

## EVOLUTION AND ASSESSMENT OF LAHORE'S TEMPORAL AND SPATIAL EXPANSION FROM 1900-2015 AND PREDICT SPATIAL EXPANSION FOR NEXT 100 YEARS

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### Abstract

Population is the main focus in all studies within the framework of geography. Population and basic natural resources are intimately related to each other. With the increase in population the land use conflicts, traffic congestion, environmental degradation, pollution and water degradation occurs. Therefore, the study and analysis of population growth and distribution in the urban development is the logical starting point for any research of the present nature. Lahore is the second most populated city after Karachi in Pakistan. As Lahore is better developed than other cities, people from all over Punjab are moving to Lahore in strive for better employment, education, health and in general a better life style opportunities. The environment of Lahore is badly affected by increase in population and limited resources. The study of spatial temporal expansion of Lahore is carried out by gathering data of Lahore from different institutes and departments of Pakistan like Jinnah Library, Survey of Pakistan, Walled City, Lahore Development Authority (LDA) etc. This has helped in understanding of the rate at which civil infrastructure is developed in the city over the years. This study has also helped in finding the solution to control this unchecked expansion. According to research the total population of Lahore was 6,318,745 as per 1998 Census but now it has increased to ridiculous figure of 11,738,186 and it is continuously increasing. The total area of Lahore is 1772 square kilometers which was 850 square kilometers in 1998. If this unchecked expansion continues then the expected increase of population and area would be 50 million and 3000 square kilometers respectively in next 100 years. This unchecked expansion should be controlled in order to improve the living standards and environmental conditions of the millions of people living in the city of Lahore by systematic monitoring of the urban development, proper management of the City and planned future development. Development authorities are established in Pakistan's big cities to cope with this haphazard spatial growth issue. It was assigned to the Lahore Development Authority (LDA) to monitor the uneven development within city boundaries.

## INTRODUCTION

Ancient Lahore's origin dates back about 2000 years. Lahore was established by "Loh," Rama's son, and the name "Lahore" is altered from the term "Lahawar" meaning "Lahawar Fort." Two possible locations of its origin are present in Lahore Fort and Ichra. Lahore arose as a settlement from the medieval era between the 7th century A.D., controlled by various empires, including the Hindu Shahis, Ghaznavids, Ghurids, and Delhi Sultanate. In the 11th century, Lahore became a city. Between the 16th and 18th centuries, it reached the height of its splendor under the Mughal Empire.[1]

Spatial and temporal expansion has become a significant problem which many metropolitan areas are facing. While there has been no overall agreement on the definition and effect of this expansion, it is often referred to as uncontrolled, dispersed suburban growth, which has increased traffic issues and reduced local resources. To create a thorough knowledge of the causes and impacts of urbanization procedures, it is critically essential to correctly characterize urban sprawl. Because of its relation with poorly planned urban land use and financial activity, it is often assessed and distinguished solely on the basis of significant socio-economic factors such as population growth, commuting expenses, employment shifts, city revenue change, and a number of commercial organizations.

Sustained urbanization and industrialization, particularly in large cities of developing countries, generates numerous problems such as overcrowding, haphazard spatial growth, slum formation, shortage of basic services, etc. (Bhalli, 2012) described this situation as urban sprawl being a global phenomenon of the current age and occurring mostly in less advanced countries. The same is endorsed by (Ahmad 2013) claiming that the world population is growing at a much faster pace than ever before and demonstrated to be one of the thresholds of fast human settlement development.

Pakistan has a population of over 140 million. The nation had an enormous influx of migrants after independence from the British Empire in 1947. Cities and villages became the primary places of housing for most of the migrants. Unfortunately, these human settlements started to develop

haphazardly owing to the lack of proper administrative structure. In 1975, the government set up Development Authorities (DAs) in the country's large towns parallel to the current scheme of local government. The country's administrative divisional level structure lies between the province and the districts. The Punjab DAs are established in the territories of Lahore, Faisalabad, Multan, Rawalpindi, Gujranwala, Dera Gazi Khan, Bahawalpur, and Islamabad in Federal Capital. The Punjab Development of Cities Act 1975 gives legal support to the DAs.[2]

The authority may initiate and sustain an ongoing process of extensive development planning for the area with the goal of preparing adequacy plans, continuously update and coordinate such development plans in the region by the organization or government departments, and create, retain and revise controls and construction laws for the region on a regular basis.

The region for this research is Lahore, Punjab province's capital town, and the country's second biggest metropolitan area. Lahore's population was 6,319,000, according to the 1998 census. Index Mundi placed the city's population at 7,566,000 in July, 2014. An assessment in January 2015 gave the Lahore aggregation population as 10,052,000. It is ranked 34 in the world's most overcrowded urban areas and the 8th largest city in the Entity of Islamic Cooperation.

