



# Urbanization and urban land use change: a study of Bhubaneswar city

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## Abstract

The term 'urban Morphology' refers to the study of a city's internal structure which includes the organization of residential buildings, the layout of roads and streets, and the arrangement of various urban spaces like community land, commercial zones, industrial area, open space, recreation areas etc. Morphology also refers to the internal structure of various land uses in urban areas. Land use is a function of land which denotes what is it used for. It is assigning use categories to land areas or allocation of land for specific purposes. Land use provides an understanding of the city structure and its characteristics. The objective of the paper is to study and analyse the changing morphology of Bhubaneswar, the Capital City of Odisha. The study is based on secondary source of data, collected from various sources like Census of India, Master Plan of Bhubaneswar, articles, reports, etc. The analysis is very much qualitative and descriptive in nature. Through this study it was found that area of Bhubaneswar has increased from 25sq km in 1951 to 135 sq km in 2011. In the land use plan during 1968-1988 and 1988-2001 the residential area and green belt zone covered maximum of the total area. In 2005, Bhubaneswar Municipal Corporation occupied an area of 135 sq km. The land use of BMC in 2005 shows that vacant land with 22.80% of the total area and residential areas with 21.85% of the total area dominated the rest of the land use category. And the agricultural land (12.45%) and vegetation/forest land (11.60%) occupied a considerable portion of the corporation area.

**Keywords:** urban morphology, land use, urbanization, census

## Introduction

The early twentieth century saw the emergence of urban morphology as a topic of study in Germany owing to the efforts of Schluter, Geisler, and Hassinger. It was brought to English speaking countries in the 1930s by M.R.G. Conzen but rose to significance when he began publishing work in the 1950s and 60s. In the early nineties, governments began to take a greater interest in the town area and strategies for town planning were made. The term 'urban Morphology' refers to the study of a city's internal structure which includes the organization of residential buildings, the layout of roads and streets, and the arrangement of various urban spaces like community land, commercial zones, industrial area, open space, recreation areas etc. According to R.E. Murphy (1996), morphological studies often deal with development of forms and patterns of the present city or other urban areas through time. The definition of urban morphology according to Bentley and Butina(1990:67) 'is an approach to studying and designing urban forms which considers both the physical and spatial component of the urban structure of blocks, streets, buildings and open spaces, all of which are considered as a part of the history/evolutionary process of development of the particular part of the city under consideration'. The morphology of any city is dynamic in nature. Definite zones for different urban functions are found in the city landscape. The urban morphology is determined by factors like climate, topography, history, economic and political development. It is assigning use categories to land areas or allocation of land for specific purposes. Land use provides an understanding of the city structure and its characteristics. Land use zoning specifies the kinds of activities that are permitted on the piece of land. The

zoning maps help for the understanding of adopted present and possible future references for conservation and development and therefore aid in decision making for such uses on a regional level. Land use planning is a multi-dimensional discipline derived from the complex inter-relationship of physical planning i.e. space, ecology i.e. existing systems of land and human systems of land use i.e. demographics, economic development, industrial, commercial, residential etc. and it is implemented through the legal system. Because of rapid urban growth, there is an increasing pressure on the land in and around urban centre. Due to shortage of land, it is required to assess and forecast the future requirement of land to accommodate urban growth. Therefore, it is essential to have an idea of spatial pattern and extent of land use in towns and cities.

In India different types of development plans are used which forms the basis of urban planning in the country. Land use planning in India is followed for all development purposes, as it involves assigning the particular activity to a given parcel of land. The master plan which governs the development of an urban area designates activities for land use in a particular area. Only the activities which comply with the given/ decided master plan are allowed to take place in that area. This is done to lessen the detrimental effects of various activities and to prevent conflict in activities on that piece of land. To lessen the detrimental effects on health, for instance, industries are not located close to residential areas. This management is also done using zoning which involves segregating different activities in different places. Land use planning in India is done by employing color codes in the development plans. Different colors are assigned in the development plan like a master plan

which indicates a particular land use. The colours specify different categories like residential, open space, recreational, commercial, transportation, industrial, public and semi-public areas on the map.

