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Impact of Urbanization on Landuse/Landcover Change in Old Cuttack and Sikharpur Zone of Cuttack Municipal Corporation

Sushmita Biswal[1], Santosh Kumar[2], Rohan Dhal[3]
[1]*M. plan Student,* [2]*Assistant Professor,* [3]*Lecturer, Odisha University of Technology and Research, Bhubaneswar*

Abstract:

- ***Land use mapping is fundamental for assessment, managing and protection of natural resources of a region .***
- ***The information on the existing land use is one of the prime pre-requisites for suggesting better use of terrain.***
- ***Land use maps are valuable tools for agricultural and natural resources studies. , With the growth of population and socio-economic activities, natural land cover is being modified for various development purposes.***
- ***Land use mapping is an important tool for land management and monitoring.***
- ***The rapid expansion of urban areas due to rise in population and economic growth is increasing additional demand on natural resources thereby causing land-use changes especially in megacities.***
- ***Therefore, serious problems associated with rapid development such as additional infrastructure, informal settlements, environmental pollution, destruction of ecological structure and scarcity of natural resources has been studied carefully using remote sensing and GIS technologies for a rapidly grown city .***

Keywords: GIS, Land use/land cover, Remote Sensing, Urbanization.

I. INTRODUCTION

1) Urbanization is a serious issue in present scenario because of rapid urbanization we are facing haphazard and unplanned growth of the town.
2) The populations have limited facilities which results in collapsing the physical and social infrastructure of the city.
3) In this study we detect the impact of urbanization on land use and land cover change of old Cuttack and sikharpur zone of CMC for last four decades (1993 – 2023) have been observed using land sat data
4) Remote sensing is an effective and economic means to collect the data and to monitor the changes occurring in land use categories. LANDSAT imageries provide up to date land use land cover information at small scale at reasonably low cost and with better accuracy.
5) It shows the major potential areas for new development and growth pattern of cities. Activity mapping of area helps to know the types of activities such as commercial, residential and industrial activity of the zone.

The importance of land use analysis is numerous some of them are

a) For proper planning and developing the land Use.
b) For regular monitoring of the resources.
c) Interpret land use from remotely sensed imagery.
d) Establish hierarchical categories by grouping similar or related uses.
e) Use a uniform point sampling technique for tabulating for large areas

II. STUDY AREA

Cuttack is the focal point of all the major activities in Odisha. The study area is one of the potential zones in terms of commercial hub. Moreover, rapid urbanization has created blight and serious congestion problems as increasing pressure due to migration of people to the city for employment. The old pattern is organic with narrow streets and lanes which are inadequate for the increasing vehicular traffic. The two zones have geographical area around 54.9 sq km ,

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The zone are surrounded by kathajodi and Mahanadi River

1) STUDY AREA is divided into 2 planning zones i.e. old Cuttack and Sikharpur zone of CMC.
2) As per the 2011 census, the population of study area is 4,17,650 , The decadal growth rate of the study area is @ 17.89%.
3) Both horizontal and vertical growth of the city is observed during the recent years, however, the horizontal growth is restricted by the rivers Mahanadi and Kathajodi.
4) The study area covers an area of 54.9 sq km. with a population above 4,17,650 . It includes road coverage of 383 km. with numerous drains of about 729 km.
5) The study area have Slums - 94 no.s
6) From Bhubaneswar it is 25 Kms through the N.H.5. Buses and trains connect many major and small town and other states.