Over the past 10,000 years, human beings have started to alter the land with the introduction of agriculture and the industrial revolution which has affected the atmosphere. The latest population growth in the world has magnified the impacts of agricultural and economic operations. While the population of the world is increasing, the urban population of the world is increasing too. More than half of the world's population will be living in urban areas within the next few years.[3]

Urbanization levels and development vary significantly from region to region. Latin American countries have the largest percentage of the population residing in urban regions among developing nations. But the highest development rates in East and South Asia are likely to be in the next 30 years. Nearly all future population growth in

the globe will be in cities and towns. Both the rise and the redistribution of the population of earth are likely to impact the earth's natural structures and the relationships between urban settings and populations [4].

The United Nations Population Division and the World Bank provide the best information on trends in worldwide urbanization. However, the UN warns world that the information is often imprecise because urban definition differs from nation to nation. Also, past urbanization predictions have often overestimated future growth rates. It is therefore essential to be cautious when drawing information on urbanization.

## 2.0 Literature Review

A lot of research has been previously done on the spatial and temporal expansion of different urban cities in the world. The increase in population is a major issue these days and all developed countries are conducting researches on how to manage them and cope with the increasing demand of natural and man-made facility.[5]

China has experienced rapid urbanization and it has made an extensive study in it using high-resolution Landsat Thematic Mapper and Enhanced Thematic Mapper data of 1989/1990, 1995/1996 and 1999/2000 and analyzed its expansion modes and the driving forces underlying this process during 1990–2000. The results showed that their urban land has increased by 817 thousand hectares of which 80.8 percent urban land area existed before the study. This temporal expansion is affecting the environment as well.[6]

A case study has been carried out in Tabriz, a land in Iran. This case study was carried out in 1989, 1998 and 2001. The results showed that urbanization badly affected vegetation, which in turn has a negative impact on the environment.

A study has also been carried out in Jeddah, Saudi Arabia to analyze the spatial-temporal relationship between urban growth and transportation using remote sensing. The results showed that during 1964–2007 Jeddah has experienced a rapid population growth and large spatial expansion largely changing land use and transportation infrastructure.[7]

As the large city and cultural center of the Punjab, Lahore is Pakistan's second biggest town in terms of its share of the country's total population. With such a recorded in history of about 1,000 years, it was defined as both Pakistan and South Asia's most lasting and intriguing town. Lahore peri-urbanization occurred owing to in-migration from nearby cities and out-migration from the middle of the city. Other variables include the absence of uniformity in land use allocation, property values, densities and socio-economic features. Distribution has been produced in some locations to separate land use from the others or vice versa. Due to weak governance and laws in peri-urban regions, pockets and gaps between planned developments have been either invaded or occupied for some unwanted or inappropriate use of land. Due to the accessibility of housing regions such as Ichra, Mozang and Model Town nearby, rural immigrants resulted residential development in peri-urban regions along Ferozepur Road and Multan Road.

In addition, new residential settlements such as GORII & III, Shadman, Fazalia Colony, Rehman Pura, Wahdat Colony, Gulberg and Kot Lakhpat Township filled the vacancies between Ichra, Mozang and Model Town. A big quantity of property that was earlier free land has now been occupied and additional buildings have been completed. Locations such as Bahria town, stage 8 and 9 of Defense that were earlier Lahore's outskirts have now become Lahore's inner region. All of this has begun to create a burden on Lahore City and an additional demand for energy resources. Most urban immigrants, who needed small-income homes, created slums and squatters. Due to weak laws, all this occurred. Even the measures of Lahore Improvement Trust (LIT) or House Building Finance Corporation could not address the enormous backlog of low-income housing. LIT's housing projects only supplied middle and lower middle revenue groups with 43 percent of the housing units, and reduced revenue groups with 7 percent. A further task for reduced revenue groups was funding, which the House Building Finance Corporation could not take up for housing units under the systems of the LIT. In 1975, taking into account the significance of Lahore among the adjacent districts, the Punjab government proclaimed most sections of Lahore district, part of