### Review of literature

Gupta (2014) <sup>[1]</sup> in his study on 'The pattern of urban land use changes: A case study of Indian cities' has focused on a set of three growing cities of India, Gurgaon, Ranchi and Jaipur for the analysis of land use/ land cover changes for the period of 25 years. Major findings shows that in Gurgaon 81% of area under agriculture was reduced to 26.5% from the period of 1971 to 2002 and was converted to commercial, residential, and other urban land uses. Whereas the built-up area increased from 8.96% to 66.44% due to impact of megacity Delhi leading to development of physical infrastructure. In Ranchi, area under crop and fallow land decreased from 77% in 1965 to 60.89% in 2004 as it was converted into built up area. The built up area increased from 11% to 33.89%. In Jaipur, crop land decreased from 280 sq.km in 1975 to 103 sq.km in 2009, fallow land decreased from 132 sq.km to 23 sq.km but the built up area increased from 46 sq.km to 197 sq.km. Hence, the ongoing development of the three cities is not well planned.

Kumar & Kumar (2012) <sup>[3]</sup> in their study on 'Monitoring urban expansion and land use/land cover changes in Rohtak city using remote sensing and GIS technique' have aimed at identifying changes taking place in the land use/ land cover pattern due to urban expansion of Rohtak city between 1973-2011. Major findings show that in 1973, agricultural area was the dominant land use category occupying 37.12% of the study area followed by bare land (24.45%) and built up area (11.46%). In 2011, built up area increased to 57.18% followed by bare land (12.93%), vegetation cover (10.21%) and agricultural land (8.29%). Higher increase in the built up area is due to conversion of vacant land to residential and commercial areas.

Bhat *et al.* (2017) <sup>[3]</sup> in their study on 'Urban sprawl and its impact on land use/ land cover dynamics of Dehradun city, India' attempted to monitor land use/ land cover of Dehradun city over a period of 2004 to 2014 for change detection analysis and to assess urban sprawl. Major findings shows that, over the period of 2004 to 2014, the urban and built up area has increased from 27.16 sq.km to 34 sq.km whereas agricultural land decreased from 25.45sq.km to 17.65sq.km. The urban sprawl increased in this period in and around the city as 6.13 sq.km of agricultural land, fallow land and vacant land has been lost to built up land.

Singh & Singh (2014) <sup>[9]</sup> in their study on 'Land use/land cover change of Delhi: A study using remote sensing and GIS techniques' analysed the status of land use/land cover of Delhi between 1992 and 2004 to detect land use changes using GIS and remote sensing data. The National Capital Territory of Delhi is an area of about 1483 sq km situated between the Himalayas and Aravali range. Data was collected from the LANDSAT TM 1992, IRS P6 LISS III 2004 and Census of India. The remote sensing and GIS data were handled with the help of Erdas Imagine 8.7 and Arc GIS 9.3 respectively. Major

findings shows that over the period from 1992 to 2004, residential area increased from 26.74% to 38.95%, commercial areas increased from 0.26% to 0.35% and open space increased from 2.37% to 3.72%. Whereas there is a decline in agricultural area and areas for parks and zoos from 44.89% to 36.93% and 1.11% to 0.96% respectively. Due to urbanization and increasing trend towards urban migration for employment and other development opportunity the region is growing in an unplanned way.

Acharya & Nangia (2004) <sup>[4]</sup> in their study on 'Population growth and changing land use pattern in Mumbai Metropolitan Region of India' have attempted to show the effect of population growth on land uses in Mumbai Metropolitan Region. Mumbai Metropolitan Region is the largest metropolitan region in India. Its administrative region includes entire district of Greater Mumbai and parts of Thane and Raigad districts. The data is obtained from the Regional Draft Plan of Mumbai Metropolitan Region (1971-91 & 1996-2011) and Census of India. Square graph technique is used to calculate the area of different land categories and simple GIS techniques is used to determine land use changes. Major findings shows that, the population in the region increased from 7.7million in 1971 to 18.3 million in 2001, due to which the total built up and industrial area increased from 4.9% in 1971 to 12% 1991 of the total area. On the other hand, during the period of 1971-91 area under forest cover declined from 30% to 27% and agricultural land decreased from 54.4% to 37.5%.

