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Urban Sprawl and Property Taxation: A comparison for Jurisdiction of South Delhi Municipal Corporation

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ABSTRACT: In Present day, a universal challenge for any developing country is day by day growing population and sprawl of urban areas. To address this challenge, it is important to study growth of urban areas and identify it pattern of rapid and inadvertent urbanisation. Analysis of urban sprawl is important to regulate and plan infrastructure of any urban body in order to route the infrastructure in organised way. Growth of urban area is directly proportionate to increase in property and increase in population. Municipal corporation is responsible to facilitate any urban settlement in term of sanitization, basic education, health facilities, maintenance of public utilities etc. For any infrastructure development related to residential amenity, municipal body need spend a certain finance. Property tax is one of the major source of revenue for urban municipal bodies. This paper analysis of the urban growth of jurisdiction of South Delhi using geospatial techniques and its comparison of municipal revenue. High resolution satellite image of year 2012 and 2017 have been used for this study of urbanisation by creating land use and land cover data. For further study static of land use transformation has been created along with number of buildings for both of the year. Also comprehensive study has been done for the tax revenue generated and properties captured for the financial year of 2012 to 2017 to see the growth rate of urbanisation and tax revenue.

Keywords: Land Use/ Land Cover (LU/LC), spatial metrics, supervised classification, urban growth, urbanization, Property tax**.**

I. INTRODUCTION

Urbanization is an extensive phenomenon which have consequence impact on development. Rapid expansion of geographic extent of town, suburbs or metropolitan areas is commonly called as urban sprawl. Urban sprawl can be considering as a very powerful and visible anthropogenic force which is capable of changing urban landscape pattern, which cannot be control to slow down [1]. For analysis of current rate of urban growth, it is important to study spatial distribution and pattern of urban growth [2]. There are three major type of urban growth *i.e.* infill, expansion/ extension and outlying [3]. Infill identified as new constructions in existing built-up, Expansion is extending construction in existing building towards outside of building footprint and outlying is built up in non-developed area. It is also called as leap frog development. Urbanization is a process were multiple spreads or patches of manmade settlements shift to one urban infill [4].

As per Reports of United Nations [5], by 2030, Delhi will overtake Tokyo as world's largest city. Rapid growth of urbanization and population are resultant of each other. Process of Constant structural change, growth and enhancement in the cities also changes the relationship with our environment. Not to mention, due to this rapid changes Delhi is facing issues related to air and water pollution which is keep increasing due to lack environment management. Also there are many challenges related to housing, sanitization, waste disposal, Traffic congestion, securities, shortage of electricity and water etc. It is an alarming stage were planning of urbanization is very much required are over populated and to maintain the requirement, resources are exhausted. These issues are the affecting urban environment quality, directly impacting proficiency and productivity of people in the overall progress [6]. It is very much important to preserve and protect the areas which are environmentally sensitive. To Monitor changes in environment and manage natural resources, analysis of variation in land use and land cover is very important [7].

Property tax: Existence of taxation on property can be seen from ancient time. Through middle ages, Europe and Asia had taxes on lands which considered as public finance support which was significant source of revenue [8]. Land taxes was also part of the Mughal period, following that in 1901, during British India land tax was about 5% of GDP which was more than 50% of total tax revenue. Following the Government of India act 1935, this base collapsed. As per this act, Modern age taxation such as Income, Excise and Customs, will be

controlled by the Central (Crown) and property tax of respective state will be assigned to elected government of state. With changing trend of politics, the elected representative shows no interest in taxing local vote bank. By 1947, share of land tax value in total revenue fallen to 7%.

Property tax is a levy levied against a property's owner by the local government to cover the costs of maintaining the property. Property tax is one of the most important sources of revenue for a state or country in order to finance the costs of development. In order for local or municipal governments to grow, they need money, and without it, it was a difficulty. In addition, taxes can be used as an urban management instrument that can track land usage, urban expansion, the land market, and property transfers. The location of a property plays a significant role in property taxation, as the value of a unit is determined by its location. Many studies connected to property or urban management need the investigation or estimation of property location as a spatial feature of property.

Table 1: List of Obligatory taxes.

