal transport networks to create compact, accessible, and economically vibrant urban centres.

Stage 3: Medium-Term Phase – Aggressive Growth
Optimize infrastructure investment and strengthen economic competitiveness.

Policy 1: Expand infrastructure and economic clusters through phased, data-driven development.
Develop transport networks, utilities, logistics hubs, business parks, and specialised economic clusters in accordance with infrastructure demand and spatial suitability identified through the Spatio-Economic

Logit Model.

Policy 2: Implement adaptive planning through periodic monitoring and model updates.
Continuously update the Spatio-Economic Logit Model using demographic, economic, transport, and land-use data to reassess infrastructure priorities and guide future investments based on changing development trends.

Stage 4: Long-Term Phase – Maturity
Achieve a resilient, inclusive, and globally competitive aerocity.

Policy 1: Ensure equitable access to socio-economic infrastructure through sustainable urban development.
Maintain universal access to education, healthcare, public transport, green infrastructure, and community facilities while promoting climate resilience, environmental conservation, and balanced land use across the aerocity.

Policy 2: Establish a performance-based planning framework to enhance global competitiveness.
Develop an Aerocity Performance Monitoring System using GIS and key socio-economic indicators to evaluate infrastructure efficiency, accessibility, investment performance, and quality of life, enabling adaptive planning and long-term global competitiveness.

VII. ACKNOWLEDGEMENT

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APPENDIX A

Household Socio-Economic Survey

Target Respondents: Residents living within the Aerocity Influence Area (Ulwe, Pushpak Nagar, Dronagiri, Panvel, Kamothe, Kalamboli, Taloja, Uran, etc.)

Section A: Respondent Profile

1. Respondent ID _______
2. Age
- □ 18–30
- □ 31–45
- □ 46–60
- □ Above 60
3. Gender
- □ Male
- □ Female
- □ Other
4. Education
- □ Primary
- □ Secondary
- □ Graduate
- □ Postgraduate
- □ Professional
5. Occupation
- □ Government
- □ Private
- □ Business
- □ Logistics

- □ Airport-related
- □ Student
- □ Homemaker
- □ Unemployed

6. Monthly Household Income

- □ Below ₹25,000
- □ ₹25,000–50,000
- □ ₹50,000–75,000
- □ ₹75,000–1,00,000
- □ Above ₹1,00,000

7. Family Size
8. Years residing in the area

Section B: Housing Characteristics

9. Housing Type

- □ Apartment
- □ Independent House
- □ Rental
- □ Slum
- □ Other

10. Ownership

- □ Owned
- □ Rented

11. Estimated Property Value
12. Distance from NMIA (km)

Section C: Accessibility

13. Distance to workplace
14. Daily travel time
15. Primary transport mode

- Bus
- Metro
- Rail
- Car
- Two-wheeler
- Walking

16. Distance to nearest railway station
17. Distance to nearest metro station
18. Distance to nearest bus stop
19. Average monthly transport expenditure

Section D: Infrastructure Availability
Availability within 1 km

Infrastructure	Yes	No
School	□	□
College	□	□
Hospital	□	□
Primary Health Centre	□	□
Park	□	□
Shopping Centre	□	□
Bank	□	□
Police Station	□	□
Fire Station	□	□
Public Transport	□	□

Section E: Satisfaction Rating
Rate from 1 (Very Poor) to 5 (Excellent)

- Road Infrastructure
- Public Transport
- Water Supply
- Sewerage
- Electricity
- Healthcare
- Education
- Parks
- Employment Opportunities
- Digital Connectivity

Section F: Aerocity Preference

1. Would you prefer to live in the Aerocity region after complete development?

□ Yes
□ No

2. Would you relocate if better infrastructure is provided?

□ Yes
□ No

3. Would you pay a higher property price for improved infrastructure?

□ Yes
□ No

4. Which infrastructure is most important?

□ Metro
□ Hospital
□ School
□ Commercial Centre
□ Park

□ Employment Hub
□ Airport Connectivity

APPENDIX B
Business and Commercial Establishment Survey
Target Respondents- Industries, Offices, Commercial Establishments, Hospitality Sector

1. Business Profile
- Business Name
- Location
- Business Type
- No. of Employees
- Annual Turnover

2. Infrastructure Requirements
Importance (1–5)
- Road Connectivity
- Airport Connectivity
- Metro Connectivity
- Internet Infrastructure
- Power Supply
- Water Supply
- Parking
- Freight Facilities
- Skilled Labour Availability

3. Future Expansion
Planning expansion?
- Yes
- No

4. Preferred location
- Within Aerocity
- Near Airport
- Elsewhere

5. Expected employment generation

APPENDIX C
Expert Opinion Survey
- Urban Planners
- Airport Planners
- Academicians
- Real Estate Experts
- Transportation Experts

Questions
1. What socio-economic factors should determine Aerocity growth?
2. Which infrastructure should receive highest investment?
3. Which international Aerocity model best suits Navi Mumbai?
4. How should employment centres be spatially distributed?
5. How can accessibility inequalities be reduced?
6. What policy interventions are required?

APPENDIX D

Variables Used in the Binary Logit Model

Variable	Type	Description
Willingness to Live in Aerocity	Dependent	Yes=1, No=0
Household Income	Independent	Income Category
Education	Independent	Education Level
Occupation	Independent	Employment Type
Distance to Airport	Independent	km
Distance to Metro	Independent	km
Distance to Hospital	Independent	km
Distance to School	Independent	km
Travel Time	Independent	Minutes
Property Ownership	Independent	Owner/Tenant
Accessibility Index	Independent	Composite Score
Infrastructure Satisfaction	Independent	Likert Scale
Employment Accessibility	Independent	Number of Jobs within Travel Threshold
Household Size	Independent	Number of Members
Age	Independent	Years