A. List Of Planning Zones of CDPA

1) Nirgundi (Zone No. 1)
2) Charbatia (Zone No. 2)
3) Chhatisa (Zone No. 3)
4) Choudwar (Zone No. 4)
5) Nimapur (Zone No. 5)
6) Bidanasi (Zone No. 6)
7) Old Cuttack (Zone No. 7)
8) Sikharpur (Zone No.8)
9) Mundali (Zone No.9)
10) Barang (Zone No. 10)
11) Gopalpur (Zone No. 11)

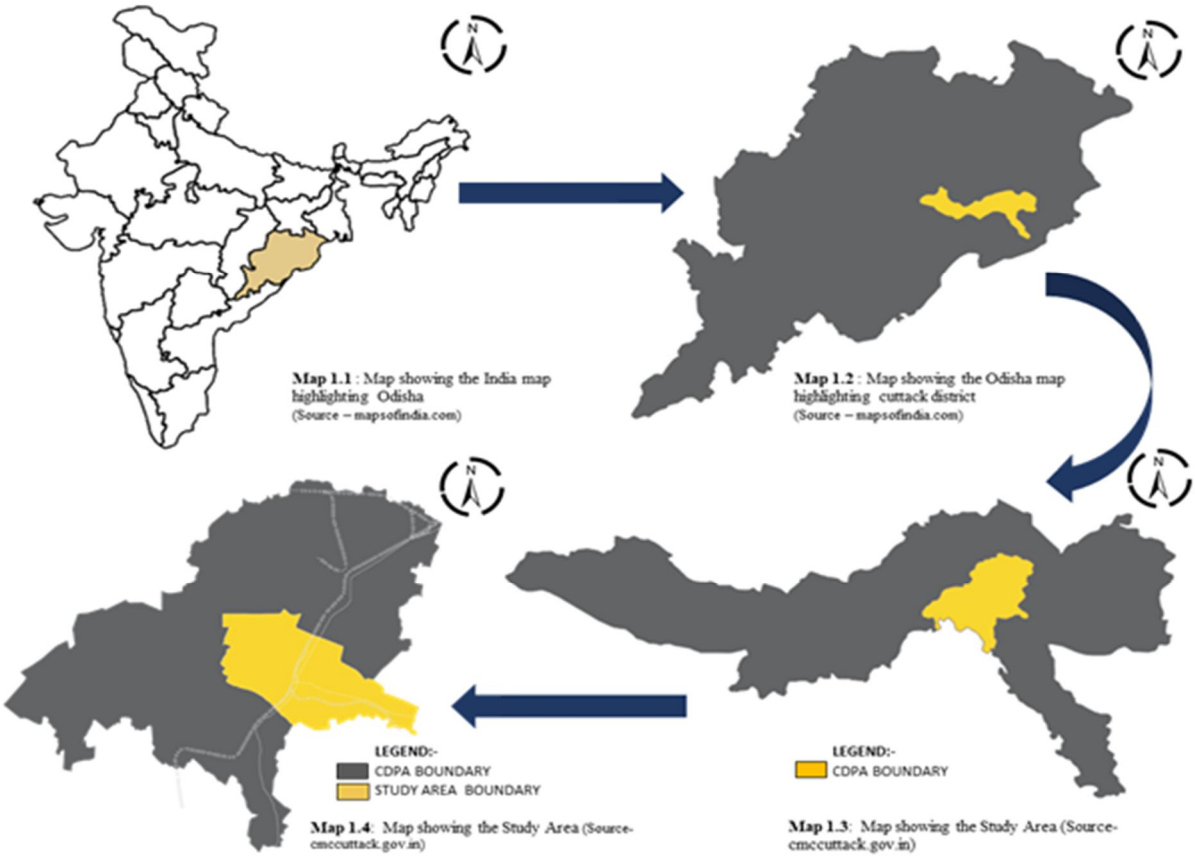


Figure 1: Location map of study area

III.OBJECTIVE

1) To identify major land cover change in the study area , where the land changes from non built up area to built up area during 1993, 2003, 2013 and 2023.
2) To predict the LULC of the study area for next four decades .
3) To analysis the impact of urbanization on growth pattern and expansion of old Cuttack and Sikharpur zone of CMC.
4) To analysis the issue cause by population growth at core urban centre and suggest for local economical development.

