

APPLICATION OF REMOTE SENSING AND GIS IN DEMOGRAPHIC AND SOCIO-ECONOMIC ANALYSIS: A CASE STUDY OF DELHI CITY

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ABSTRACT

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A nation's strength depends not only on the quantity of population, but also on its quality. A perusal of the demographic and socio-economic structure of workforce and social status etc., of population, have resulted in several constraints existing resource base. The process of urbanization in Delhi city in terms of accretion of population has been faster in recent decades and coupled with changes in socio-economic structure of the population. Migration from suburban and rural areas to the city in search of jobs has been an important factor in shaping the socio-economic profile of the city's population.

Keywords:

Quantity Of Population , Demographic , Workforce , Social Status .

The Article Is Published On March
2015 Issue & Available At
www.scienceparks.inDOI:[10.9780/23218045/1202013/49](https://doi.org/10.9780/23218045/1202013/49)**1.Introduction**

A continuous influx of population results in changes in the socio-economic characteristics of the city's population. It has its impact felt on the sex ratio, which mostly show declining trends due to male selective in-migration into the city. Moreover, it has its impact felt on other social parameters like literacy and education. The occupational structure also undergoes changes and most of the migrants usually find employment in the urban informal sector. Moreover, a pressure of housing often turns out to be a major constraint, a city often is not geared to incorporate all the immigrants most of whom are often from lower economic groups. Hence a demographic and socio-economic analysis of New Delhi using some powerful tool like Remote Sensing and GIS has become essential.

**History Of Delhi:**

Delhi, a true cosmopolitan city with diversified culture is the capital of the world's largest democracy, INDIA, known as Indraprasta in ancient time. Delhi has glorious and tumultuous 5,000 years old history. Delhi has been traditionally created with being the capital of the pandvas(Mahabharata). The area around the Yamuna River (near purna Qila) has been identified with the city of Indraprasta. The history of Dehli started only after coming of Aryans from the central Asia. The modern Delhi has founded in the 8th century A.D. by Tomara Rajputs who were later supplanted by the Chauhans. Prithiraj Raj Chauhan, the last ruler of this dynasty, was defeated by Mahammad Ghari in the second battle of Terrai in 1192. That was the end of the Hindu rule at Dehli. It then became the pivot of the muslim rule in India, which continued till 1857. After Mughal dynasty, Delhi became the capital of India in 1911 during British rule.

An Overview Of Literature:

Statistics has a long tradition of using graphic and mapping techniques as support tools in various stages of work. For instance, mapping has been used in specifying a delimiting the spatial units for data collection operations, in conducting post-censal survey to verify the accuracy, consistency and comparability of the results in presenting the internal and spatial data on a similar base maps as an accepted cartographic convention dates from the late 1770's, although precise representation of spatial attributes was not possible until the mid-nineteenth century. As early as 1871, some countries began to disseminate their population census results in graphic and cartographic formats (OPCS1992, JBGE 1982).

In the early part of the twentieth century graphics processing and automated mapping techniques have been evolving at a slow pace. It was not until the early 1960's that refinements in cartographic methods, improvements in digital computer assisted cartography. These newly developed techniques have made a number of previously arduous tasks much easier to perform. These tasks include, among others, map production and editing, the retrieval and display of data from large files already in digital forms and various analytical procedures involving the combination of two or more spatially referenced data sets. Additional advantages are the large storage capacity and the ability to archive perishable paper maps in digital forms.

However, the hardware required for computer cartography, at the time, was extremely costly and the design of the systems which required complex operations was cumbersome and difficult to apply. Almost simultaneously, in the fields of environmental science and regional and coverage of statistics, geography and cartography and performs simulations with time dependent data. It offers the possibility to browse across a geographical area without interruption of map sheet boundaries, permits map overlays and display the world in three dimensions. At the same time, it shows the relationships between different phenomena.

The purpose of a GIS is to represent the real world means of a two or three dimensional model. Such a system allows the processing and modeling of the data that it contains on the basis of a homogeneous spatial reference system. The objects of the real world are represented by the description of the situation (geometry) and specific properties (attributes) as well as by the spatial relations (topology) between the objects (Hang, 1993).