Kumar & Rathore (2016) <sup>[5]</sup> in their study on 'Urban spatial growth and land use change detection analysis of Aligarh city, Uttar Pradesh, India using high resolution remote sensing data, GIS and GPS techniques' have attempted to analyse the temporal urban growth and land use change of Aligarh city. Aligarh city located in the central region of the state of Uttar Pradesh is a historical city. Data for the study has been collected from the Survey of India topographical maps, guide map of Aligarh city; IKONOS satellite (Google Earth) and field study. Arc GIS software 10.1 and GPS mobile mapper 10.0 are used for processing of image and map layout. Major findings shows that over the period of 1971 to 2014, built up area increased from 47.13% to 87.49%, industrial area increased from 0.23% to 1.79%, open space and plantation area decreased from 50.87% to 3.39% and 1.75% to 0.77% respectively. The city growth was mainly towards the south and south west.

Hashem & Balakrishnan (2015) <sup>[5]</sup> in their study on 'Change analysis of land use/ land cover and modelling urban growth in Greater Doha, Qatar' have analysed the land use/ land cover change and its spatio-temporal pattern in Greater Doha in the years 1997 and 2010. Qatar is a peninsula located along the west coast of the Arabian Gulf. Greater Doha is a metropolis area made up of a number of adjacent cities and urban areas, where the majority of the country's population concentrated. Data was collected from census, national GISnet, aerial photographs and field visits. Markov model available in IDRISI software was used to analyse land use changes. Major findings shows that over the period of 1997 and 2010, open spaces have reduced from 76.81% to 25.3% to meet the fast

growing development demands, built up area increased from 10.12% to 39.40%, recreational area increased from 1.73% to 9.20% which shows a planning attitude towards improving living standard and farm area increased from 0.73% to 1.30% which shows improved attempt for food security.

Talukdar (2018) <sup>[10]</sup> in his study on 'Impact of urban growth on land use: A case study of Guwahati city, Assam' have analysed the land use/ land cover of Guwahati city from 1976 to 2016. The study area encompasses the southern part of the Greater Guwahati Municipality in Kamrup district of Assam, measuring about 179.76 sq km. Data was collected from IRS satellite imagery 2006 & 2016, Google Earth imagery and Survey of India toposheets no. 78N/2. Arc GIS 10.4 software was used to prepare land use maps. Major findings shows that over the period of 1972 to 2016, built up area increased from 22.93% to 61.32%, open space declined from 39.87% to 17.74%, forest area reduced from 32.19% to 18.91% and water bodies reduced from 5.01% to 2.03%. Built up area increased at the cost of decreasing open land, forest area and water bodies.

### Significance of the study

From the above review it was found that no study has been done about the comparative analysis of land use of the city Bhubaneswar, Odisha. Since the land use of the city is changing with the rapid growth of population which is due to migration, it is imperative to study the changes in the land use pattern that has happened over the years.

### Operational definition of keywords

**Urban morphology-** It refers to the study of the physical and spatial characteristics of urban areas. This includes the layout of streets and buildings, the distribution of land uses and the patterns of social and economic activity within urban areas.

**Land use-** The term is used to describe the human use of land. It represents the economic and cultural activities (e.g., agricultural, residential, industrial, mining and recreational uses etc.) that are practiced at a given place.

**Urbanization-** The term "urbanization" implies the rise in the population residing in towns and cities. It occurs because population shift or migration from rural to urban areas.

**Census-** The population of a country, state, or other geographic area is counted during a census. It is the entire process of gathering, organizing, evaluating, and sharing social, economic, and demographic data relevant to every person living in a nation or a precisely defined region of a nation at a certain point in time.

### Objectives of the study

The present study addresses the following major objectives:

1. To study urban land use and analysing changing morphology of the Bhubaneswar city by comparing Master Plans of 1968-1988 and 1988- 2001.
2. To study the land use plan of Bhubaneswar Municipal Corporation in 2005.
3. To find out the nature of urban sprawl and unplanned growth of Bhubaneswar city.