IV.DATABASE

The data collection involved collection of demographic details, zone maps, toposheets and satellite data . The nature of these data and their sources are as follows:-

Table 1: Primary and Secondary Data details of the study area

Old Cuttack and Sikharpur zone	Sources
Toposheets	Survey of india , scale 1:25000
Satellite imagery (landsat)	Global land cover facility (GLCF)
Demographic details from primarycensus	Census of india
All secondary data	CDP Report of cuttack
Zone map and administrative boundary	CMC and CDA

V. METHODOLOGY

Application of geo spatial technology have been identified and used to monitor / detect land use/ land cover changes using ERDAS and Arc GIS Software.

A. Data Collection and Pre processing

Remote sensing data collected from USGS website, the remote sensed data are used to delineate the spatio temporal changes of land use and Land cover prepared in GIS. Pre processing has involved scanning, geo referencing and digitization of survey of India

B. Image Classification

The classification of land use and land cover was categorized unto six major classes such as agriculture land, vegetation, vacant land, built up area (Residential, Commercial, Industrial, Public and Semi-public), water bodies, and open space.
Field work is also taken out to understand the existing land use/land cover change of study area using GPS survey and photographs.

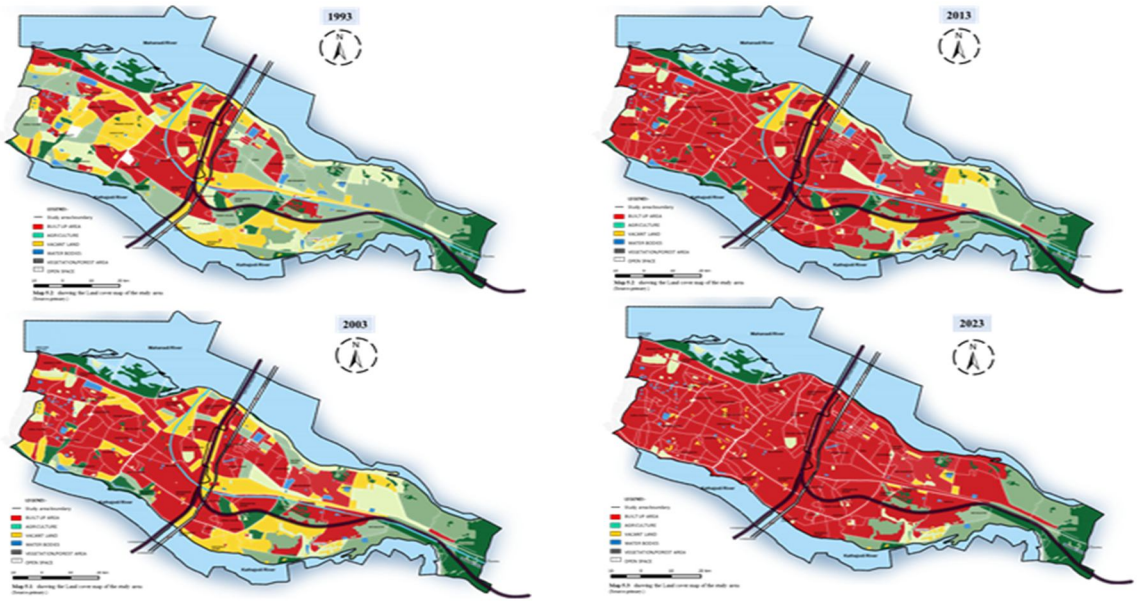


Figure 2: land sat imageries of the study area: (a) 1993 (b) 2003 (c) 2013 (d) 2023