In the mid-sixties, Symap, mapping software, it was developed jointly by the laboratory for computer graphics at HARVARD University, United States of America and the Canada Geographic Information System for the agriculture rehabilitation and development agency program of the Canadian Government to analyze environmental problems. This software was generally acknowledged as the first significant mapping and GIS package. However, the high costs and technical difficulties restricted the development and utilization of the mapping and GIS technology to a few academic institutions and government agencies for almost a decade.

In the early 1970's, the applications of mapping GIS techniques began to emerge in the national statistical offices of a few countries, namely Canada, Sweden, Switzerland, United Kingdom and United States of America. The absence of commercial GIS software and the necessity to fulfill specific goals within distinctive national settings sometimes led to the in-house development of geoprocessing systems on mainframe computers.

The Region:

Delhi is located at 28° 38' N and 77° 13' E and lies in northern India. The city is bounded by Uttar Pradesh on the east and Haryana on the west. The average altitude of the Delhi city is 293 m above mean sea level. The city is physiographically covered by Yamuna flood plains. Gangetic plains and Municipal Corporation (NDMC), Delhi Municipal Corporation (DMC) and Delhi cantonment covering 134 wards, and 9 wards and 7 wards respectively. All wards of city total area is 1483 sq. km..

Delhi has a hot and humid climate for most of the season. The city climate becomes very hot during the month of June. Delhi is situated on the banks of river Yamuna with Himalayas being in the north of Delhi. This is the main region behind Delhi's climate being called as the "continental climate". The average temperature of Delhi during summer ranges from 25°C to 46°C. May and June are considered to be the hottest months of the

year. Winter season lasts from November to February –March. Temperature is substantially falls to 3 to 40 c at the peak of winter. The monsoon lasts from July to September. The population of Delhi city, according to 2001 census is 1,38,50,507 persons. The density of population is 9340 persons per sq. Km. The sex ratio is 821 per 1000 male population. The literacy level is 81.67 percent. The birth rate is 21.24 per 1000 population and death rate is 5.81 percent.

Objectives:

The silent objectives of the study are identified as follows:

- 1) To study the spatial distribution and density of population in Delhi.
- 2) To examine the socio-economic characteristic of the population in Delhi NCT.

Scope And Limitation Of The Study:

Remote sensing and Geographical information system has wide scale applicability in demographic and socio-economic studies. Together with co-relate information, they can vary precisely depict case of rapid urbanization and its associate effects, presently a problem of the third world countries. Moreover, GIS supportive of a huge database can portray very effectively through thematic analytical maps, multivariate analysis often used by development scientists, in ascertaining levels of development of areas in order to formulate policy decisions.

The present study however has been handicapped by certain constraints. Because of non availability of census data for the year 1991 and other social parameters (water supply, electrification, hospitals and other amenities for the year 1991 and 2001, the whole study is based on census 2001 only.

Data Base:

The sources of data for the study include the follows:

- i) LANDSAT imagery of Delhi region 10th May, 2003.
- ii) Guide map of Delhi city.
- iii) Census of India, 2001 of Delhi State.

Methodology And Software Used:

ARC GIS 9.3 is the software used for the analysis of demographic characteristics of the study area and for the image processing ERDAS 9.1 software has been used.

- ❖ The first step had been incorporated include collection of data including LANDSAT Imagery, Survey of India Toposheet and Guide map Census data.
- ❖ Then followed by Georeferencing the Guide map with the already reference LANDSAT data in UTM grid system, WGS 84.
- ❖ Creation of polygon then consisting of the ward map of Delhi city and creating ward attribute table.
- ❖ Preparation of socio- economic database in Excel and then converting the same into a common database file.
- ❖ Joining of the attribute table and the database file.
- ❖ Creation of land use and other thematic maps.
- ❖ Creation of map based on creation queries.
- ❖ Creation of diagrams and charts in excel.
- ❖ Generation of the Report.

The flow chart showing the methodology is shown in following figure.