Obligatory Taxes
Property tax on buildings & vacant lands
Tax on vehicles and animals
Theatre tax
Tax on advertisements
Duty on transfer of property
Tax on building plans
Tax on boats
Tolls

The Delhi Municipal Corporation Act 1957 (DMC Act, sections 113 & 114) provide the list of obligatory taxes to be levied by the MCDs.

In Delhi, property taxes are calculated using the unit area approach. Self-assessment of property taxes has been in place since 2004. Since then, there has been a decline in the number of properties that can be assessed [9]. In addition, MCD only has information on properties that have paid their property taxes. The MCD is unaware of any properties that have never paid taxes.

Urbanisation vs Property Tax. Urbanization is directly proportionate to urban population. Also with rise of urban population, there is declination of rural population. Rapid urbanisation comes with challenge of increase of demand of municipal services.

NCT was divided among three local bodies, namely, the MCD, the NDMC and the DCB. In February 2012, the MCD was trifurcated into MCD- East, MCD-North and MCD-South. This make the number of municipalities in Delhi from three to five. The area and population details of these five municipal bodies are presented in Table 2.

The three MCDs make up to as much as 97.81% of the area and 94.23% of the population of the NCT, (b) MCD- North and MCD-South are almost equal in terms of area and population, (c) MCD-East is about 2/3 in terms of area vis-à-vis MCD-North and MCD- South, and (d) Population density of MCD-East being 37,281 persons per sq. km. is almost four times that of MCD-North and MCD-South and six times that of NDMC. The contribution of the various taxes to the total tax revenues of the South Delhi Municipal for 2015-16, in absolute terms and also in relative (percentage) terms, is presented in the graph of Fig. 1.

Table 2: Area and Population of the Municipal Bodies in Delhi.

Municipal body	Area		Population-2011		Population Density	No. of Ward
	sq.Km	Share in NCT (%)	Persons (in lakhs)	Share in NCT (%)	Person per sq. km.	
East	105.98	7.14	39.51	23.53	37281	64
North	636.37	42.85	62.55	37.26	9829	104
South	656.91	44.24	62.14	37.01	9459	104
MCD (Combined)	1399.26	94.23	164.2	97.81	11735	272
NDMC	42.74	2.88	2.58	1.54	6036	
Cantt	42.97	2.89	1.1	0.66	2560	

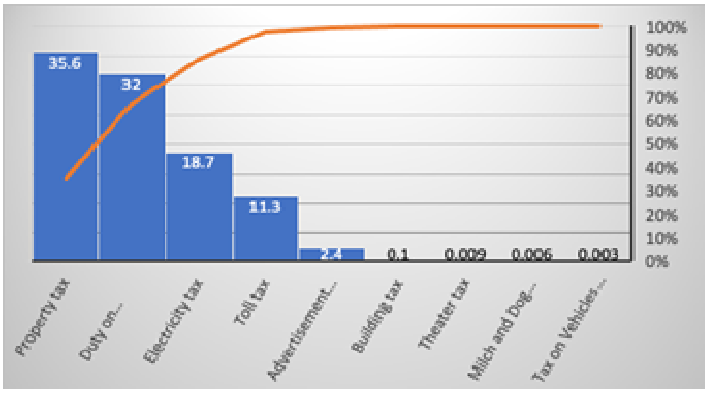

Fig. 1. Share of Revenue from Various Own Tax Sources of SDMC 2015-2016 (Rs. In Crores).

Property taxes have remained the single largest 'own' source of revenue for the municipalities, being of the order of 30 to 40% of the own tax revenues of the SDMC. The incidence of this tax falls on buildings of all types, as well as on vacant lands. The significance of property tax in the overall own tax receipts of South Delhi Municipal can be seen from the Table 3.

Scope and Objectives. The major scope of the study is to evaluate the urban growth vs property tax collection from 2012 to 2017, which provides vital information on the urban expansion and its impact on the surrounding environment.

Table 3: Share of Property Taxes in the Total Own Tax Revenue of the Municipalities.