### Methodology

The present study is based on descriptive survey design. The secondary data has been collected from various sources like Census of India, Master Plan of Bhubaneswar, articles, reports, etc. The analysis is very much qualitative in nature however statistical techniques like frequency, percentage and graphical analysis has been adopted in analysing the data and information.

### Study area

The present study focuses on changing morphology with special reference to the Capital City of Odisha. The Capital City of Odisha, Bhubaneswar has derived its name from 'Tribhubaneswara' or 'Bhubaneswara', which means the Lord of the Earth (a name of Lord Shiva, the deity of the Lingaraja Temple). It is also known as the "Temple city" of India. Bhubaneswar together with Puri and Konark, forms the "Golden Triangle". This city is known all over the country as a historical, cultural, religious and tourist centre, having a large number of ancient temples, distinguished in indigenous sculpture, art and architecture.

The city was designed by the German Architect Otto Koenigsberger in 1946. It was one of India's post independence planned cities. Bhubaneswar, the capital city of Odisha, which was originally planned for 40,000 people in 1948 with an area of 16.48 km<sup>2</sup> with a density of 10 to 12 families per ac, has grown to about 135 km<sup>2</sup> with a population of 837,737. The town plan is based on the concept of neighbourhood planning. Due to rapid urbanization which led to increase in the population, city grew faster and the intervening areas were filled up quickly. Today the "New Capital" with distinct land use and a well laid out road network, presents a sharp contrast to the Old Town, which developed organically with its temples and tanks, and existed adjacent to the city. The city occupies a central location between two metropolises, i.e. Kolkata and Vishakhapatnam along the south-east railway line and national highway (NH 16) of the country.

**Table 1:** Population, decadal growth and density of Bhubaneswar, 1951-2011

Census Year	Population	Decadal Growth (percent)	Area (in sq. km.)	Rise in Area (per cent)	Density	Rise in Density (per cent)
1951	16512	-	25.9	-	638	-
1961	38211	131.41	50.25	94.0	760	19.1
1971	105491	176.07	65.03	29.4	1622	113.4
1981	219211	107.8	92.92	42.8	2359	45.4
1991	411542	87.74	124.74	34.2	3299	39.8
2001	648032	57.46	135	8.2	4800	45.49
2011	837737	29.27	135	0	6205	29.27

**Source:** City Development Plan Report (2010) of Bhubaneswar Development Plan Area, Odisha and Census of India, 2011

As per the Table 4, total population of Bhubaneswar was only 16,512 in 1951 and increased to 38,211 in 1961 within a decade. The city witnessed the highest increase of population of about 176 percent during the decade 1961-1971, owing to the shifting of the Capital City of the State from Cuttack to Bhubaneswar during the year 1949. The growth rate is highest in all the three

decades (1961-81) in the state and among the cities constructed after independence of the country. Bhubaneswar got a very high growth rate of population since 1961 due to the migration from all parts of the state to the capital in search of jobs and better education.