Result And Discussion:

1. Population Distribution:

Population distribution reveals that in the central and southern part of the city. Concentration of population is high which gradually decreases as the distance increases from the city core area. Highest population is observed in ward no. 65,97 and 37 whereas

the lowest number of persons are found in NDMC wards.

2. Population Density:

Population density is known as a man –land ratio. It is one of the variables that influences the urban socio-economic as well as infrastructure development. Average population density of Delhi city region is 9,340 persons per sq. km. The highest population density is observed in Chandani Chowck and Bazar Sitaram wards (1494&2386 persons per hectare respectively where as the lowest population density is observed in wards 102 with 2.74 persons per hectare. Concentration of migrants and small scale industries are the major factors for the high density.

3. Distribution of 0-6 population:

The total child population aged 0-6, within the Delhi region is 1899136 which is 14.40% of the total population. The concentration of 0-6 population is high in north western and north eastern wards. Wards nos. 38, 65, & 87 have highest 0-6 population ranges from 31000 to 46000, while in the western and across Yamuna river region, it ranges from 16000 to 31000. In the remaining area 0-6 population is less than 16000.

4. Distribution of Male- female population:

According to 2001 census, the total population of Delhi region is Out of which male population consists of 48% while female share is 45.12%. Highest female concentration of 48% is observed in ward no. 9 (greater Kailash), whereas the lowest female concentration of 40% is observed in both ward no.5(Jagnapura) & Delhi cantt.

5. Social characteristics of population:

To examine the social status of the city, two variables namely literacy and caste structure have been considered.

i)Sex Ratio: Sex ratio is the indicator of the social upliftment of the society. In the study region, the average sex ratio is 803 which is lesser than sex ratio of India(933).Defence colony (933), Greater Kailash (933), Tilak Nagar (945) and Nagalrai (910) are the wards where sex ratio is lowest ranging from 900 to 1000 female per 1000 male. It is noted that these are the areas where the upper middle class & Panjabi communities are residing. Srinivas (6910 & Pratap Nagar (669) are the wards where sex ratio is highest. In the study region, sex ratio ranges between 600 and 700 in 2.08 % of total area, between 700 and 800 in 5.5% of the total area and between 800 and 900 in the remaining areas as shown in Table.

ii)Distribution of SC/ST Population: SC and ST constitute a considerable proportion of Indian urban population (15.35%) as shown in map. These people are considered to be socio-economically weakest sections of the society. In Delhi region, total No. of SC population is 22, 39, 883 which is about 17.02% of total population. The distribution of SC population in the region. The highest SC population of 65% is in ward no. 130 (Dev Nagar) and lowest of 4.3% in ward no. 20(Subhash nagar).According to 2001 Census, no data about ST population is available.

iii)Literacy: According to 2001 Census, the total literacy of the study region is 71.04% which is higher than literacy rate of India. Out of total literacy of the Delhi region male literacy is 65% and the female is 35%. In terms of percent of literates to the population of the city the highest percentage of literates (68% to 88%) is observed in central part of NDMC, DC, Shadara, Karolbag and western district, whereas in Narela, Chaterpur, Sangmvihar< Baderpur, Deoli, Kanjawala, Burarinandnagari literacy rate is less than 48% which lowest in the region.

The male-female literacy of Delhi in 2001 revealed that the male literacy is higher than the female literacy like other parts of the country. In an average, 62.99% males are literates while percent share of female literacy is 37.11%. The highest male literacy is observed in ward no. 66(72.74%), whereas the highest percent of female of 46. 77has been noticed in ward no. 9.

In the study region, the total percentage of illiteracy is 29.96, out of which male consists of 45.675 while 54.32% of females are still illiterate.

iv) Work Participation: The total work population of Delhi region is 4317580 out of which male participation rate is 87.20% and female participation rate is 12.80%. The total no. of main workers is more than 94.30% of total working population in all the wards, whereas the percentage of marginal workers is negligible. The highest working population of 42.23% is observed in ward no. 12 (Greater Kailash) whereas the lowest working population of 25.07% is observed in ward no. 91 (94.52%) and lowest in NDMC ward no. 5 (77.08%). The female work participation rate is highest in Seelampur i.e. NDMC ward no. 7 (25.82%) and lowest in ward no. 98 (6.02%).