Year	Property tax revenue (In Crores)	Total own Revenue (In Crores)	Share of Property Tax (%)
2012-13	539.9	1469.3	36.7
2016-17	901	2177.3	41.4

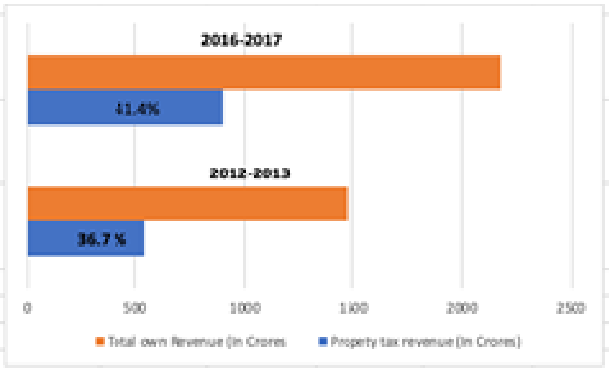

Fig. 2. Share of Property Taxes in the Total Own Tax Revenue of the Municipalities.

To realize the scope, the study is divided into 3 main objectives which are listed below:

1. Generation of urban Land Use/ Land Cover map of Delhi using satellite data for two time periods (2012 and 2017)
2. Change detection analysis of urban land use.
3. Comparison of property tax and no. of properties for 2012 and 2017

II. MATERIALS AND METHODS

Study Area

Delhi lies at a latitude of 28°34′N and a longitude of 77°07′E having an average elevation of 233 m (ranging from 213 to 305 m) above the mean sea level. Total geographic area of Delhi is 1483 km^2 (Rural-689 km^2, urban- 624 km^2 and forest- 170 km^2). There are two part of Delhi, East and West, which is divided by Yamuna river. Delhi is located in the northern part of India. The North west neighboring state is Haryana, Uttar Pradesh on east and Rajasthan is on west side of Delhi. There are many significant historical monuments in Delhi such as Humayun's Tomb, Qutub Minar, Safdarjung's Tomb, Jantar Mantar, Red Fort, Jama Masjid etc.

NCT has three local municipal corporations: Municipal Corporation of Delhi (providing civic amenities to an estimated 13.78 million people), New Delhi Municipal Council (New Delhi) and Delhi Cantonment Board. Delhi is a city has a large population of about 1.68 crore [10]. There are no panchayats in the NCT and the entire area is covered by the five municipalities, namely, the Municipal Corporation of Delhi (MCD)- East, MCD-North, MCD-South, New Delhi Municipal Council and Delhi Cantonment Board.

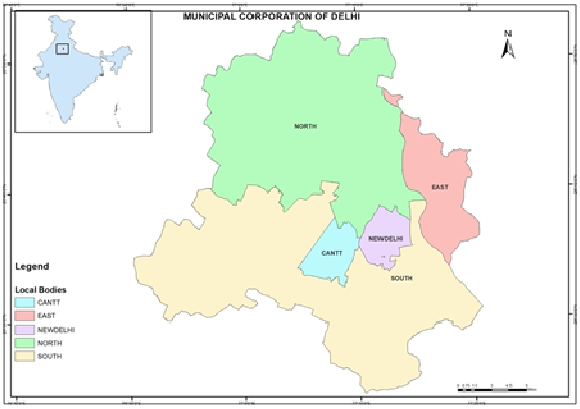

Fig. 3. Map showing local bodies of Delhi.

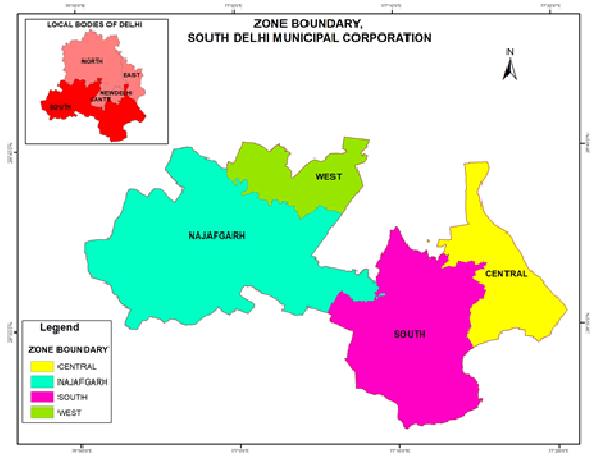

Fig. 4. Map showing zonal boundary of South Delhi Municipal Corporation.