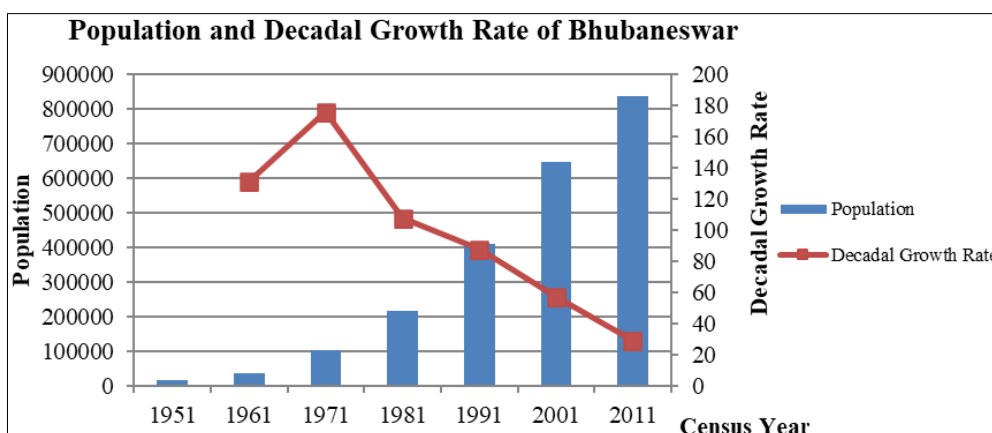


Fig 1: Population and Decadal Growth Rate of Bhubaneswar

**Land use analysis of Bhubaneswar city 1968 -1988**

The first plan for the Bhubaneswar city was prepared during the year 1968 with a plan period of 20 years (1968-1988). The town planning organization of Odisha suggested seven functional zones for Bhubaneswar with specific land uses, that

is, residential, commercial, industrial, public & semi-public, open spaces, green belt and transportation. This land use distribution was originally suggested by the German Architect Dr. Otto H. Koenigsberger.

Table 2: Land Use Pattern of Bhubaneswar (1968-1988)

SI No.	Land use/zone	Area in hectares	Percentage to total area
1	Residential	2206	22.92
2	Commercial	262	2.72
3	Industrial	481	5.00
4	Public & semi-public	1274	13.24
5	Open space	1392	14.46
6	Green belt	1880	19.55
7	Transport	1482	15.40
8	Others	645	6.71
	Total	9622	100.00

Source: Master plan 1968, Bhubaneswar Development Authority

During the years 1968-1988, in Bhubaneswar the major land use category that dominated all others was residential area (22.92%) followed by green belt zone (19.55%), transport (15.40%), open space area (14.46%) and public and semi-public area (13.24%). The commercial area and industrial area occupied 2.72% and 5% respectively. The residential area dominated all other land use category due to the growing demand for settlement after the shift of capital city from Cuttack to Bhubaneswar in 1949.

**Land use of Bhubaneswar (1988- 2001)**

Due to the increasing population and the changing socio-economic status of the city, there-examination, evaluation and modification of the Master Plan of 1968 was inevitable. Hence in 1993 an improved Comprehensive Development Plan (CDP), prepared by Bhubaneswar Development Authority came into force. The C.D.P. for Bhubaneswar proposed was for [www.dzarc.com/education](http://www.dzarc.com/education)

the time period of 1988-2001 specifying the various land use zones with a set up zoning regulations for regulating all the development in zones.

Table 3: Land Use Pattern of Bhubaneswar (1988-2001)

SI no.	Land use	Area in hectares	Percentage of land use
1	Residential	7540	32.3
2	Commercial	494	2.11
3	Industrial	586	2.51
4	Institutional	1001	4.28
5	Open space	1377	5.9
6	Transport	1891	8.10
7	Water Bodies	3641	15.6
8	Green belt	6815	29.2
	Total	23345	100.00

Source: Comprehensive development plan, 1988-2001; Bhubaneswar development authority

As the city began to grow, the population also increased rapidly. The total geographical area of the Bhubaneswar city was 23345 hect (i.e. 233.45 Sqkms). Hence, during the year 1988-2001, residential area dominated all other land use

category by 32.3% followed by green belt area (29.2%), water bodies (15.6%), transport (8.10%), open space (5.9%) and institutional area (4.28%). The commercial area and industrial area occupied 2.11% and 2.51% respectively of the total area.

**Table 4:** Comparison of the land use growth (1968-1988) & (1988-2001)

Sl no.	Land use	Percentage of land use		Growth percentage
		1968-1988	1988-2001	
1	Residential	22.92	32.3	40.92
2	Commercial	2.72	2.11	-22.42
3	Industrial	5.00	2.51	-49.8
4	Institutional/public & semi-public	13.24	4.28	-67.67
5	Open space	14.46	5.9	-59.19
6	Transport	15.40	8.10	-47.40
7	Green belt	19.55	29.2	49.36

*Source:* Calculated by author

From the above table it can be summarized that, there is approximately 50% and 41% growth in the green belt area and residential areas respectively. There is a sharp decrease in the area occupied by institutional/ public and semi-public and open spaces dropping to 67% and 60% respectively over the years. There is also 50% decrease in the area occupied by the industries. Transport and commercial areas also decreased to 47% and 22% respectively.