C. Analytical Framework

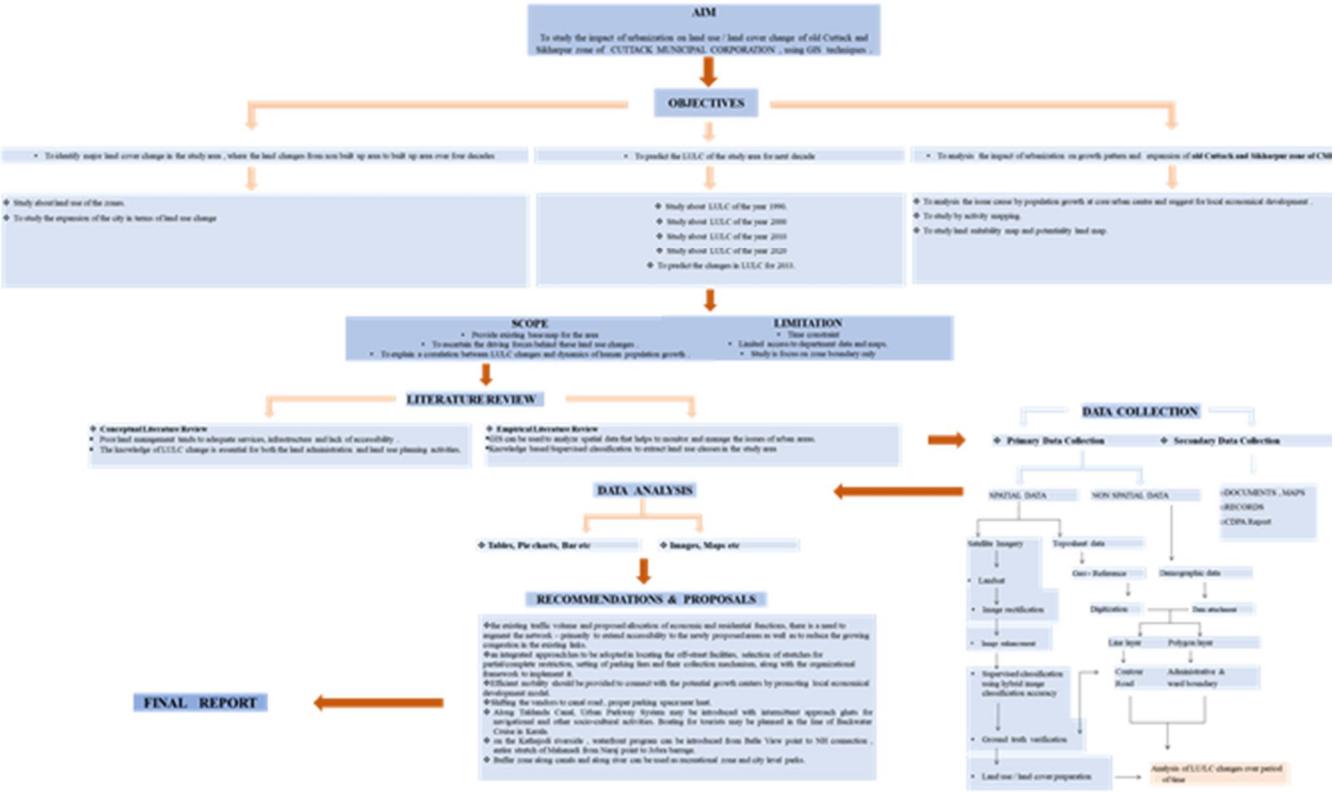


Figure 3: Flowchart of Methodology

D. Change in land use /Land cover

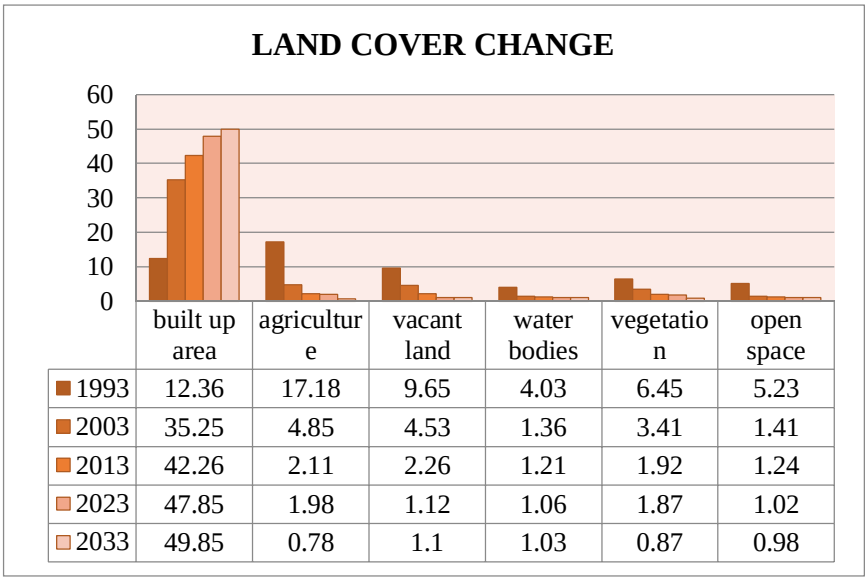
1) The broad land cover map of the study area reveals that the density of BUILT UP urban areas exist only in older part of Cuttack , with built concentration getting thinned down along the transport corridors .

2) Highest built up growth was observed in old Cuttack zone.

3) The urban expansion has also taken place in all directions but more extensively in the eastern and western directions as it has more potential for development because of Cuttack – paradeep rail line and link road for east-west connectivity .

Table 2: details of land use/land cover change between four decades of the study area

LANDUSE CATEGORY	AREA 1993	AREA 1993	AREA 2023	AREA 2023	Change (1993-2023)	Change (1993-2023)	INFERENCE
	in sq. km	in percent	in sq. km	in percent	in sq. km	in percent	The negative value in built up area depicts the higher per capita land consumption and the **city is expanded physically with high rate of expansion i.e. 66.16 % .**
Agriculture	17.18	31.29%	1.98	3.66%	15.2	27.63 %	
Built up area	12.36	22.51%	47.85	88.67%	-35.49	66.16 %	
Vacant land	9.65	17.57%	1.12	2.07%	8.53	15.5 %	
Vegetation/forest land	6.45	11.7%	1.87	3.46%	4.58	8.24 %	
Water body	4.03	7.34%	1.06	1.93%	2.97	5.41 %	
Open space	5.23	9.52%	1.02	1.89%	4.21	7.63 %	



	built up area	agriculture	vacant land	water bodies	vegetation	open space
1993	12.36	17.18	9.65	4.03	6.45	5.23
2003	35.25	4.85	4.53	1.36	3.41	1.41
2013	42.26	2.11	2.26	1.21	1.92	1.24