Among all the corporations, South Delhi Municipal corporation is the largest one having area of 667.38 Km Sq which is 44.24 % of National Capital of Delhi. Population of South Delhi municipal

Data used

In the present study, two satellite imageries of year 2012 and 2017 have been utilized for LU/LC change detection. Financial records related to property tax have been taken from Municipal corporation and 5th Delhi finance commission.

Methodology. In order to start, pre-processing of satellite image is the first step to follow. For generation of land cover classes of urban area, Supervised classification has been done. Below is the flowchart of methodology to achieve the result.

Land cover Description. Satellite image of 2012 1nd 2017 has been used for the analysis. LU/LC maps have been generated by using classification scheme. The images are classified in Built-up, Open Land, Garden and Parks, Agriculture, Forest, Water. For demarcation of LU/LC classes, here, Supervised classification has

been adopted. To enhance the accuracy of classification, Post classification refinement has been carried [11, 12]. Brief of classes of LU/LC are stated in the Table 4. To identify change in LU/LC pattern, complex landscape structure has been categorized into simple and distinguishable pattern by creating spatial metrics [9].

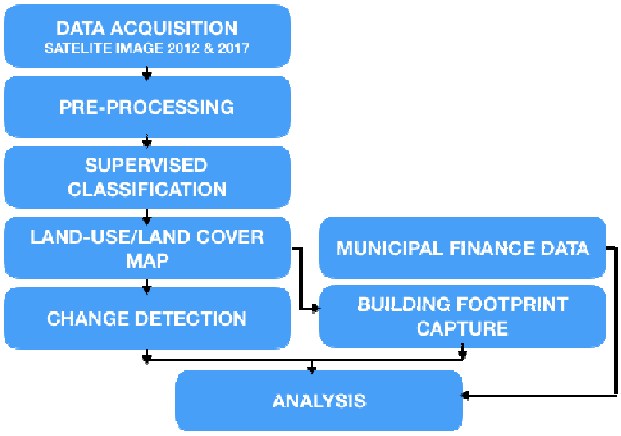

Fig. 5. Methodology.

III. RESULTS AND DISCUSSION

Land Use/ Land Cover (LU/LC) map generation

According to the estimates of Ehtisham Ahmad (2014) [12], the built-up percentages of the Delhi region increased from 7.67% of the total area in 1977 to 38.28% percent of the total area in 2014.

Using both of satellite image, Supervised classification has been carried out. In order to perform classification, grouping of LU/LC classes i.e. Built-up, Open land, Recreation Park, Agriculture, Forest and water. Classified map of LU/LC for both images has been given in figure. Result of classification is given in the Table 4. Also for further analysis building foot print has been captured.

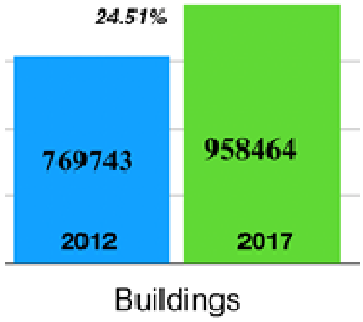

Fig. 6. Count of Building Footprints.

As it can be seen that the urban area, which was 80.01 km^2 (13.39%) in, has increased to 98.71km^2 (16.52%) in 2017. The open land including barren land as well, which was 133km^2 in 2011 has decreased to 129.99km^2 in 2017. The Cultivation land which was 187km^2 (31.27%) in 2011 has decreased to 186 km^2 (31.44%) in 2017. Recreational parks covered Urban green space, garden and park.