#### Land use of Bhubaneswar Municipal Corporation (BMC), 2005

Bhubaneswar in the year 1948 was declared as a Notified Area Committee, Municipality in the year 1979, then finally to a corporation in the year 1994. Bhubaneswar Municipal Corporation or BMC is the local urban governing body of the city Bhubaneswar. In the year 2005, the Bhubaneswar Municipal Corporation (BMC) covered an area of 135 sq km.

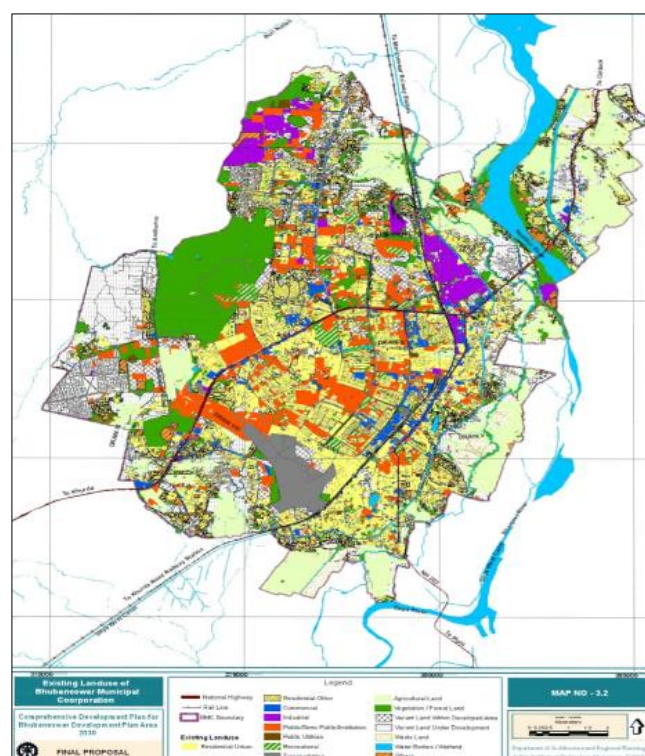
**Table 5:** Land use of Bhubaneswar Municipal Corporation (2005)

Sl no	Land use	Area sq.km	Percentage
1	Residential	29.5	21.85
2	Commercial	2.3	1.71
3	Industrial	3.24	2.40
4	Traffic and transportation	11.88	8.80
5	Public/semi-public/institution	10.1	7.46
6	Utility & services	0.72	0.54
7	Recreational	2.51	1.86
8	Vacant land	30.78	22.80
9	Agricultural land	16.8	12.45
10	Vegetation/forest land	15.66	11.60
11	Waste land	5.86	4.34
12	Water bodies/ wet land	3.4	2.52
13	Others	2.25	1.67
	Total	135	100

*Source:* Odisha Space Application Centre (ORSAC) 2008; City Development Plan Report 2010

During the year 2005, the land use category that dominated was vacant land with 22.80% followed by residential zone with 21.85% of the total area. The other major land use category was agricultural areas with 12.45%, vegetation/ forest land with

11.60%, traffic and transportation with 8.80% and public/semi-public/institution with 7.46% of the total area. The agricultural area occupying 12.45% of total area, caters to the needs and demands of the population. The commercial areas occupying 1.71% are confined within the planned units. The market complex in Unit-1 and Unit-2 comprises of daily and weekly markets are considered to be the main shopping centre of the city. Industrial and recreational areas only occupy 2.40% and 1.86% of the total area respectively. Utility and services occupies only 0.54% of the total area. Water bodies/ wet land and waste land occupies 2.52% and 4.34% respectively.