Kasur district, and Ferozewala Tehsil of Sheikhpura county the jurisdiction of Lahore Metropolitan as vide notification from the Housing & Physical Planning Department dated May 19, 1975. It includes approximately 1772 sq.-Km, comprising 250,61 sq.-km of ex-municipal boundaries, 92,67 sq.-Km. Board of Lahore Cantonment. In 1988, the Director-General, Lahore Development Authority (LDA) included extra region from South of Lahore. By 1998, Lahore became a metropolis with a population of approximately 6.32 million, estimated at 7.71million in 2001 [8]. By the year 2001, i.e. during the first 50 years after Pakistan's creation, urban Lahore has evolved somewhat physically along significant 68 sq. corridors. Km 397 square. km. This growth is not only for immigrant accommodation, but also for the growth of industrial estates, small businesses, universities, professional schools and vocational institutes. As a result of advances in technology, the built-up region is overlaid on satellite imagery along with freshly designed systems to view the urban magnitude. The built-up region is currently being densified by the growth of infills. On Ferozepur Road, Shahdara, Bund Road, and River Ravi, peripheral development remains haphazardly. Some large-scale projects in the private sector include :Bahria Town ,DHA (future phases), and LakeCity [9]. Research is also about to be completed on new campuses along Raiwind Road and Kala Shah Kaku Lahore Motorway Bypass. The complete region of the district of Lahore is 1,772 sq. according to an estimate in 2012. Km with approximately 09 million inhabitants, of which roughly 82% are urban. In 2012, Lahore has 150 union councils, 122 of which spread over 367 square kilometers and 28 of which were rural, covering 1405 square kilometers.

Some features affect the development of the town. The North and North west Ravi River functions as a natural border to Lahore City's development. Expansion to the east is restricted due to the closeness of the Indian border. Some other restriction to the development of the city is the existence of ' Notified Areas and Other Restricted Areas ' delineated under the LDA Act 1975 amended in 2014, which also includes, among other things, all the region within 1,143 meters of an weapons depot ( Thokar Niaz Baig has such a

depot). In addition major roads including G.T.Road, Multan Road, Sheikhpura Road and Ferozepur Road, interfere with the urban sprawl as they involve a distinct road grade. This haphazard /unplanned construction also refers to all of the city's railway tracks. Much of the property under Lahore Municipal Authority jurisdiction is owned by private ownership and is now being developed into private housing systems. This expansion needed the Lahore Development Authority (LDA) to provide facilities at the city level in regions with comparatively low population density as compared to the urban centers [10].

Functioning under the earlier in this thread-mentioned circumstances, in the parameters discussed ahead, Lahore experienced growth. Densification is the first of these parameters, which is most prominent in the town centers. Low-income organizations lack funds to procure land in these fields, so construction operations are practiced through the ' subdivision of current parcels, filling vacant parcels and adding stories.' But this can only continue until the fundamental facilities are too overcrowded to sustain future growth after which it will have to be taken elsewhere. Lahore's development along the town boundaries was disjointed and unplanned, and such a trend is most easily observed in Harbanspura, some regions in the south of Khairi Distributary along both sides of ferozepur Road, Shahdara Road, river bed across Bund Road, regions along G.T.Road. Because of property absence in other directions, the town of Lahore has extended to the south and southwest where you find most of the private housing systems, which implies a general rise in the number of commuters to work. This rise has resulted to a rise in the already burdened highways seeking extensive trunk infrastructure investment. If business, trade and commercial centers are shifted to these recently developed facilities, this will not only prohibit the additional road infrastructure burden, but will also prevent unplanned ' ribbon development [11].

The NESPAK & LDA prepared Integrated Master Plan and CDGL notified it in 2004. IMPL provides guidelines for spatial expansion of Lahore and its land use zoning for development up to 2021, mainly in South Western part of Lahore between Ferozepur Road and Multan Road. IMPL includes suggestions

on various urban planning industries, i.e. Land Development, Housing, Transportation, Public Utilities, Infrastructure, Environment and Institutional Framework, etc. IMPL's planning period expires in 2021 [12].

The government has formally notified the amended and approved master plan of the Lahore division by publishing it in the Punjab Gazette. After being notified the amended master plan has now come into force for Lahore and its districts. Lahore Development Authority's Chief Metropolitan Planner (CMP) Waheed Butt told Dawn on Friday. Below the revised scheme, the developers / sponsors of housing societies, projects, etc. will now need to seek no objection certificate (NOC) from the irrigation office concerning fields and the organizations and departments involved will be specifying noodle routes / area specifications [13].

### 3.0 Methodology

Methodology involves a scientific pattern and systematic way to analyse the collected data and present it in a proper way. Although the research was aimed to detect urban growth due to population growth from 1951–1998 due to the availability of census data till 1998, however, the population of Lahore is estimated for 2009. The time duration was extended to 2009 to detect recent changes occurring in the urban expansion of Lahore.

This research involves two steps of methodology:

#### 3.1 Step 1: Pre-Satellite Image Era (Before 1972)

This was the period when no satellite images were available. However, population census data and agriculture land use data were available for Lahore since 1951. The outer limits of Lahore's urban area were calculated with the help of the agricultural census of 1950 and 1970, and the population census of 1951 and 1972. A field survey was conducted to mark the outer limits of the urban area in 1951 and 1972. The boundaries of the urban area in 1951 and 1972 were marked through historical buildings and personal interviews of the local residing people. The results of the field survey were cross-checked with government-published census reports of population and agricultural land use. This was the period when the population of Lahore became double for the first

time after independence. The master plan of Lahore is also utilized for land use change detection.