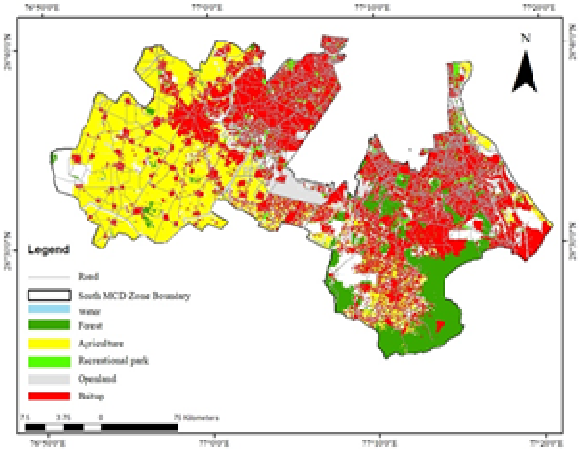

Fig. 7. Land Use map, 2012.

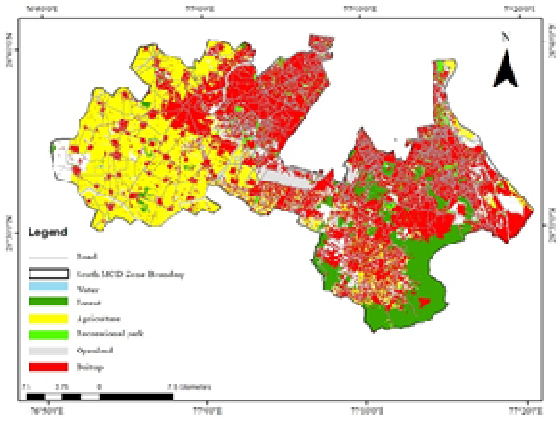

Fig. 8. Land Use map, 2017.

Table 4: Land use/Land Cover Statistics.

Land Cover	Area in Km^2 and % (2011)	Area in Km^2 and % (2017)	Change in Km^2 (+/ -)
Water	7.30 (1.22 %)	7.28 (1.21 %)	0.018
Garden	34.43 (5.76 %)	34.07 (5.70 %)	0.358
Forest	154.71 (25.90 %)	154.29 (25.82 %)	0.424
Building	80.01 (13.39 %)	98.71 (16.52 %)	-18.69
Open land	133.14 (22.29 %)	129.99 (21.75 %)	3.152
Cultivation land	187.82 (31.27 %)	186.85 (31.44 %)	0.970

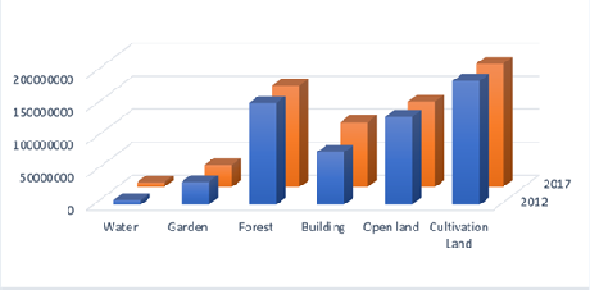

Fig. 9. Graph showing Land use/Land Cover Statistics 2012-2017.

Land Use/Land Cover change detection analysis. Analysis of change detection has been done using output of LU/LC. In Table 5, conversion land cover has been mentioned. From analysis, it is seen that in five year of interval approx. 5 Km^2 from analysis of area is converted to the built-up. Most of the changes in LU/LC have been observed in Najafgarh and Dwarka, however many built up construction is seen in and around Sanik farm. After the analysis, it's been observed that pattern of sprawl in South Delhi is Infill and expansion. Also most of the built changes have noticed in Laldoras (Laldora are classified name which is considered as village area).

Table 5: Land use/Land Cover Change detection statistics.

Class Name	Change in area (m^2)
Water to Built-up	18087
Garden to Built-up	358275
Forest to Built-up	424485
Open Land to Built-up	3151650
Cultivation Land to Built-up	969751

Table 6: Number of Properties Covered and Revenue Collected under Property Tax by MCD-South during 2012-2018.

Year	No. of Properties covered under Property Tax	Y-o-Y growth	Amount of Property Tax collected (in crore)	Y-o-Y growth
2012-2013	399028		607.92	
2013-2014	383572	-3.87%	531.25	-12.61%
2014-2015	377508	-1.58%	547.31	3.02%
2015-2016	410151	8.65%	643.34	17.54%
2016-2017	444232	8.31%	901	40.05%

Property Tax vs Properties. The information about the number of properties covered and revenue collected under property tax is taken from MCD-South. The details about the number of properties covered and revenue collected under property tax by MCD-South.