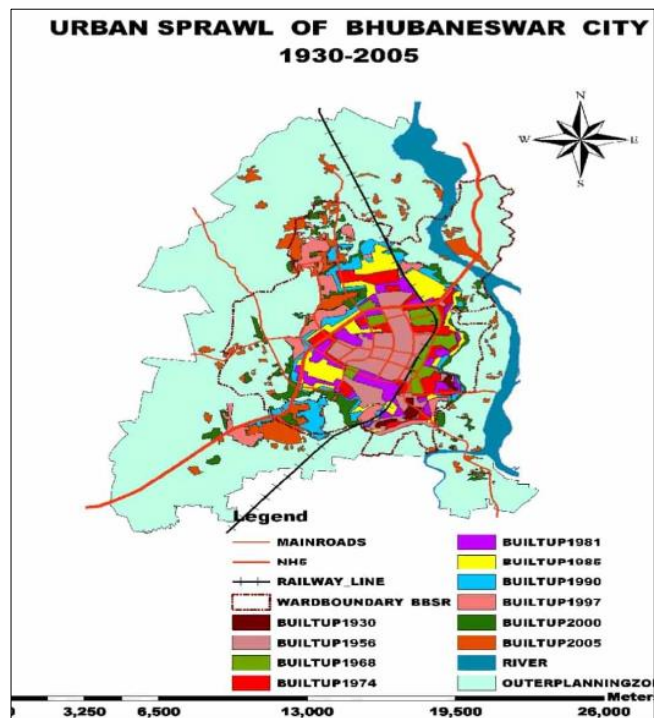
*Source:* Bhubaneswar Municipal Corporation (BMC), 2010

**Fig 2:** Land Use of Bhubaneswar Municipal Corporation, 2005

#### Urban sprawl of Bhubaneswar City

As the size of the city of Bhubaneswar is increasing rapidly, it's land use has shown a tremendous rise in the built-up-form

from agricultural area, vegetation and vacant land over a period from 1930-2005. The city today has its centre at the core areas. The city initially evolved in rectangular shape on a grid iron pattern outward from the centre. Growth of the city is largely towards north, northwest and southwest direction along the main transport routes. There is no growth towards east and south-east due to the location of the flood plains of Kuakhai and Daya River.



Source: City Development Plan Report (2010)

Fig 3: Urban Sprawl of Bhubaneswar City, 1930-2005

### Major findings of the study

- In the capital city of Odisha, there is an increase in the population from 16,512 in 1951 to 837,737 in 2011. In the years 1961, 1971 and 1981 the increase in the population was maximum.
- The decadal population growth rate was 176.07% - the highest during the year 1961-1971. This is because of the shift of the capital city from Cuttack to Bhubaneswar. The density also increased from 638 persons per sqkm in 1951 to 6205 persons per sqkm in 2011.
- The very high growth rate of population in Bhubaneswar since 1961 is due to migration from all parts of the state to the capital city in search of jobs and better education.
- The area of Bhubaneswar has also increased from 25sq km in 1951 to 135 sq km in 2011.
- The land use of Bhubaneswar has changed over the years with increasing population. During 1968-1988 the total area of Bhubaneswar was 9622 hectares. The land use plan of 1968 shows that, residential area and green belt zone covered maximum of the total area, with 22.92% and 19.55% respectively.
- During 1988-2001 the total area of Bhubaneswar was 23345 hectares. The land use plan of 1988 again shows the residential zone and green belt zone dominated the rest of

the land use category with 32.3% and 29.2% respectively.

- After comparing both of the land use plan it was found that the growth percentage of the green belt zone (49.36%) was higher than the residential zone (40.92%). The areas occupied by institutions, open space, industries and transportation have decreased considerably.
- In 2005, Bhubaneswar Municipal Corporation occupied an area of 135 sq km. The land use of BMC in 2005 shows that vacant land with 22.80% of the total area and residential areas with 21.85% of the total area dominated the rest of the land use category. And the agricultural land (12.45%) and vegetation/forest land (11.60%) occupied a considerable portion of the corporation area.

### Conclusion

From this study it can be concluded that like many cities in India, the city of Bhubaneswar in Odisha has expanded rapidly due to urbanization. The land use has being constantly changed to accommodate the rapid population growth due to migration from the rural areas. Hence the percentage of residential areas has dominated the land use category. Besides, with rapid urbanization the city also faces the challenge of the growth of slums and problems associated with it. So, the authorities should take appropriate measures so that the city could develop holistically and land use plans should be made in such a way so as to cater the needs of the rapidly growing population.

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