#### 3.2 Step 2: Master Plan and Spatial Analysis

Following the amendment to the LDA Act-1975 in 2013, the jurisdiction of Lahore Development Authority (LDA) extended to the Lahore Division. The primary role of LDA is to enhance the area's quality of life through an integrated development strategy via the preparation and execution of the Master Plan. Rules-2014 of the Lahore Development Authority Master Plan empower LDA to prepare and amend Master Plans and Outline Development Plans (ODPs).

For integrated spatial development of an area, formulation of a master plan is a prerequisite. Many spatial development plans were prepared in the past in the form of Master Plans, Structure Plans, Outline Development Plans, and Agrovillage Development Plans for Lahore and neighboring settlements. However, most of them have either become outdated or been thwarted by rapid urbanization, industrialization, and infrastructure development. Therefore, the amended Master Plan of Lahore Division was initiated to integrate existing urban development plans and cover remaining areas.

To address residential and industrial land use, surveys were conducted for existing industrial units in Lahore Division in consultation with departments such as the Industries Department, Labour Department, LCCI, PIEDMC, Urban Unit Punjab, and IGC at LUMS. The surveys targeted:

- Major roads with existing industries
- Roads proposed by LCCI
- Sites along Hudaira drain by FRIA
- Clusters of industries and PIEDMC-proposed sites

These surveys provided foundational data for revising and preparing a new master plan. Recommendations from various sub-committees and legal and environmental constraints were also integrated into the spatial analysis and planning process.

### 4.0 Results

In 1850-1900 the area of Lahore was 60 square kilometers which has increased from 60 to 1700 square kilometers till now. According to research the total population of Lahore was 6,318,745 as per



1998 Census but now it has increased to ridiculous figure of 11,738,186 and it is continuously increasing [14]. If this unchecked expansion continues then the expected increase of population

and area would be 50 million and 3000 square kilometers respectively in next 100 years as shown in the tables and graphs below.

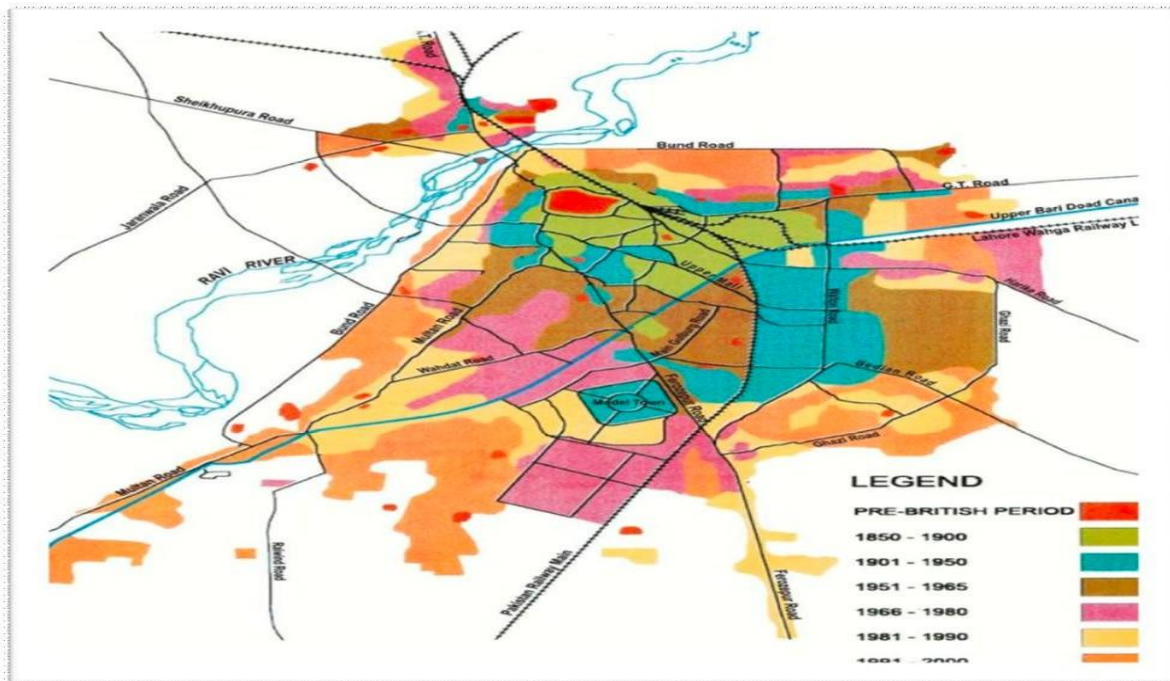


Figure 1. Map Showing Built Up Area Increase From 1850-2000



Figure 2. Land use Map of Lahore

### Area Of Lahore

Year	Area(KM <sup>2</sup> )	Cummulative Area(KM <sup>2</sup> )
1850-1900	60	60
1901-1950	150	210
1951-1965	160	370
1966-1980	150	520
1981-1990	170	690
1991-2000	160	850
2000-2013	350	1200
2010-2018	500	1700