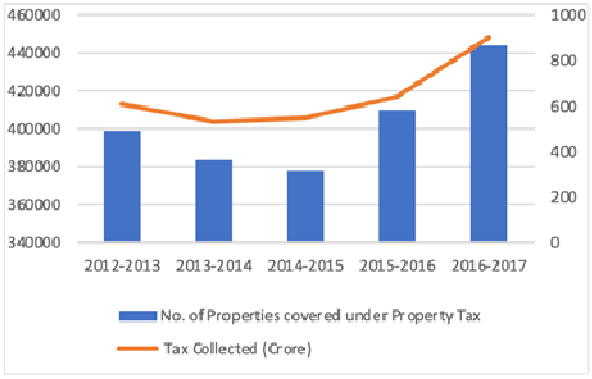

Fig. 10. Graph showing Number of Properties Covered and Revenue Collected under Property Tax by MCD-South during 2012-2018.

It is clearly visible that Property tax is declining for year 2013-2014. Even in the year of 2014-15, count of property has increased still tax collection is in deficit. For year 2014-2015, property tax as well as property count has increased at gradual rate. In 2016-17, even the property count has gradual rate of increment but Revenue Collection has significant amount of rise. The reason of surge in tax collections attributed to the amnesty schemes or due to demonetisation.

Table 7: Comparison in increase different entities.

	2012	2017	Growth Over 5 year
No. of Buildings	769743	958464	24.51%
Area of Built up (km2)	80.018	98.706	23.35%
No. of Properties under Tax net	399028	444232	11.32%
Tax collected (in cr)	607.92	901	48.21%

As final comparison of growth of building, built-up area, No. of properties and tax collection, it is seen that growth rate of no. of building and built-up area s moderate. Whereas growth rate of No. of properties under tax net is lowest and growth rate of Tax collection is highest. As mentioned earlier it is due to demonetization were huge amount of areas has been paid and other reason is amnesty scheme. These kind of spurt is not sustainable. Also Corporation should avoid amnesty scheme as indirectly it penalizes regular taxpayer and promote indiscipline among taxpayer.

IV. CONCLUSION

Urban growth is regular process. From the study, it is observed that of rate of growth of urbanisation and property data under tax net and tax collection is not same. To bring these growths on same pace it is important to track the urban growth and at same time enhance the current system of property tax collection.
Unplanned and uncontrolled urbanisation leads to unauthorised colonies which always bring challenge in implementation of development and cause burden to municipal projects. Used mechanism to trace urbanisation is good enough to track horizontal sprawl. However, in account of future perspective, in capital cities like Delhi, there is limitation of horizontal sprawl and urbanisation is moving towards vertical growth. The government policies should also reflect scope of vertical growth. Existing tax collection method should also be strong enough to bear the vertical urban growth. Apart from this urban sprawl study also give the idea of ecological and environmental distribution of surrounding which is very imperative for sustainable planning of urban infrastructure.

V. FUTURE SCOPE

For micro-level planning, municipal applications require databases of a considerable scale. The building of a digital database is the first and most crucial step in the process of development. However, this enough for local government use. Among the most important parameters for property tax assessment are the following: street address, neighborhoods name, category of neighborhoods, number of floors in building, covered area, unused land area, type of property (residential or commercial), occupancy type (owner or tenant), structure type (Kaccha or Semi-Pucca), construction

year, and type of owner (single or joint). A full ground investigation is needed to complete this database because images cannot capture all of the information. Field work and the transmission of different attributes of the data may be done more effectively thanks to the GIS platform that has been used to gather the data. Additional information about colony infrastructure, including the type of road and drain and governing bodies, is critical for the evaluation and growth of colonies. In order to accomplish this, all of the departments data must be digitized and linked to a geographic database. There will be various solutions to municipal problems if this one-time task is completed correctly. If you need to analyze or build something, you can use this database to store both historical and present data. GIS platforms are widely available; therefore, this can be used in any IT-enabled GIS application.

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