2023	47.85	1.98	1.12	1.06	1.87	1.02
2033	49.85	0.78	1.1	1.03	0.87	0.98

Figure 3 : Comparison between LULC changes in the study area

VI. RESULTS AND DISCUSSION

The study is focused land cover change of two planning zones of cmc i.e. old Cuttack and sikharpur .

The change in landcover is mainly due to mixed commercial and residential activities as a dominant feature in most parts of the planning region. The study shows huge reduction in agricultural land and decrease in water body. Except for the grid-road layout after the formation of the CDA and IDP 1964 there has been no guiding master plan ever during last few decades. Thus, the entire land use pattern of Cuttack Municipal Corporation presents an urban clutter. Commercial building exist side by side with residence. The largest share of 15.68% of STUDY area is occupied by waste area. The residential area having majority of houses in substandard condition occupies only 8.99%. Dense development has taken place in the central area around the main bus terminal. The eastern part of the CMC, excepting some development on Paradeep Road and Industrial Estate Complex, is occupied by hamlets, villages and agricultural land. Some part of the wholesale trade, especially the Malgodown area could be shifted elsewhere to bring about planned market development. Cuttack is the district's headquarter and all the district level offices are located here occupying 1.93% of total CMC area. Majority of the south-eastern part of CMC along the Kuakhai River is under agricultural land use occupying almost 5.80% of STUDY area.