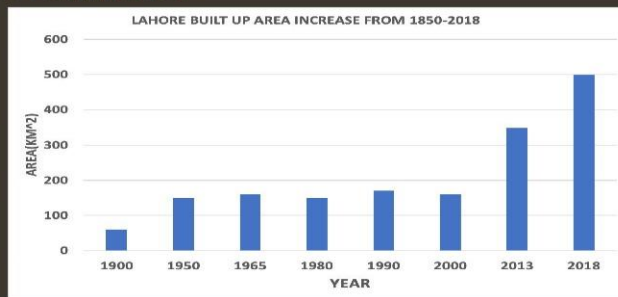


Figure 3. Built Up Area Increase of Lahore from 1850 Till 2018

### Area Of Lahore

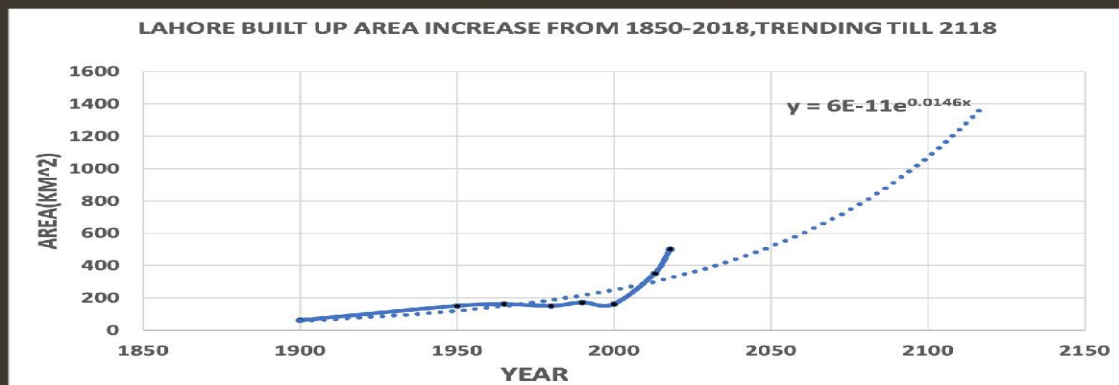
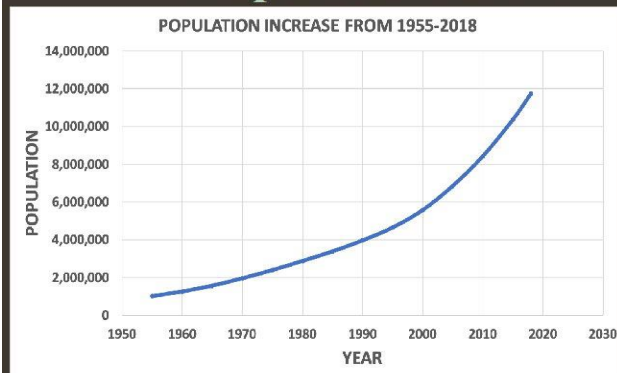


Figure 4. Built Up Area Increase of Lahore from 1850 Till 2018, Trending Till 2018

### Population Of Lahore From 1955-2018



Year	Population
1955	1,021,679
1960	1,264,277
1965	1,574,981
1970	1,963,951
1975	2,398,576
1980	2,881,596
1985	3,387,873
1990	3,970,161
1995	4,652,529
2000	5,576,372
2005	6,856,969
2010	8,432,132
2015	10,369,137
2018	11,738,186