Analysis:

In this section, an attempt has been made to find out socio-economic structure of population based on query builder using of Arc GIS. To find out the relationship between two variables, two different themes have been considered.

i) Literacy and work population: The map of literacy and working population reflects the inverse relationship between them. Ward nos. 7, 35, 37, 45, 54, 60, 81, 83, 86, 88, 90, 93, 95 and 104 are reflecting high percentage of literacy. (More than 60%) and low work participation (less than 30%).

ii) 0-6 Population and Female literacy: Kanjwala (ward no. 38.) Sangamvihar (ward no. 64.), Badarpur (ward no. 90) and Quarawal (ward no. 97) are the wards where 0-6 population is more than the female literacy is low. On the other hand, it can be said that female literacy is associated with the high rate of 0-6 population.

iii) Illiteracy and Working population: The map of illiteracy and working population reflects no relationship between illiteracy and working population. It is observed that in ward nos. 1 (Minto Road), 2 (Nizamudin), 8 (shrinivaspuri), 29 (Shakurpur), 66 (Harkesh Nagar), 105 (Adarsh Nagar), 114 (Civil Lines), 124 (Ramesh Nagar), 128 (Naraina), 131 (Qadam Sharif), and 134 (Ananda Parbat) the illiteracy is more than 30% and work participation rate is high.

iv) Population density and working population: Population density and working population have inverse relationship in the study region, where population density is less than 250 and work population is high (More than 30%). In other words, these areas belong to upper middle class social structure. The ward coming under this condition are ward nos. 1 (Minto Road), 2 (Nizamudin), 4 (Defence Colony), 5 (jangpura), 8 (Shrinivaspuri), 9 (Greater Kailash), 13 (hauszkhas), 14 (Gulmohar Park), 15 (r.K.Nagar), 16 (Vasanta Vihar), 55 (Bijwasan), 56 (mahipalpur), 59 (Sakat), 66 (Harkesh Nagar), 119 (Kamala Nagar), 127 (Rajendra NMagar), 129 (bidanpura), NDMC wards 1, 4 & 9 and Delhi cantt.

v) Status of women: To find out the status of women, two queries have been built. Ward no. 2 Nizamudin is the area where status of women is low with low female literacy (less than 35%) and low female working population (less than 15%). On the other hand, ward no. 26 (Paschim Vihar), 18 (Nangal Raya), 5 (janjpura), 4 (Defence colony), 12 & 9 (Greater Kailash I & II) and NDMC wards 7 & 8 are the wards where the status of women is high in terms of literacy (more than 60%) and working population (not less than 20%).

Summary And Conclusion:

❖ In the city region of Delhi, old Delhi and across Yamuna are the areas where population concentration is high because of concentration of labour migrants, Muslim community and small scale & cottage industries.

❖ Distribution of 0-6 has reveals more in western part of the Delhi city region.

❖ Number of households and population ratio indicate that in the Delhi city, the average family size is 5.0 persons per household that ultimately shows the integrity of family structure of the society.

❖ Karyawala, Sangam Vihar, Baderpur and Qurool Nagar are the areas where female literacy play a negative role for population explosion because these are the areas where 0-6 population is maximum as well as female literacy rate is low.

- ❖ Status of women in Delhi is not satisfactory level.
- ❖ Concentration of unskilled population is high in the study region.
- ❖ Female literacy percentage is very low as far as the metro city region is concerned.
- ❖ Female literacy and child population are inversely related.
- ❖ According to census2001,ST population is negligible while concentration of SC population is mostly observed in outer urban areas of the Delhi city region.
- ❖ In all, the demographic analysis of the study region stated that in Delhi, Process of urbanization has a complex in nature there is rurban characteristics are found not only in the outer areas but also city core.
- ❖ To improve the status of women some steps should be taken in the region, proper planning is essential fo the increasing population pressure of the city core area.

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