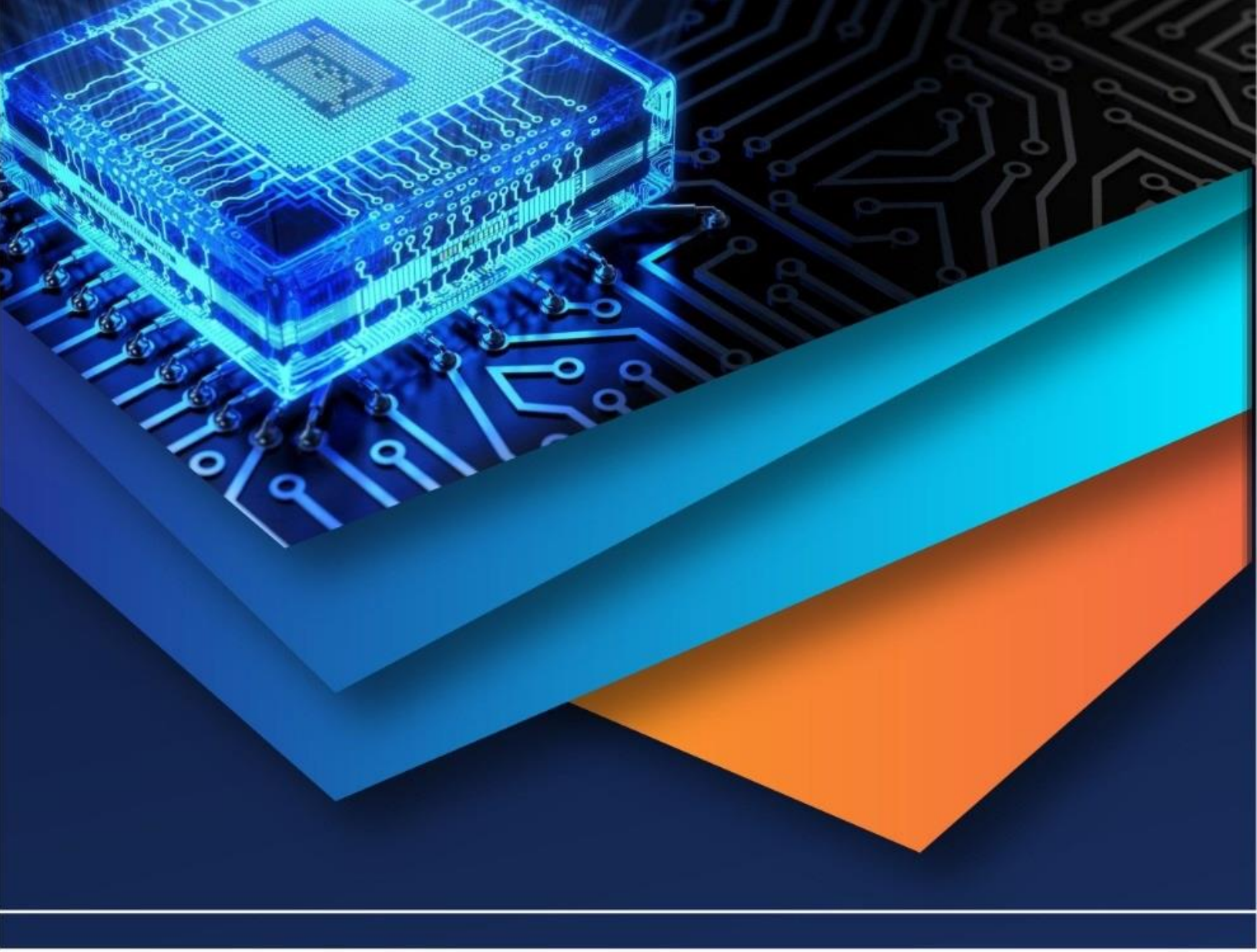
Table 3 : Table showing the Issues identified and recommendation for the problems in land use due to urbanization of the study area