Figure 5. Population of Lahore from 1955 Till 2018

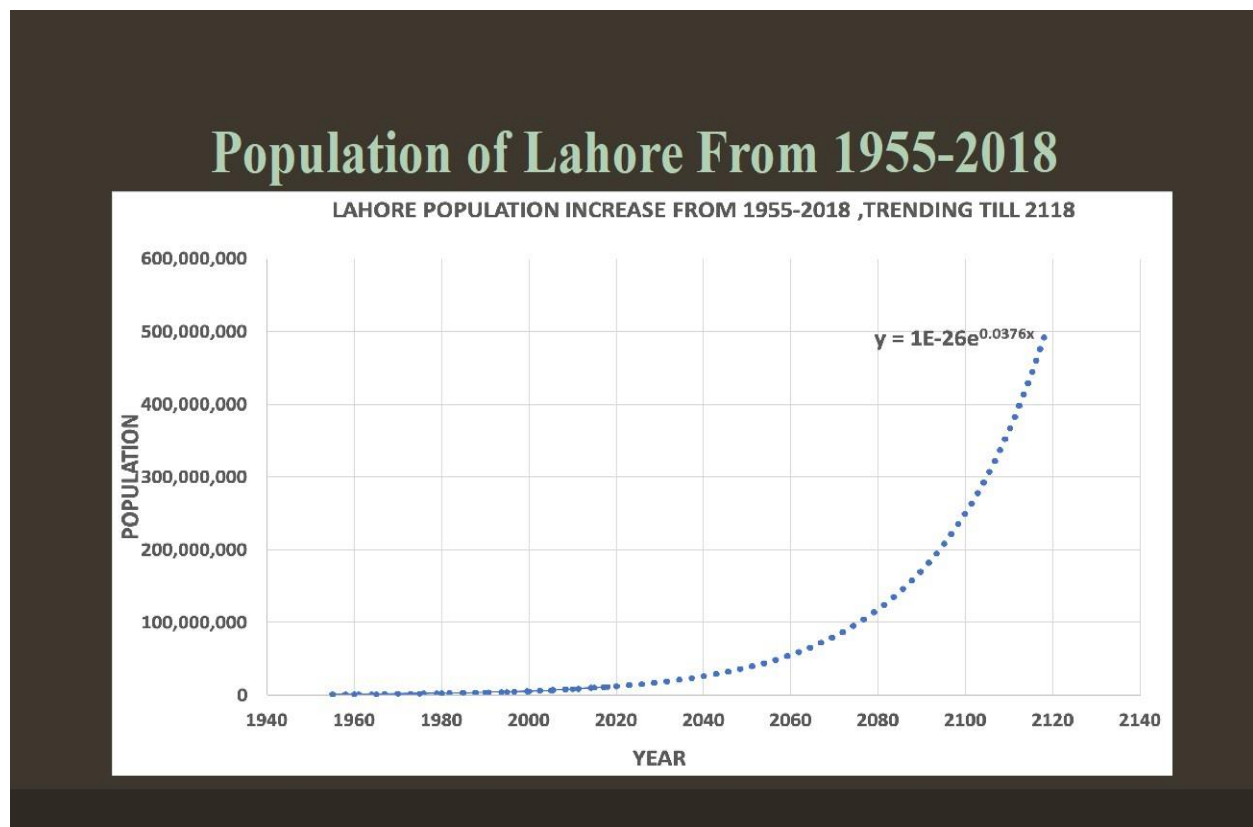


Figure 6. Population of Lahore from 1955-2018, Trending Till 2018



Figure 7. Current Map of Lahore



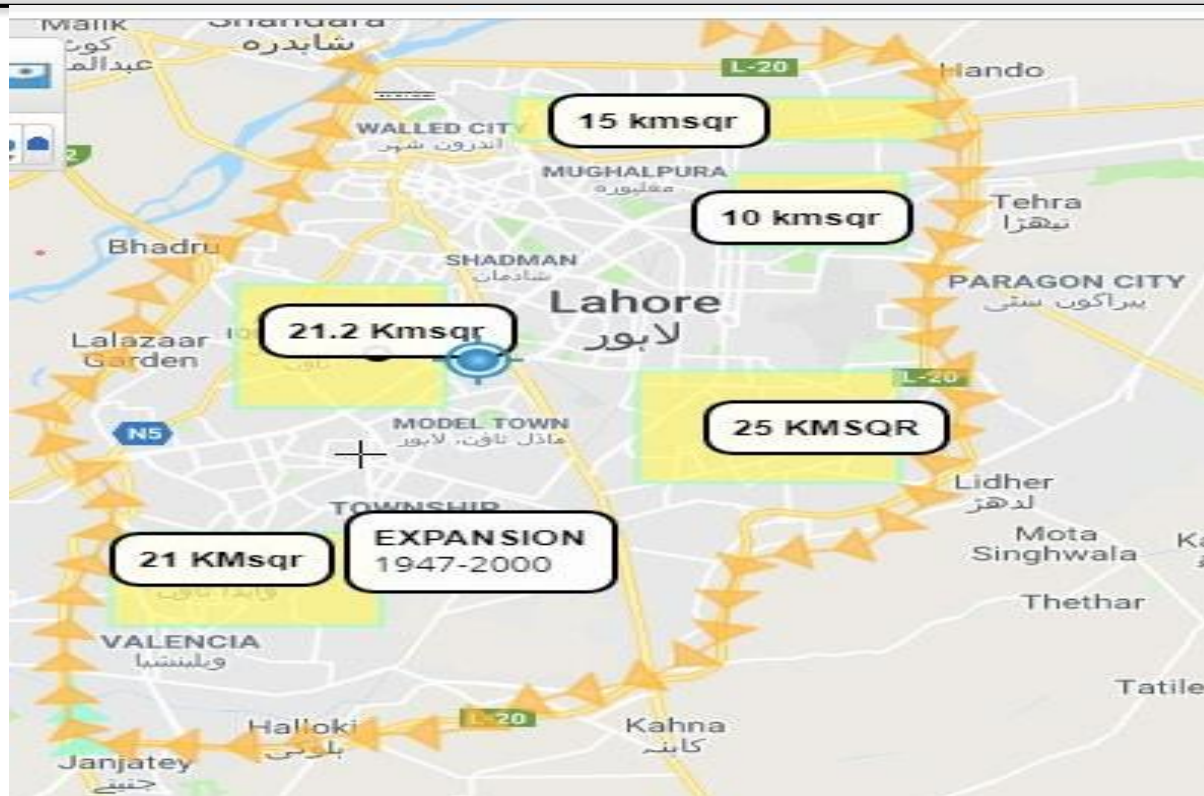


Figure 8. Built Up Area Increase of Lahore from 1900-1947

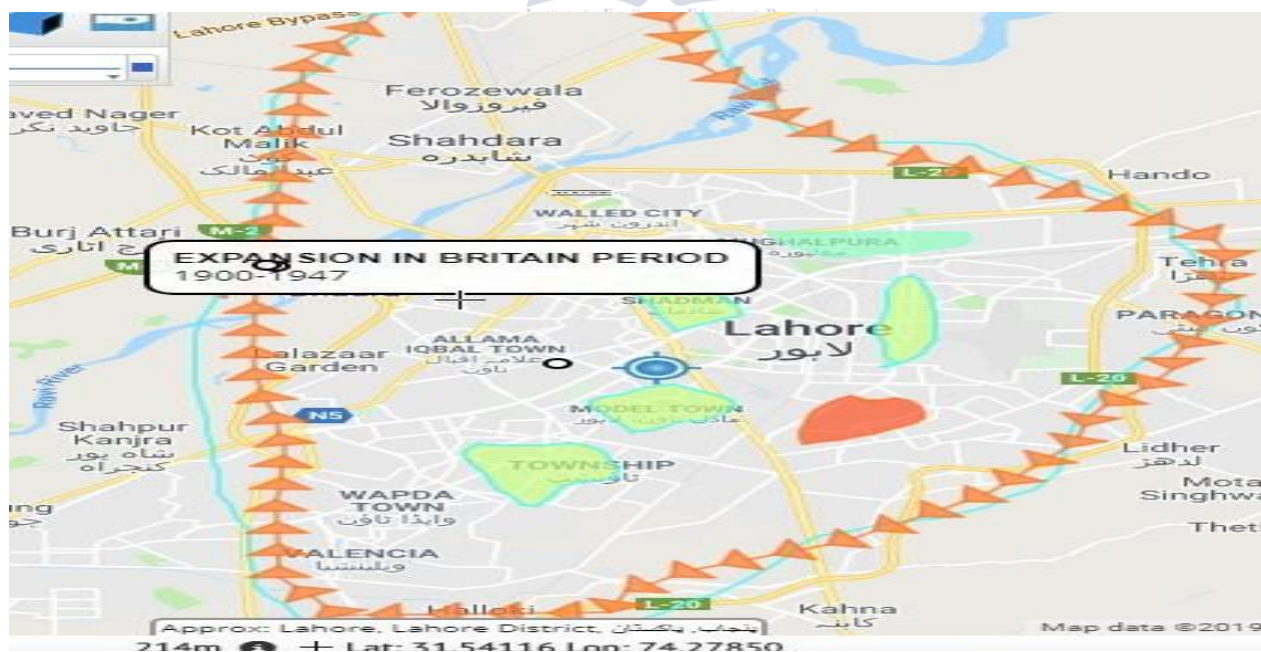


Figure 9. Built Up Area Increase of Lahore from 1947-2000

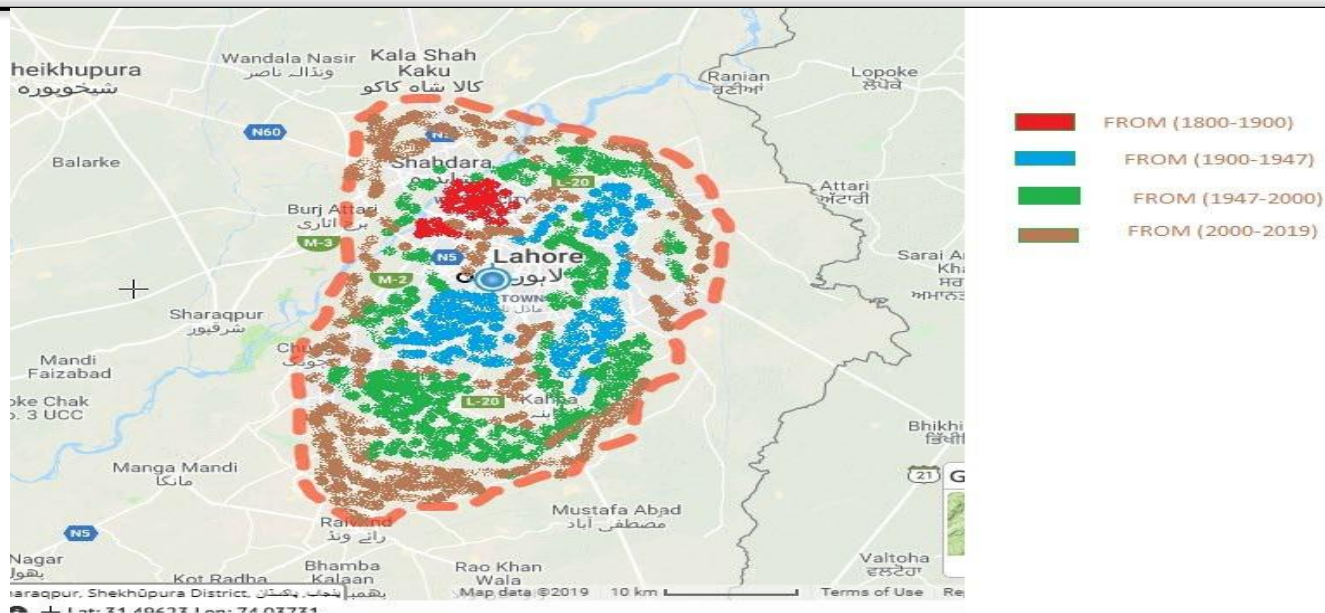


Figure 10. Built Up Area Increase of Lahore from 1800 Till 2019

### 5.0 Conclusion

Lahore of today is far different from what it was a couple of decades ago. Although Lahore possesses a marvelous history but the city has lately become the center of property development, making it an attraction for developers, investors and residents. The boundary of city was never demarcated properly because of which it has expanded rapidly. As per the statistics issued by Punjab Government, the total area of Lahore is 1772 square kilometers. However, with the expansion of Lahore real estate sector, this area seems to have increased notably [18]. The geography of Lahore also allows southward and westward expansion. Lahore is bordered with India on the east and lies closely to Sheikhupura District on its north and northwestern sides and has Kasur to the south. Now, the real estate developments in Lahore approaching to its outskirts, the developers seem to be giving vent to new communities which were previously far away from the center of the city. From the center of the city to Gajumatta, Raiwind, and Shahdara the whole city seems to be extremely populated.

Today, when travelling on Multan Road from Thokar Niaz Baig, various residential societies accompanied us for about 30 kilometers. It is also the condition of Raiwind Road. Now the whole area till Jaati Umra seems to be apart of Lahore. On the

northern ends of Lahore, various societies have been developed till Shahdara. Sadly, the water of river Ravi is sweeping away, so the dry land is considered for developing new residential communities. Till Kala Shah Kaku, there are many residential communities, which can now be regarded as a part of Lahore. A city should not be expanded beyond its demarcated bounds. New cities should be developed to accommodate the needs of increasing population. This will allow the administration to segregate the duties and, in this way, better development plans can be devised and implemented [15].

### 6.0 Recommendation

Preparation of New Master Plan of Lahore Division upto 2040.

The exercise may be outsourced or alternatively new hiring may be carried out for in house.

Action against illegal housing schemes.

Field Staff, Logistics, Sub-Engineers and Equipment may be provided.

Preparation / launching of New LDA schemes in Kasur, Sheikhupura and Nankana Sahib districts to reduce urbanization of District Lahore.

Sub-offices may be built in Nankana, Kasur and Sheikhupura.

Provision of better living environment by streamlining non-compatible land uses.

Proposals for establishment of new industrial zones, corridors and estates.

Provision of new residential, commercial, public building sites, graveyards, sanitary landfill sites and vocational spaces etc.

Water resource regeneration through rain water harvesting and other measures.

Urban renewal and densification of existing housing schemes (Public/Private).

Control over horizontal urban sprawl and compact boundaries for urban areas.

Provision of better transportation linkages and development of missing links of roads, railways, structure plan roads etc.

Urban Governance for Integrated development control by allied infrastructure development departments.

Purpose built Master Planning Directorate in Metropolitan Planning Wing for continuous monitoring, evaluation, feedback, update, and implementation.

Preparation of Basemap using GIS data.

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