Issues /problems identified in land use due to urbanization		Inference	Recommendations
Traffic congestion and hawkers	❖ Dolamundai is the main junction from which most of the traffic passes as it is connected to mahatab road , chattrabazazar , ranihat and badambadi road. ❖ Road that connect chattrabazar is mahatab road which is extremely crowded due to street vendors and the wholesale vendors residing on the sides of road and selling goods. ❖ On street parking at NH-5 stretch within the study area	❖ The road is responsible for the most of the traffic congestion because of vendors blocking the road ❖ No proper parking facilities for on street parking in front of commercial and public /semi public areas. ❖ Vendors also captured drainage area as there is no proper vending zones .	❖ the existing traffic volume and proposed allocation of economic and residential functions, there is a need to augment the network – primarily to extend accessibility to the newly proposed areas as well as to reduce the growing congestion in the existing links. ❖ an integrated approach has to be adopted in locating the off-street facilities, selection of stretches for partial/complete restriction, setting of parking fees and their collection mechanism, along with the organizational framework to implement it. ❖ Efficient mobility should be provided to connect with the potential growth centers by promoting local economical development model. ❖ Shifting the vendors to canal road , proper parking space near haat.

Due to mixed land use Irregular settlements Land suitability for developme nt	❖ Extended plinth a typicality of the houses in old cuttack which reduce the road width. ❖ Some of the areas have been transformed into the old city slums due to multiplication of household and lack of sanitation and maintenance .	❖ mixed commercial and residential activities as a dominant feature in most parts , along the major road. ❖ Dense development has taken place in the central city around the main bus terminal. ❖ The area near Kathajodi-Mahanadi flood plain is mostly alluvial in nature and unsuitable for large construction. The North western part of the Cuttack planning zone contains laterite soil, which is not very suitable for agriculture.	❖ Relocation of the wholesale commerce to Sikharpur due to its proximity to the eastern by-pass is likely to transform the Sikharpur zone into a 'commercial centre' of the CDPA. ❖ Provide adequate community facilities, services and utilities consistent with the future land use plan . ❖ FAR is mandatory in every new/redevelopment project within the influence zone. ❖ Norms should be followed for mixed use land, avoiding deviation in regulations.
Slum encroachm ent	❖ they unauthorized occupation of land, ❖ congested inner-city built up areas, fringe area unauthorized developments, ❖ slums within urban areas and in the periphery, irrespective of tenure or ownership of land	❖ Mainly the slums, along the Taldanda Canal, Malgodown areas and the riverfront areas of Old Cuttack, Sikharpur Zones are to be relocated.	❖ Special housing zone for rehabilitation of slums along taladanda canal and malgodown area and redensification to sikharpur area. ❖ Also the slums along the heritage areas near commercial zone and those occupying prime locations in study area need to be relocated. ❖ Alternative land has to be made available for relocation of these slums. The government can create a land bank for this purpose.
Lack of open space and recreational space Low lying areas	❖ The natural depressions and ponds, which were instrumental in preventing excess storm run-off, are getting filled up at a rapid rate due to urbanization. This may further aggravate the existing problem of water logging.	❖ Cuttack city is saucer-shaped in its geographical formation. In earlier times there were many ponds which use to retain & moderate storm water runoff into the drain. These ponds were eventually filled and became low lying areas such as shankarpur , badambadi and pithapur with little scope for natural drainage.	❖ Along Taldanda Canal, Urban Parkway System may be introduced with intermittent approach ghats for navigational and other socio-cultural activities. Boating for tourists may be planned in the line of Backwater Cruise in Kerala. ❖ on the Kathajodi riverside , waterfront program can be introduced from Belle View point to NH connection , entire stretch of Mahanadi from Naraj point to Jobra barrage. ❖ Buffer zone along canals and along river can be used as recreational zone and city level parks.

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